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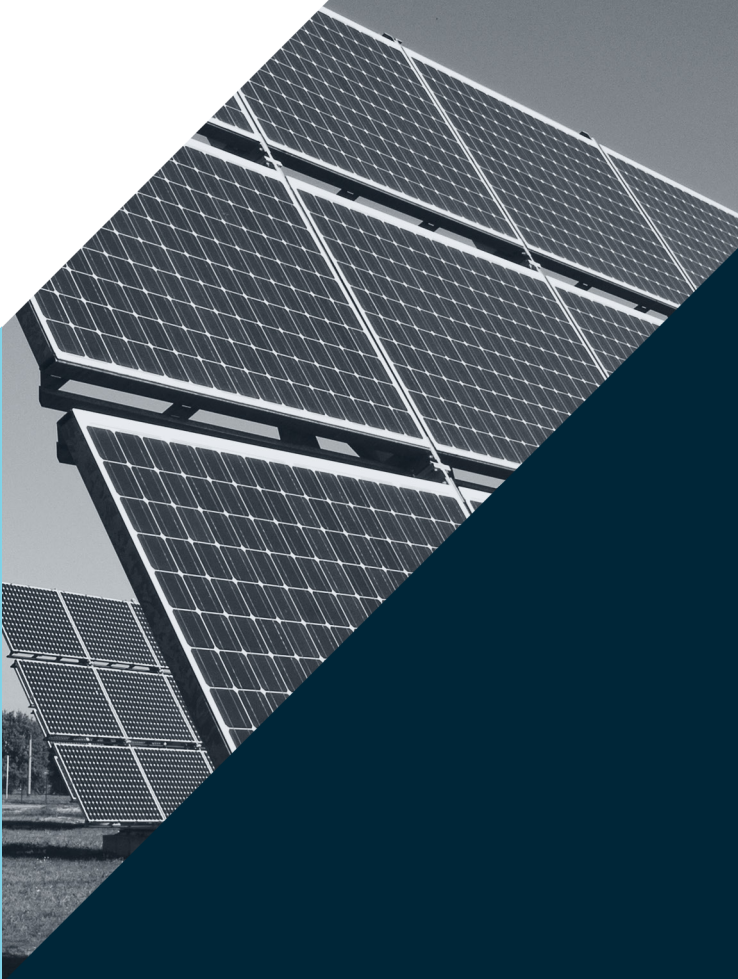
# Environmental and Social Impact Assessment Report

## Ayg-1 200MW PV Plant

Armenia

—  
May 2023

MASDAR 



# Document Information



<b>Document Name</b>	Environmental & Social Impact Assessment
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# Document Disclaimer



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# Alvus is Latin for beehive

In our world, bees do much more than produce honey. They play a key role as pollinators, enabling plants, crops, and life to flourish. However, as our societies have expanded, bee populations have declined at an alarming pace. Despite the severe ramifications of their disappearance, no effective solutions have yet been implemented.

Bees showcase how environmental risks, socio-ecological systems, and the globalised economy interact to create multifaceted challenges with far reaching consequences. These complex issues require research, collaboration between different stakeholders, and strong governance tools to reach effective solutions.

We work with our clients to address their Environmental, Social, and Governance (ESG) challenges. We reduce their risks by deploying a strong scientific and technical knowhow, and work with all stakeholders to design bespoke governance systems.

A robust management of ESG aspects is critical for every organisation, not only does it contribute to continued sustainable development, but it is also strongly correlated with improved financial performance.

By improving ESG management, we aim to increase the positive externalities of Projects and Companies on society through community development, empowerment of vulnerable groups and the promotion of human rights.

## Mission Statement



### Contribute

To shaping a sustainable future by developing tools to effectively manage environmental and social challenges.



### Promote

Human Rights, the empowerment of vulnerable groups, public participation and poverty reduction.



### Understand

Our clients needs and help them effectively integrate sustainability into their business operations.



### Create

A fulfilling working environment to grow and enjoy work while making a positive contribution to society.

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## Glossary of Terms

**Asian Development Bank (ADB):** The Asian Development Bank is a regional development bank established in 1966. ADB assists its members, and partners, by providing loans, technical assistance, grants, and equity investments to promote social and economic development. The AYG-1 Project is aligned with ADB safeguards and regulations as well as other applicable international standards.

**Affected Communities:** Any people or communities located around the Project site who are subject to actual or potential Project-related risks and/or adverse impacts on their physical environment, health or livelihoods. For the Ayg-1 Project, the affected communities are Talin, Dashtadem, Ashnak and Katnaghbyur settlements.

**Affected Households:** Those households that will likely notice residual impacts during the Project's on-site construction and operations. These households are within 2km of the Solar Plant Project. For the Ayg-1 PV Project, most affected households are Talin, Dashtadem, Ashnak & Katnaghbyur settlements.

**Biodiversity:** The Convention on Biological Diversity defines Biodiversity as “the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species, and ecosystems.”

**Community:** A group of individuals broader than the household, who identify themselves as a common unit due to recognized social, religious, economic or traditional government ties, or through a shared locality or administrative unit.

**Community Development Plan / Actions:** Activities implemented by the Project to improve the quality of life of the Affected Communities, for example through improvements in areas like education, health, nutrition, water and sanitation, income, etc. Community Development activities include, but are not limited to, activities such as training, the provision of infrastructure, or support to economic activities and ongoing governmental social programmes. Community Development activities are designed in consultation with local communities and often rely on and support existing Community Based Organizations (CBOs), local initiatives and ongoing County programmes.

**Community Liaison Officer (CLO):** CLOs are members of the Project E&S team who are the focus point for the relation between the Project and members of a community. They provide written and verbal updates to those working and living in communities, facilitate negotiation processes, collect grievances and resolve conflicts.

**Development Financial Institutions (DFIs):** A DFI is a financial institution that provides risk capital for economic development projects on a non-commercial basis. The Project is in discussions with a number of DFIs that will lead the financing for the Project, subject to the Project's compliance with the relevant bank requirements.



**European Bank for Reconstruction and Development (EBRD):** EBRD is an international financial institution founded in 1991. As a multilateral developmental investment bank, the EBRD is owned by 71 countries and uses investment as a tool to build market economies. The AYG-1 Project is aligned with EBRD Performance Requirements as well as other applicable international standards.

**Ecosystem Services:** Ecosystem services are the benefits that people, including businesses, derive from ecosystems. Ecosystem services are organised into four types: provisioning services, regulating services, cultural services and supporting services.

**Environmental and Social Impacts:** An environmental impact is defined as any change to the environment, whether adverse or beneficial, resulting from a Project or activity. The environment is defined as the complex of physical, chemical, and biotic factors (such as climate, soil, water and biodiversity) that act upon an organism or an ecological community and ultimately determine its form and survival.

Social impacts can be defined as changes to one or more of the following:

- People’s way of life – how they live, work, play, and interact on a day-to-day basis;
- Their culture – that is, their shared beliefs, customs, values, and language or dialect;
- Their community – its cohesion, stability, character, services, and facilities;
- Their decision making systems – the extent to which people participate in decisions that affect their lives, the level of participation that is taking place and the resources provided for this;

- Environmental Services – the quality of the air and water people use; the availability and quality of the food they eat; the level of hazard or risk, dust, and noise they are exposed to; the adequacy of sanitation, their physical safety, and their access to and control over resources;
- Their health and well-being – health is a state of complete physical, mental, social, and spiritual well-being, and not merely the absence of disease or infirmity;
- Their personal and property rights – particularly whether people are economically affected, or experience personal or social disadvantage; and
- Their fears and aspirations – their perceptions about their safety, their fears about the future of their community, and their aspirations for their future and the future of their children.



**Environmental & Social Impact Assessment**

**(ESIA):** The process of identifying, predicting, evaluating a Project’s positive and negative environmental and social (E&S) impacts on the biophysical and human environment as well as identifying ways of avoiding, minimising, mitigating and compensating these, including offsetting in the case of the environment and remedying in the case of social impacts. The ESIA process includes consultation with stakeholders and is the first step in the development of a detailed Environmental and Social Management System (ESMS) for the Project. The ESIA process is documented in an ESIA report.



**Environmental and Social Management System (ESMS):**

An Environmental and Social Management System is a set of processes and practices to consistently implement the objectives outlined in the Environmental and Social Policies of a Company, including its compliance obligations. The goal is to make sure that the Company has the appropriate policies and procedures in place to meaningfully comply with the relevant E&S requirements and that people consistently follow them. The management system helps Companies to assess and control their E&S risks and is the key to lasting improvement. The ESIA is the first step in the set up of the ESMS. The ESMS develops the relevant step by step procedures for the implementation of the mitigation and monitoring measures identified in the ESIA. The ESMS also includes risk management measures to identify any other risks that could arise and implement continuous improvement.

**Habitat:** A terrestrial, freshwater, or marine geographical unit that supports assemblages of living organisms and their interactions with the non-living environment.

**Household:** A person, or group of persons living together, in an individual house or compound, who typically share sleeping, cooking and sanitary facilities, and form a basic socio-economic and decision-making unit.

**International Finance Corporation (IFC):**

IFC, a division of the World Bank Group, which provides investment and advisory services to private sector Projects in developing countries, with the goal of ensuring everyone benefits from economic growth. IFC has published a number of guidelines on Environmental and Social management, including but not

limited to the IFC Performance Standards on Environmental and Social Sustainability (2012), which are considered to be a benchmark of good international practice.



**Mitigation Hierarchy:** The mitigation hierarchy is a tool that aims to limit as much as possible negative impacts from development Projects. It lists a number of actions to be undertaken, in order of decreasing preference, when potential negative impacts are managed:

- Avoidance: measures taken to avoid creating impacts from the outset, such as careful spatial or temporal placement of elements of infrastructure, in order to completely avoid impacts on sensitive receptors.
- Minimisation: measures taken to reduce the duration, intensity and/or extent of impacts (including direct, indirect and cumulative impacts, as appropriate) that cannot be completely avoided, as far as is practically feasible.
- Rehabilitation/restoration: measures taken to rehabilitate or restore receptors following exposure to impacts that cannot be completely avoided and/ or minimised.
- Compensation: measures taken to compensate for any residual significant adverse impacts that cannot be avoided, minimised and/or rehabilitated or restored, in order to achieve no net loss or a net gain for the sensitive receptor. These include biodiversity offsets and replacement of lost assets for households or communities at full replacement cost.



**Power Line:** The power line is the Project component that connects the Project to the Armenian electrical grid. The Project will connect to an existing power line that crosses the site. The Project will use a ‘loop in, loop out’ method of connecting the solar panels to the existing power line. Cable trenches will be used to connect the solar panels and inverters to the Project substation and from the project substation a 300m long overhead transmission line (OHTL) will connect to the existing 220 kV OHTL. This method uses electricity pylons which are already established near the site enabling electricity to be routed to Armenia’s main electricity grid.

**Project Alternatives:** Different means of meeting the general purposes and requirements of the activity, which may include alternatives to (i) the location where it is proposed to undertake the activity; (ii) the type of activity to be undertaken; (iii) the design or layout of the activity; (iv) the technology to be used in the activity; and (v) operational aspects of the activity.

**Project:** The AYG-1 Project is a solar photovoltaic Project that aims to install 200MW of solar PV capacity to be connected to the Armenian electrical grid. The main physical Project components for the Ayg-1 PV Plant Project are Solar panels, Transmission lines, Substation, Access roads, Control centre, Temporary construction infrastructure, and the staff, facilities and activities required to build and operate these components.

**Project Area:** The Project area is the geographical zone where impacts from on-site Project activities are noticeable. In this case, the Project area is defined as the Project site, a buffer area of 2.5km and the four affected

communities. Strictly speaking, the impact area is specific to each impact and receptor, and some Project impacts occur far from the Project site. Nevertheless, it is still useful to define the area in which most environmental and socioeconomic impacts will be noticeable.

For the Ayg-1 PV plant, most impacts from an environmental perspective will be observed during the construction and decommissioning phase of the Project during earthworks. Environmental construction impacts (noise, dust, etc) are usually noticeable only within approximately 500m of the site boundary. Social impacts during construction are noticed mostly at the affected communities and include employment, influx, community health and safety risks, etc. The affected communities are the communities of Talin, Dashtadem, Ashnak and Katnaghbyur. The land provided by the Government of Armenia (GoA) for the project was communal land of Talin and Dashtadem. The Project will give a donation to Talin and Dashtadem as per Government requirements.

**Project Site:** The area within the site boundary, i.e. the area required to physically accommodate the Project, including the plots that have been acquired for the PV Plant and the on-site substation. Temporary construction facilities like lay-down areas and site offices will be located within the Project site.

**Residual Impact:** An impact that adversely affects one or more environmental and / or social components, and remains, or is predicted to remain, after efforts to avoid or minimize the impact are implemented.

**Stakeholders:** Any individual, group, organization, and institution interested in and/or potentially affected by a Project or having the ability to influence a Project. Stakeholders may include locally affected communities or individuals and their formal and informal representatives, national or local government authorities, politicians, religious leaders, civil society organizations and groups with special interests, the academic community and other businesses.

**Stakeholder Engagement:** The systematic effort to identify and involve any persons or groups of communities who are directly or indirectly affected by the Project, as well as those stakeholders who may have interests in a Project and/or the ability to influence its outcome. Stakeholder engagement involves

a range of activities such as public disclosure of Project information, consultation with stakeholders, and mechanisms by which people can make comments and raise grievances.



**Vulnerable Persons / Groups:** People who by any characteristic, such as gender, ethnicity, age, physical or mental disability, economic disadvantage, social status or any other aspect, may be more likely to be adversely affected by the Project than others, may have a lower capacity to adapt to changes of any kind induced by the Project and / or may be limited in their ability to claim or take advantage of related development benefits.



PV Panels

**Table 1 Table of Acronyms**

Acronym	Definition
ADB	Asian Development Bank
ARCH	Archaeological and Cultural Heritage Management Plan
AMD	Armenian Dram
ANIF	Armenian National Interests Fund
CBO	Community Based Organisations
CDP	Community Development Plan
CEMP	Construction Environmental Management Plan
CFP	Chance Find Procedure
CLC	Community Liaison Committee
CLO	Community Liaison Officer
CR	Critically Endangered (species categorization as defined by the IUCN)
CSMP	Contractor and Supply Chain Management Plan
CSR	Corporate Social Responsibility
DFI	Development Financial Institution
EBRD	European Bank for Reconstruction and Development
E&S	Environmental and Social
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EN	Endangered (species categorization as defined by the IUCN)
EPC	Engineering, Procurement and Construction
EPRP	Emergency Preparedness and Response Plan
ESAP	Environmental and Social Action Plan
ESIA	Environmental and Social Impact Assessment
ESMS	Environmental and Social Management System
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIIP	Good International Industry Practices
HH	Household
HMWP	Hazardous Materials and Waste Management Plan
HR	Human Resources
IBA	Important Bird and Biodiversity Area
IBAT	Integrated Biodiversity Assessment Tool
IFC	International Finance Corporation
ILO	International Labour Organisation
IPCC	Intergovernmental Panel on Climate Change
ISO	International Standards Organisation
IUCN	International Union for Conservation of Nature and Natural Resources



Acronym	Definition
LC	Least Concern (species categorization as defined by the IUCN)
LRP	Livelihood Restoration Plan
LWCMP	Labour & Working Conditions Management Plan
MP	Management Plan
MW	Megawatt
NGO	Non-Governmental Organisations
NT	Near Threatened (species categorization as defined by the IUCN)
NTP	Notice to Proceed
O&M	Operations & Maintenance
OEMP	Operational Environmental Management Plan
OHSMP	Occupational Health and Safety Management Plan
OHTL	Overhead Transmission Line
OP	Observation Point
PL	Power Line
PPA	Power Purchase Agreement
PPE	Personal Protective Equipment
PR	Performance Requirements
PS	Performance Standards
PV	Photovoltaic
SEP	Stakeholder Engagement Plan
SREP	Scaling Up Renewable Energy Program
SMP	Security Management Plan
STD	Sexually Transmitted Disease
TMP	Traffic and Transportation Management Plan
UAE	United Arab Emirates
UN	United Nations
UNDP	United Nations Development Program
VMG	Vulnerable and Marginalized Group
VU	Vulnerable (species categorization as defined by the IUCN)
WAMP	Worker Accommodation Management Plan
WHH	Women Headed Households
WHO	World Health Organisation





## Non-Technical Summary

Masdar Armenia CSG (The Company) is developing and will build and operate a 200MW Solar Photovoltaic (PV) Power Plant (AYG-1 or the 'Project') in the Aragatsotn Marz region of Armenia.

The Company is owned by the Armenian National Interests Fund (ANIF) and Abu Dhabi Future Energy Company (Masdar) a renewable energy developer based in the UAE. ANIFs mandate is to attract foreign investments and stimulate Armenia's economic development by supporting investments on large-scale Projects in Armenia such as Ayg- 1. The Armenian Government selected Masdar as the developer for this Project in partnership with ANIF.

Solar Power is a reliable technology that has grown very significantly worldwide to produce renewable energy, avoiding greenhouse gas emissions that contribute to climate change. PV Plants are large scale solar installations where PV panels are used to harvest energy from the sun. By the end of 2020, renewable energy contributed to approximately 30 percent of all electricity generated worldwide, demonstrating the increased demand for renewable energy Projects such as this PV Plant. The proposed AYG-1 200-megawatt plant will become Armenia's largest solar power plant once constructed.

The Republic of Armenia is highly dependent on imported oil and gas to meet its energy needs. Current energy policy is focused on developing indigenous energy sources, focusing on renewables.

PV Plants play a significant role in the development of renewable energy. PV Projects do not emit harmful air pollutants or Green House Gases (GHG), allowing the country to meet its international commitments to

minimise anthropogenic climate change. In addition, the development of PV Plants can reduce Armenia's reliance on import of fossil fuels and other resources, which assists the country to have more reliable, secure and affordable energy resources.

The Ayg-1 200MW solar power Project will occupy approximately 525 hectares of land. The PV panels are the most commonly recognized component in a photovoltaic array. The solar panels will be mounted and angled approximately 1.6 meter above ground level on tracker structures to maximise exposure towards the sun's rays. The solar panels convert solar energy to electric currents, and the inverters and transformers convert electric current into electricity with the right specifications to be transported through the national electrical transmission and distribution network.

The Project will connect to the Armenian grid through an existing power line that crosses the site, using a 'loop in, loop out' method. There will be approximately 300 meters of overhead transmission line (OHTL) within the site between the Project substation and the existing OHTL.

The Project is expected to be completed in 2025 and will be operational for 25 years.



Tracker Structure

The Project has undertaken an Environmental and Social Impact Assessment to ensure that negative impacts from construction, operations and decommissioning are avoided or mitigated and that positive impacts are maximised.

The Project is fully committed to keep all stakeholders and the local communities informed about this ESIA process and about the Project in a transparent and proactive way, and to gather feedback from all stakeholders to improve the Project.

The first round of consultations with stakeholders occurred in December 2021 and informed members of the community about the Project and the ESIA process. The consultations included one on one meetings with key stakeholders as well as public meetings which are open to all community members and stakeholders. The ESIA process was presented to the participants, focusing on ESIA scoping. The second round of stakeholder engagement consultations occurred in July 2022, shared results of the scoping phase and focused on impact assessment and the proposed mitigation measures to minimise negative E&S impacts and maximise positive externalities of the Project. An additional round of consultations was undertaken in December 2022 to disclose and gather feedback on the ESIA documents and discuss support for former land users (i.e herders). A final round of ESIA consultations will be undertaken once the authorities provide their feedback on the ESIA package, presenting the final outcomes and detailing the Environmental and Social Management System and the measures in place to continue a close interaction with the Project stakeholders during construction and operations.

In addition to the meetings, all stakeholders, community members and interested parties

are welcome to submit suggestions, concerns, questions or grievances about the Project, either to the Company through the suggestion boxes installed at the affected communities or by phone, email or post to the Project's consultants (Energy Advisory and Alvus ESG Consulting). The Project has set up a grievance mechanism to ensure that all comments are documented, assessed and replied to.

The construction and operation of the PV Plant is described in further detail below.

### PV Plant Construction

The construction of the Project requires an access road, site fencings, targeted leveling of the site, transport of the PV panel components to the site, assemblage of PV panels and other equipment using heavy machinery where necessary.

Underground and overground electrical cables will be installed to connect the PV Panels with inverters and the Project substation and a short power line will connect the power to the national electricity network.

The following positive and negative impacts and risks can occur during the construction phase of PV Plant:

**Employment:** During the construction phase of the PV Plant a minimum of 250 workers are expected to be employed. Based on availability and requirements, during the construction phase between 25-75% will be local hires. Some engineers and specialists will likely be hired abroad or in other areas of Armenia if there are no available local experts, while laborers and semi-skilled construction workers can be hired locally. The Project aims to maximise the benefits to local communities and will require the Engineering, Procurement



and Construction (EPC) contractor to recruit men and women from local communities in the Project area when and where possible. If there are no suitable candidates from the local communities, candidates from other regions of Armenia or foreign nationals will be considered. The Project will ensure a fully transparent recruitment procedure will be set up and disclosed to the communities.

The influx of skilled labour to the Project will be managed through a recruitment plan, worker accommodation plan, traffic management plan and employee code of conduct, to minimise disturbance to local residents.

**Local Procurement:** The PV panels, inverters and transformers will be selected by the EPC contractor and will most likely be imported. However, the Company will support local businesses to provide services for the Project (e.g. provision of construction inputs, food for workers, etc). Local providers will be selected as long as they meet the required quality standards and are within prevailing market prices.

**Biodiversity:** During construction, the footprint of the access road, internal roads, PV panel piles, temporary site offices and the lay-down areas will be cleared. A terrestrial ecology survey has been conducted to identify the habitat and species with the intention of translocating protected species prior to the start of construction. The biodiversity survey results indicate that a few protected species were identified on site in low numbers. Management measures will be implemented to mitigate any negative impacts on biodiversity through a Biodiversity Management Plan. Invasive plants may spread as a result of the construction activities, either by transport in the machinery or the dispersal/spreading of topsoil. Mitigation measures to prevent the dispersion of invasive species are included within this ESIA.

**Waste:** The main types of waste generated during construction include concrete, scrap steel, glass, plastic, wood, packaging materials and waste from construction workers. Production of solid waste through packaging materials is expected to be high. Construction materials are predominantly inert and do not pose a threat to human health or the environment. However, correct management is required in order to reduce associated secondary waste impacts such as reducing resource use and avoiding impacts to natural habitats.

The hazardous fraction of construction waste (oils, solvents, paints) is estimated to represent less than 5% of the total amount of construction waste likely to be generated. All waste will be adequately contained and transported by licensed contractors to licensed treatment and disposal facilities. Reuse and recycling on-site will be maximised.

**Traffic:** The construction process will generate traffic due to the transport of equipment and staff to the site by road. The increase in traffic levels could potentially lead to congestion along routes that are already heavily used such as the national highways. The impact to natural habitats from the increase in traffic movements from construction activities on the national roads is considered negligible. Mitigation measures to minimise impacts on local roads include load optimisation thus reducing the number of vehicle trips, vehicle maintenance, speed limits and driver training to maximise safety as well as checks to ensure that drivers are qualified to drive heavy vehicles.





**Community Health and Safety:** Potential negative social impacts from the Project include conflicts between workers or security on-site and community members. Security staff and workers will be trained, and procedures will be put in place to ensure that the interaction with local communities is respectful and positive. Influx of outsider job seekers will be minimised by prioritising local recruitment and following a clear recruitment procedure that forbids hiring at the gate and restricts the use of casual laborers.

**Construction Noise:** Construction activities and traffic will create some intermittent noise. Construction activities will only be carried out during the day, to avoid disturbance to nearby houses during resting hours, and all equipment will be regularly inspected to minimise noise emissions.

**Air Quality and Dust:** Earthworks may generate dust and subsequently impact local air quality while the use of vehicles and heavy machinery can produce increased air emissions from exhausts. The impact will be localised and is not expected to reach the communities. Only well maintained vehicles will be used on site and measures to minimise excess dust will be undertaken and are included in this ESIA.

### PV Plant Operations

During the Project's operational phase sunlight is converted into usable electricity. Solar panels are made up of a transparent PV glass as well as PV cells which are responsible for converting sunlight into electricity. Inverters and transformers are then used to convert the electric current to domestic electricity to power homes etc. This electricity is then routed to the national grid through a short (300m) OHTL.

The following impacts are expected during operations:

**Climate Change:** The Project will generate electricity without burning fossil fuels, so no greenhouse gases will be released as a result of the electricity generation process. This contributes to meet Armenia's international commitments on climate change mitigation and to minimise the negative environmental and social impacts associated with Climate Change.

**Employment:** Employees will be required during the operational phase of the Project, but the number of employees will be significantly lower than during construction. The Project is expected to employ 15-25 employees of which at least 50% would be local hires.

**Landscape and Visual Impacts:** Due to the topography and the low elevation of the panels, the Project will be not be visible from a wide area. During site investigations, two smaller operational PV Projects were identified in the nearby communities. The Ayg-1 Project is not expected to change the landscape significantly in the Project area. The PV plant will have little effect on the overall characteristics of the landscape visible from nearby settlements.

**Water:** Water is expected to be used during the operational phase of the Project for various on site activities. It should be noted that water will not be used during PV Panel cleaning, dry cleaning methods will be employed instead to minimise water consumption. The Project will ensure that the source of water used for activities does not affect community access to water and water availability for other users. Various sources of water for on site activities are considered in this ESIA.



**Community Development Plan**

The Ayg-1 Project aims to improve the living conditions of local communities and the local environment, and is developing a Community Development Plan (CDP) to achieve this aim. CDP actions are not directly related to negative impacts or risks from the Project, but aim to maximise positive impacts and improve the livelihoods of the local communities. The CDP will support local communities on the use of the donation amount made by the Project to the communities, and guide any further CSR contributions.

**Livelihood Restoration Plan**

The Armenian Government have selected Masdar as their company of choice to develop this Project in partnership with ANIF. The land that will be used to build the Project on were communal lands of Talin and Dashtadem. The land was acquired by the Government of Armenia and provided to the Project. The Project will make a donation to the Talin and Dashtadem communities, as required by the Government of Armenia. The Project is not expected to cause any physical displacement, meaning that no houses will be affected.

The Project will implement livelihood restoration measures for the four affected communities, since all four communities surrounding the Project site have confirmed they use the communal land located at the Project site for livestock grazing. As part of the Livelihood Restoration Plan, all herders will receive livelihood restoration. The LRP studies indicated that the productivity and carrying capacity of the site are low.

Proposed measures include supporting herders through training, providing vaccines and a small amount of fodder during winter months

were initially suggested as compensation measures but are now being reviewed due to feedback received at public consultations.

The project has donated the amount determined by the Government to the Talin and Dashtadem communities, who owned the land before it was transferred to the Government and to ANIF. The donation amounts to 320,000,000 (three hundred twenty million) AMD in total to Talin and Dashtadem communities. The donation agreement funds shall be used exclusively for the implementation of development programs within the Communities' administrative boundaries. In order to access these funds, the community must provide a plan detailing use of funds to a committee known as 'R2E2'. The proposed plan will then be discussed in a steering committee with ANIF and Masdar included, if the plan is considered an appropriate use of funding, R2E2 will release funds to the community. This will be completed in stages as and when Talin and Dashtadem decides to build / improve / do something for their administrative regions.

Overall, the economic displacement caused by the Project is minor. The Livelihood Restoration Plan (LRP), included in the ESIA package, details the assessment and mitigation for economic displacement.



Road in the Project Area





# 1 Introduction

Masdar Armenia 1 CJSJ (the ‘Project Company’ or the ‘Company’) is developing a 200MW Soar Photovoltaic (PV) Power Plant (AYG-1 or the ‘Project’) in the Aragatsotn Marz region of Armenia.

The Company is owned by the Armenian National Interests Fund (ANIF) and Masdar Armenia 1 CJSJ, a renewable energy developer based in the UAE. ANIF’s mandate is to attract foreign investments and stimulate Armenia’s economic development by supporting investments on large-scale Projects in Armenia such as AYG- 1. The Armenian Government selected Masdar to develop and operate this Project in partnership with ANIF.

The Republic of Armenia is highly dependent on imported oil and gas to meet its energy needs. Current energy policy is focused on developing indigenous energy sources, mainly renewable.

The lender group for this Project is likely to include EBRD, DEG and PROPARCO.



The Project aims to manage its E&S aspects by ensuring it is fully aligned with all applicable regulations and with international best practice. In addition to Armenian laws and requirements, the Project will comply with the International Finance Corporation Standards on Environmental and Social Sustainability and other Lender requirements (2012), EBRD Performance Requirements (2019) ADB SPS (2009) The E&S requirements of PROPARCO and DEG are aligned with the IFC PSs.

This ESIA process aims to obtain the relevant License from the Ministry of Environment, to fully comply with lender requirements and ensure that all relevant Environmental and Social (E&S) risks and impacts are assessed, mitigated and monitored in accordance with Masdar’s ESG Policies, which are applicable to all its Project's including AYG-1.

This report is part of an E&S studies package that includes the Livelihood Restoration Plan and the Stakeholder Engagement Plan, in addition to this ESIA report. The ESIA package covers all aspects of E&S compliance for the design phase of the Project.

### 1.1. ESIA Report Objectives

The primary objectives of this ESIA Report for the Project are as follows:

- Identification of baseline environmental and social conditions, based on the review of available information and site surveys;
- Impact identification, assessment and mitigation for key environmental and social risks related to all Project phases to ensure that environmental and

social risks are proactively addressed, that negative impacts are mitigated and positive impacts maximised, and that all impacts are compliant with the regulatory framework; and

- To establish the framework for the Project’s construction and operational phase ESMS.



### 1.2. Structure of the ESIA Report

This ESIA Report includes the following elements:

- Section 2 describes the Project location, Project site and Project area;
- Section 3 describes the key features of the proposed Project facilities, the Project design and the scope of construction and operational activities. This section also provides the schedule of the proposed Project;
- Section 4 describes the regulatory framework and standards applicable to the Project, particularly the national and international requirements for PV plant Projects;
- Section 5 describes the environmental and social assessment and planning processes including the scoping and ESIA impact prediction, assessment and mitigation methodologies;
- Section 6 to 24 present the following information for the different environmental and social aspects under consideration (namely climate change; protected areas & biodiversity; noise; landscape and visual impacts; surface water and drainage; geology, groundwater and soils; air quality; waste

management; demographic conditions; economic conditions; social conditions; community safety and security; traffic and transportation; archaeology and cultural heritage; labour and working conditions; and occupational health and safety):

- An overview of the existing conditions of the Project site and an evaluation of existing environmental and social information;
- Baseline site surveys (methodology, results and assessment);
- Determination of the sensitivity of existing receptors;
- Overview of the environmental and social impacts (both negative and positive) associated with the construction, operation and decommissioning of the Project facilities;
- Assessment of impact significance with respect to the identified sensitive receptors;
- Management measures for construction, operation and decommissioning phases of the Project;
- Assessment of residual impact significance; and
- Monitoring measures for construction, operation and decommissioning phases of the Project.

### 1.3. ESIA Team

The Project Company has engaged Alvus ESG Consulting (Alvus) to lead the ESIA process for the Project. Alvus is an international consultancy firm focused on independent

advisory work for internationally funded power Projects. Since Alvus was founded in 2018, we have successfully completed 72 Projects in 28 countries and four continents, 92% of which have been related to renewable energy.



Alvus works together with Energy Advisory (EA), a leading independent energy consulting company providing environmental, technical and economic consulting services for energy Projects in Armenia. Alvus and EA have collaborated on the preparation of ESIA's for other internationally funded renewable energy Projects in Armenia in the past. Additional work and support was provided by EcoConsult, an environmental and social consultancy firm based in Jordan with a strong track record on renewable energy and with Lenders.

Three archaeological companies have participated in the ESIA. Areni-1 Cave Scientific-Research Foundation (Areni-1) is the most experienced archaeological foundation in Armenia. Cortés Arqueología y Patrimonio from Spain oversaw the site inventory, to ensure alignment with European good practices. Quercus Heritage, a UK based heritage consultancy firm specialised in the assessment of PS8 / PR8, prepared the final archaeology assessment.

Members of the Scientific Center of Zoology and Hydro-ecology Armenia and the Institute of Botany Armenia carried out the biodiversity survey. Turnstone, a UK based ecology firm, prepared the Project's critical habitat assessment.

## 2 Project Location

The proposed PV Project is located in the Aragatsotn Marz Region of Armenia, as depicted in the map below. The Project site is located between the settlements of Dashtadem, Talin, Ashnak and Katnaghbyur and is located on the territories of the Dashtadem and Talin settlements. It was formally communal land belonging to these two communities.



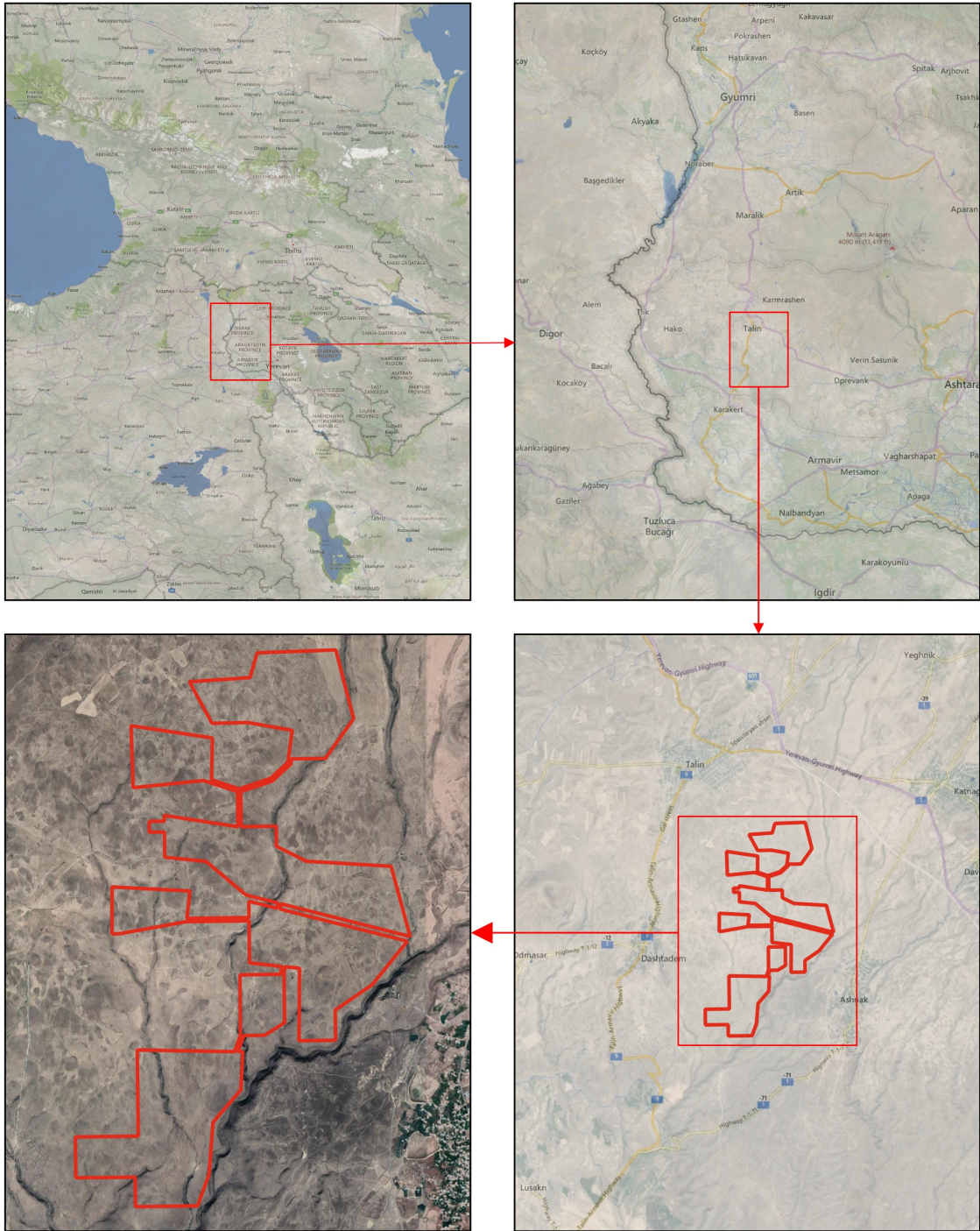
The plot of land located in Dashtadem (363.05 hectares) and Talin (156.31 hectares) has already been acquired by the State and transferred to the Company. The mapped overleaf depicts the communal land from Talin and Dashtadem that the Project will use.

The PV Plant will span over 525 hectares. Within the local communities there are two other small scale PV Projects, both have an operational capacity of 5 MW.

As a result of this, the community members in these affected communities are familiar with PV technology and understand operational PV panels do not pose a risk or cause nuisance to neighbouring communities.



Figure 1 Project Location






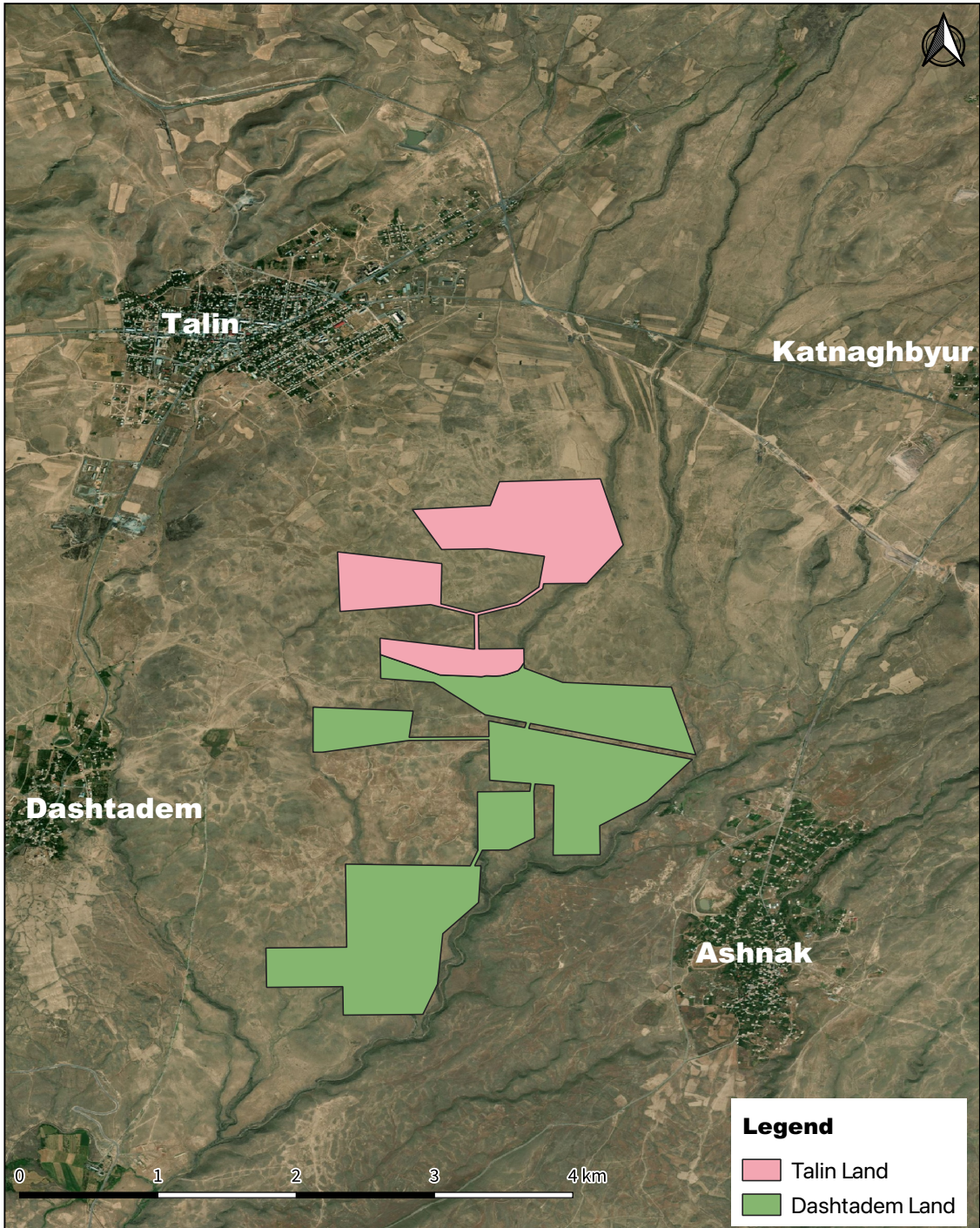
<p>Consultant</p> 	<p>Project</p> <p>AYG-1 Solar PV Project, Armenia</p>	<p>Map Location</p> 
<p>Client</p> 	<p>Map Title</p> <p>Project Location</p>	



Table 2 Community Safety and Security- Impact Assessment- Construction Phase



<p>Consultant</p> 	<p>Project</p> <p>AYG-1 200MW PV Plant, Armenia</p>
<p>Client</p> 	<p>Map Title</p> <p>Talin and Dashtadem Communal Lands</p>



**Table 3 Project Location**

Region	Municipality	Nearby Settlements	Distance to Settlement
Aragatsotn	Talin	Talin	1.4km
		Dashtadem	2.30km
		Katnaghbyur	1.25km
		Ashnak	0.5km



## 2.1. Project Site and Project Area

Due to its intra-continental location and the presence of mountain ranges, the climate in Armenia is mostly dry. The climatic conditions in the Project Area mostly consist of dry hot summers and cold winters with snowfall usually lasting for 3 months. The average annual precipitation is 438mm, showers are possible, up to 67 mm. August is the hottest and driest month of the year maximum temperature is 38°C, minimum relative humidity of the air is 38%. The predominant habitat is dry steppes, with small shrubs and herbaceous vegetation. Vegetation growth is also limited by a shallow bedrock and rocky soils.

The climatic conditions and poor soil characteristics limit the vegetation, natural habitat and agricultural uses of the Project Site. Currently there are no trees onsite, only small shrubs and herbs. There is no cultivation onsite due to the unsuitable soil and climatic conditions and lack of water. The area is used for livestock grazing, but the rocky terrain and lack of water significantly limits the productivity of the pastures.

There are no residential or agricultural structures on-site. All the settlement around the site (Talin, Dashtadem, Katnaghbyur and

Ashnak) are connected by local tarmacked road, so local community members do not use the site for passage due to the presence of rock outcrops and some relatively deep canyons between the site and the villages.

The site is not frequently used by the local communities due to low productivity and access challenges. The site is mainly used for pastoral agriculture with community members grazing their cattle onsite and in the surrounding areas. Extensive pastoralism is only viable at certain times of the year (e.g. not in winter), and extensive pastoralism is combined with housing cattle at barns. Due to the limited vegetation cover and growth, the site has a low value as a grazing area. There is no crop planting on site at the moment, but the clearing of rocks and off site planting activities suggest that there could have been attempts to plant cereals onsite in the past.

The Project site boundary is depicted on the mapped overleaf and pictures of the Project site, illustrating site conditions, are provided below.

Figure 2 Project Site

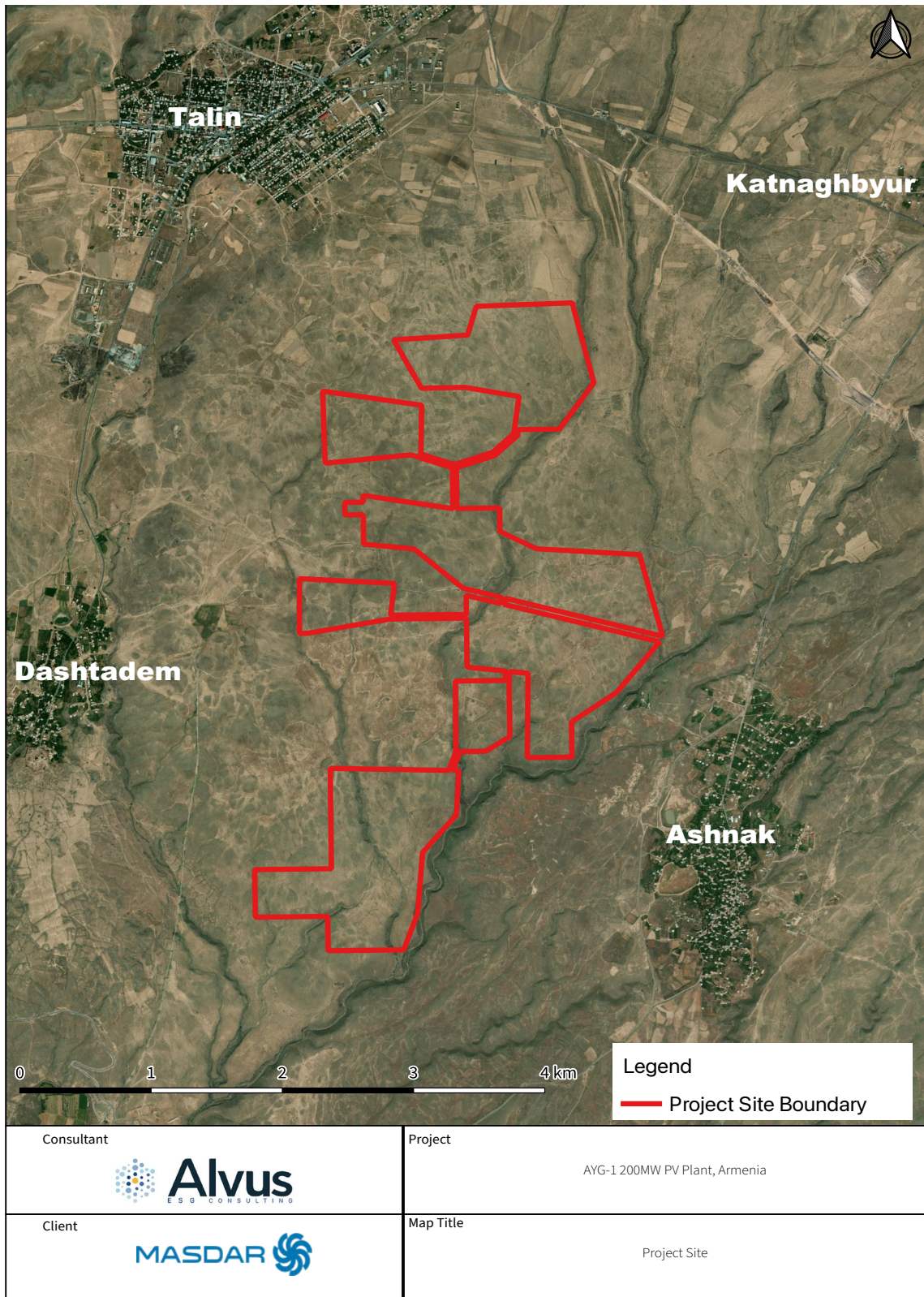




Plate 1 Project Site



Project Site- Landscape



Project area- Landscape with the Aragats Mountain Range in the Background



Project Site, Transmission Line in the Background



Dry Ephemeral Water Channel, Transmission Line in the Background





Rocky Terrain, Prevalent in Most Areas of the Site



Accumulation of Rocks to Clear Land for Agriculture (USSR period mechanised clearance)

Plate 2 Project Area- Land Uses around the Project Site



Ploughed Land Around the Local Communities Agricultural Purposes (off-site)



Ploughed Agricultural Land Near the Local Communities (off-site)





Land prepared for Agricultural Activities (off-site)



Rocks Piles Made by Communities to Use the Land for Agricultural Purposes

## 3 Project Description

### 3.1. Project Justification

The Republic of Armenia is a landlocked country, almost solely dependent on imported oil and gas to meet its energy needs. The reliance of such a high level of imported energy has caused significant constraints for Armenia. Armenia's current energy policy is focused on developing indigenous energy sources, mainly renewable, and on replacing the country's main nuclear reactor.

The Government of Armenia has identified renewable energy as central to meet the country's energy needs. Several laws and policies focus on renewable energy development and energy efficiency implementation to improve Armenia's renewable energy supply.

PV Plants play a significant role in the development of renewable energy with far reaching positive impacts. Operational solar Projects do not emit harmful air pollutants or Green House Gases which enhances the Armenia's ability to meet its international commitments to minimize anthropogenic climate change.





Furthermore, the development of PV Plants in Armenia will aid in reducing the country’s heavy reliance on fossil fuel imports such as oil and gas. This will enable reliable, secure and affordable energy solutions and resources for the population of Armenia.

Armenia has implemented a number of laws and regulations for the energy sector in order to promote the use of renewable energy and improve energy efficiency. The two major renewable energy related laws are “Energy Law” of 1997 and “Law on Energy Saving and Renewable Energy” of 2004, the main purposes of which are to strengthen the economic situation and energy independence of Armenia by increasing the level of renewable energy generation.

Armenia has also committed to making 21% of its energy production renewable by 2020, with that figure increasing to 26% by 2025. In order to meet its renewable targets, the country launched the Scaling Up Renewable Energy Program (SREP) in 2014 to install up to 397MW of small hydro, 100MW of wind, 80MW of solar and 100MW of geothermal by 2025.

In summary, the development of the proposed PV Project will assist the country in having a more reliable and an economically stable source of energy, thereby reducing Armenia’s dependence on imported fuel for energy production and vulnerability to volatile fuel prices and supplies. The Project will also offer positive and long-term environmental effects, as renewable energy resource does not emit harmful air pollutants or Green House Gases (GHG). This will help the country to meet its international commitments with regard to minimizing anthropogenic climate change.

### 3.2. Project Components



The Project is expected to have a generating capacity of 200 MW, produced by solar panels spanning over 525 hectares of land in the Dashtadem and Talin communities.

The Project consists of the following key components:

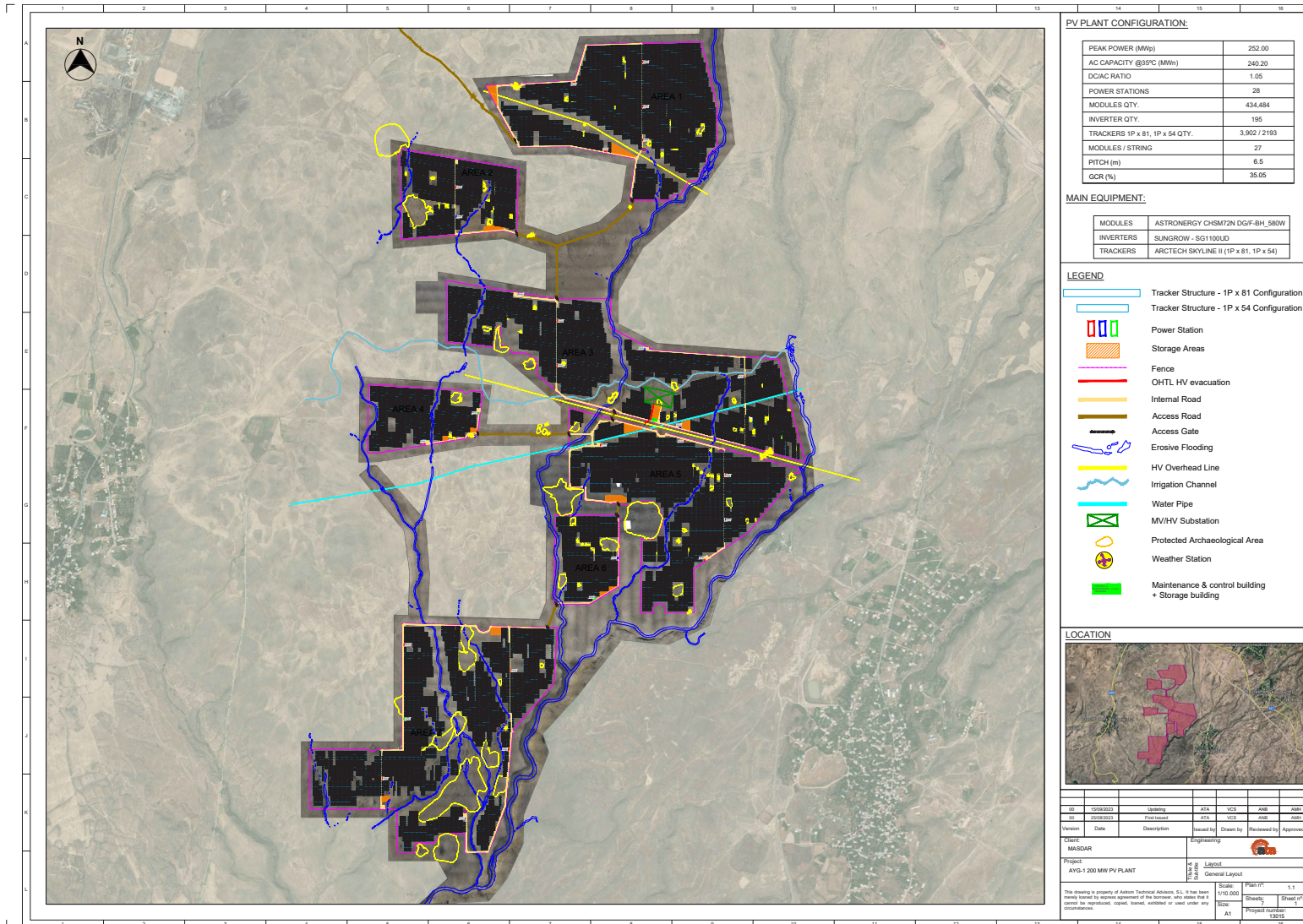
- Solar panels & inverters;
- Project Substation;
- Interconnection;
- Access roads;
- Control centre;
- Temporary construction infrastructure.

The three main components of modern solar panels are:

- Solar Photovoltaic Panels made up of a transparent photovoltaic (PV) glass as well as PV cells;
- Inverter which converts direct current electricity, to alternating current (AC) electricity;
- A transformer which enables connection of the PV Plant to the national electricity grid.

The Project has not yet decided on the solar panel supplier, this will be selected after the EPC contractor is finalized. However, only tier 1 suppliers will be considered with a proven track record and fulfilment of ISO / other international standards.

Figure 3 AYG-1Project Design



A preliminary Project design has been completed thus far by Masdar. Once the EPC contractor is selected, a detailed Project design will be finalized.

### 3.2.1. Transmission Lines and Substation

The interconnection option that has been selected will connect to an existing power line adjacent to the site. The Project will use a ‘loop in, loop out’ method of connecting the solar power plant to two 220KV existing transmission lines. Cable trenches will be used to connect the solar panels to the Project substation. The Substation will be designed based on a thorough Grid Interconnection Study which lays out the requirements to best comply with the conditions of the Grid. The preliminary substation layout is detailed the Figure below.

The length of the interconnection line to the existing transmission line is 300m. There will be no transmission towers required to support the interconnection line seeing as the connection point is a short distance away from the existing transmission line.

### 3.2.2. Logistics and Site Access

Imported equipment, including the solar panels, inverters and transformers as well as other associated equipment will be shipped and transported to the site by road. The main roads for delivering components are: Yerevan-Gyumri highway (M1), existing community roads and site access roads.

A logistics study will be undertaken by the selected EPC Contractor to confirm the maximum size of equipment that can reach the Project area through existing highways

and roads, and determine if and where roads should be reinforced. Local roads may need to be improved to allow for the access of heavy and special vehicles. Access roads that cross local communities poses a significant risk and shall be avoided whenever possible, access roads that allow direct access from national roads without crossing communities shall be favoured. A short (approximately 2km) access road will be constructed from the existing road network to the site to provide access to employees, trucks, deliveries, solar panels etc. This access road options are being evaluated between the indicated options below (Figure 6). The road that is most likely to be chosen as the access road is depicted in green, preliminary evaluations have suggested that this road will have the lowest level of impact on communities. The access road will be asphalted and dual carriage.

During public consultations, Dashtadem community indicated that they preferred for the access road to be constructed from Dashtadem in order to facilitate accessibility to other lands near the Project site. The Project considered this option, but the assessment indicates that this access road will pose a higher level of risk to communities, hence the ESIA consultants recommend not to implement this option.

The Project has not yet finalized the selection of the access road, this will be selected after the EPC Contractor is finalized. Within the plant, the types of roads would be:

- Main Gate to the Substation building – The road will be asphalted dual carriage roads with hard shoulders and comply with the applicable codes and standards
- Perimeter Roads - These roads are to be compacted with a minimum width and shoulders that would comply with the





applicable codes and standards

- Internal roads – These roads are to be compacted with a minimum width and shoulders that would comply with the applicable codes and standards.



**Figure 4 Access Road Options**

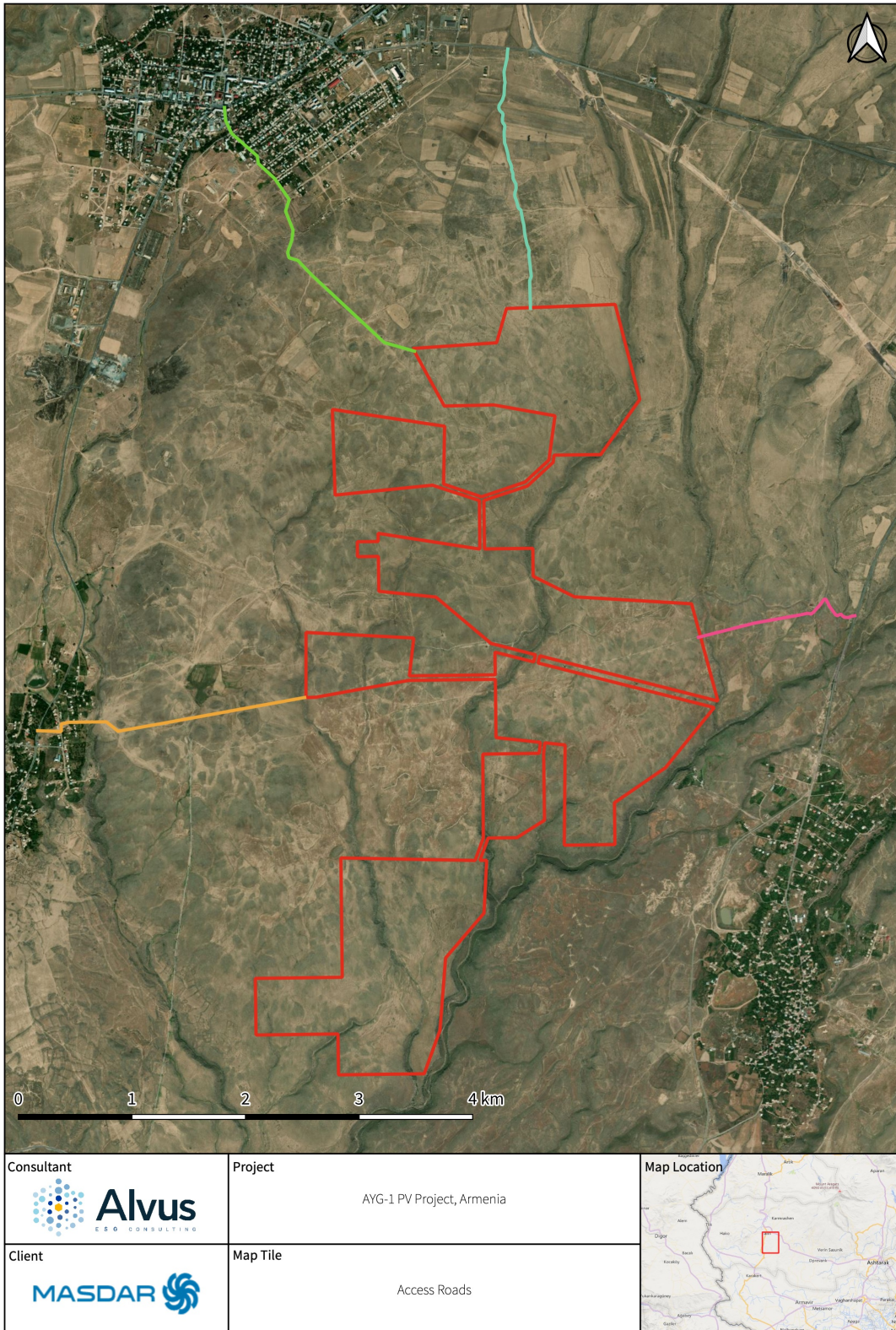
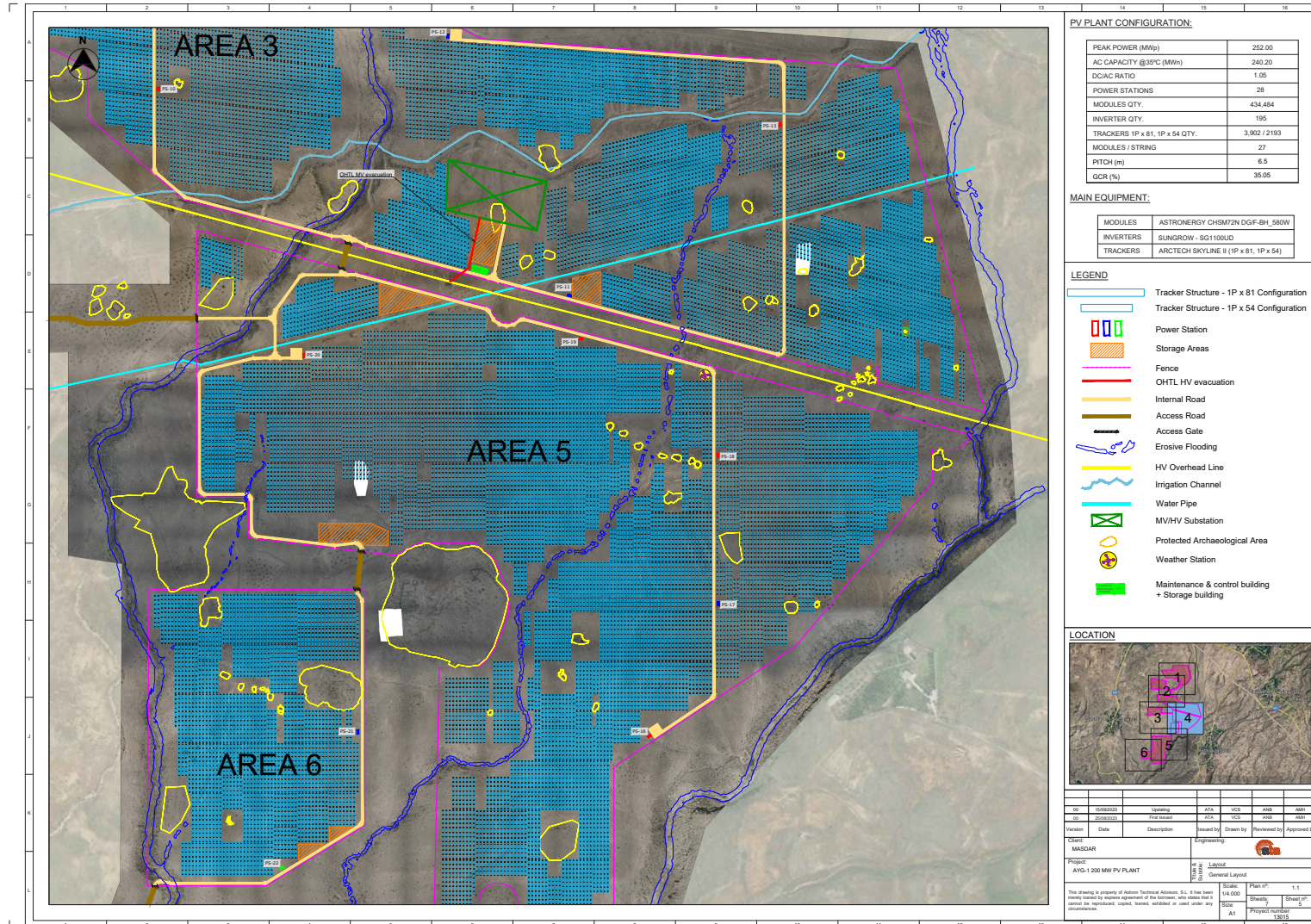






Figure 5 OHTL Interconnection



### 3.3. Project Schedule

The detailed construction schedule will be provided by the EPC once selected. The construction period is estimated to last between 18-24 months.

The Project is expected to reach financial close by early 2023. Following this, the Project has estimated that it will issue notice to proceed status by mid 2023.

By 2025, the Project aims to reach the commercial operation date meaning the PV Plant will become fully operational and begin creating renewable energy for the national grid, and it will operate during 25 years.

Typically, the PV plant is built as follows:

- Initial Site Works are done alongside Detailed Design and Sourcing Activities
- Upon finalization of Detailed Design, the Main Equipment contracts are executed
- Civil works are underway (trenching, cable laying, foundations setting, building erection)
- The Trackers are installed along with inverters and other equipment
- PV Modules arrive and are then installed, the HV Transformer arrives and is installed

- Upon this all connections are made, and Testing and Commissioning is started (Electromechanical Testing, Functional Testing, Performance Testing)
- Plant passes tests and is then Commissioned



### 3.4. Workforce Requirements

The Construction personnel expected for the project will be a mix of Management, Skilled and Unskilled Labor. The Manpower requirements will ramp up and wind down in the typical manner as is expected in the construction of PV power plants of this size. The only anomaly is that the construction will slow down during the winter months due to harsh weather conditions (in between construction – denoted in red box in the Figure overleaf)

A minimum of 250 workers are expected to be employed during the construction phase. Based on availability and requirements, during the construction phase between 25-75% will be local hires. The Table below details the manpower figures expected during the construction phase. The Project is expected to employ 15-25 employees during operations, of which at least 50% would be local hires.

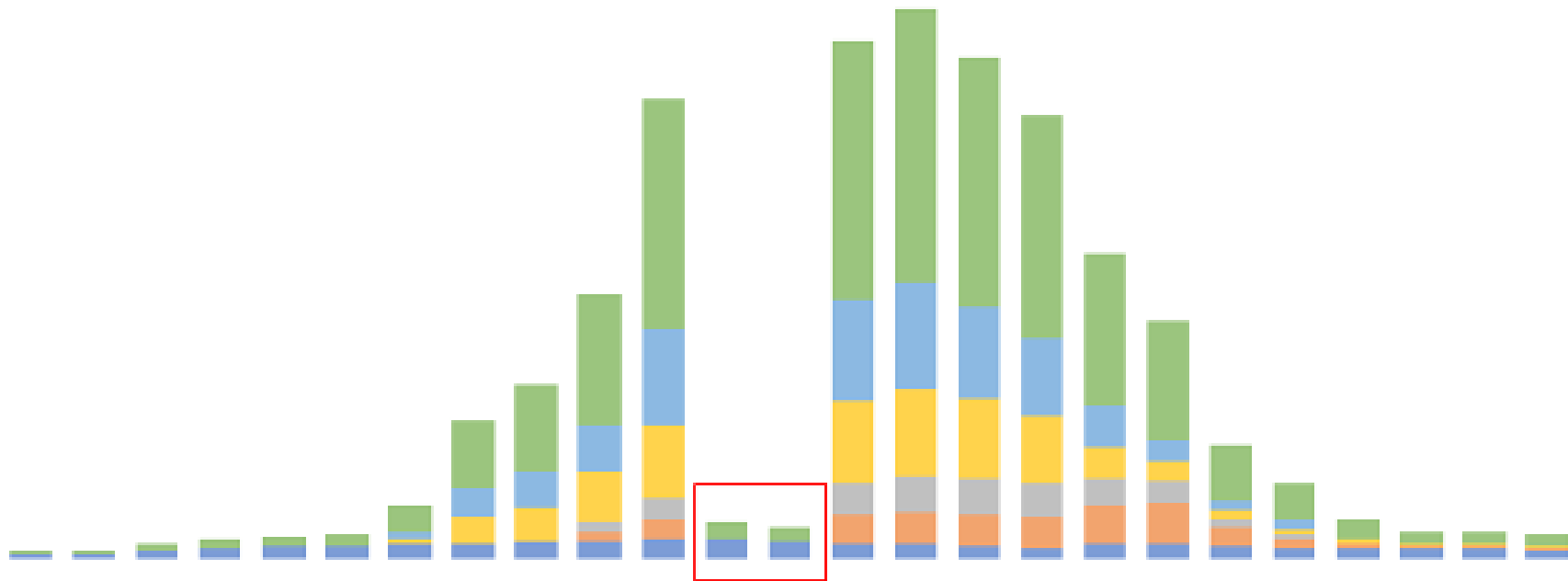
**Table 4 Manpower Required During Construction**

Type	Average	Maximum
EPC Personnel	25	98
Subcontractor	224	570

Figure 6 AYG-1 Manpower Estimate per Month



## AYG-1 = MANPOWER DEPLOYMENT PLAN



Each column represents one month since Notice to Proceed. This monthly manpower estimate is for illustrative purposes only, and it should consider that construction is expected to last between 18 and 25 months.

### 3.5. Construction Activities

Construction activities will include:

- Recruitment of workers and deployment of specialists;
- Establishment of construction compound and worker facilities;
- Site preparation, including installation of fencing or suitable barriers;
- Compounds and lay down areas;
- Limited site levelling and internal roads;
- Construction/establishment of the cement batching plant;
- Construction, widening and strengthening of access roads;
- Laying of tracker foundations;
- PV panel delivery, tracking facility assemblage, PV panel installation;
- Installation of underground cable network, set up transformer and control system;
- Testing PV Panels and verify correct operation;
- Construction of buildings and infrastructure for the operational phase, including the substation Building (comprising of the Transformer, Switchgear, LV/MV Switch rooms, Battery room etc), warehouse/Workshop, O&M Building, fire-fighting infrastructure, and toilets;
- Completion of loop in, loop out transmission line/ grid connection;
- Commissioning of the PV Plant; and
- Decommissioning of temporary construction facilities.

### 3.6. Construction facilities



Temporary construction facilities such as site offices and lay down areas will be located within the Project site. Worker accommodation may require the construction of a camp, but this is considered unlikely, given the availability of existing unused buildings in the region where workers can be lodged. The Information on construction support facilities (e.g. worker accommodation, temporary access roads, offices), number of workers, equipment details, etc. will be confirmed by the EPC contractor once selected and incorporated into the ESMS.

The construction phase of the Project will require concrete. Concrete can be purchased from suppliers and delivered by mixers or batched onsite. This ESIA assesses the potential impacts on on-site concrete batching.

A Mobile Concrete Batching plant could be placed on site for the preparation of the concrete to be used for the foundation installations for the Trackers and potentially for the Substation building. Having the Mobile Concrete Batching plant within the site is potentially beneficial as it reduces the transportation requirements (which saves emissions, reduces traffic risks and costs). Another benefit is that the concrete will be of a higher quality since external factors such as heat and dampness will not have the same effect as they would if the cement was being transported from off-site. Furthermore, having delays in the transportation process will require the concrete to be diluted in order to not set, which will reduce the quality of the concrete. An example of a Mobile Concrete batching plant that will be used is shown below in Plate 3.



Plate 3 Example of a Mobile Concrete Batching Plant



### 3.7. Construction Materials

The main materials required during the construction phase of the Project and their sources are summarized in the table below:

**Table 5 Construction Materials and Likely Sources**

Materials/Equipment	Source
PV panel components	Imported
Trucks for transportation of PV components	Imported/locally sourced
Aggregate material and building sand	Locally sourced
Concrete blocks, cement and coarse aggregate	Locally sourced
Steel reinforcement	Local suppliers
Power supply equipment	Imported/locally sourced
Tools for vegetation clearance	Locally sourced
Heavy Machinery	Locally sourced/imported
Water	Locally sourced

### 3.8. Project Alternatives

The Project Alternatives are described and assessed below. The no Project alternative is considered, alternative energy sources are assessed, alternative locations are discussed, and alternative Project designs and components are discussed. This discussion includes a description of the process followed to select the final PV panel model and the final panel locations.

#### 3.8.1. No Project Alternative

The no project scenario is that the PV Plant is not built. In the event that the PV Plant is not built, there will be a negative impact as Armenia will remain reliant on fossil fuel imports and will have to develop other renewable energy projects in order to fulfil its commitment to reduce GHG emissions. Under the No Project alternative, there will be no positive or negative impacts on local communities, and there will be no Community Development Plan (CSR) implemented by the Project Company.

#### 3.8.2. Alternative Energy Sources

Alternative electricity generation technologies are illustrated in the figure below, including solar energy benefits and impacts relative to other energy sources. The alternative attributes of each energy generation technology relative to wind energy are as follows:

- Hydropower: has higher water requirements than solar energy as well as higher construction and electricity costs. Long droughts can severely affect hydropower generation.

- Geothermal power: has higher water requirements than solar energy and also produces more air emissions (CO<sub>2</sub> and other) and waste products. Construction and electricity costs are also higher compared to PV Plants.
- Biomass power: has a much higher water requirement than solar energy as well as air emissions (CO<sub>2</sub> and other) and waste products. Construction and electricity costs are also higher compared to PV Plants.
- Wind Power: The cost of constructing a wind farm is higher compared to PV plants. Wind farms can have negative impacts on birds and bat if not adequately mitigated and managed. Wind farm locations are constrained by wind resource availability and power generation at wind farms peaks during high wind periods, that do not necessarily match demand peaks.



Overall, solar energy plays an important role in the renewable energy mix, to ensure competitive and stable renewable electrical generation. The figure below summarises the pros and cons of different energy sources.

Figure 7 Relative Benefits and Impacts of Electricity Generation Technologies



### 3.8.3. PV Panel Alternatives

There are a variety of different solar PV technologies and products. The performance and cost of different products varies greatly. The most common solar PV technologies are:

- **Mono-crystalline silicon panels:** typically the most efficient commercial solar panels at converting light into electricity
- **Multi-crystalline silicon panels:** typically slightly less efficient than mono-crystalline panels but often less expensive

- **Thin film panels:** this encompasses a range of technologies (including those made from cadmium telluride, copper indium gallium diselenide and amorphous silicon).

Mono-crystalline panels will be used for the AYG-1 Project. The specific supplier of the PV panel model will be selected once the EPC contractor is finalized.

### 3.8.4. Site Alternatives

Prior to the tender process, Masdar was in discussions with the Government of Armenia to develop a 200MW PV project on a bilateral basis. Three other areas were considered for the Project which are mapped below but were ultimately rejected by the Armenian Government.

The sites that were initially considered were discarded due to either being private land (which is very difficult to acquire), intended for agricultural use (for which it is not possible to get environmental clearance) (Figure 9) or for government use (Figure 10 & 11). As such, the final site for the AYG-1 PV Plant was chosen by the Government as it was the only identified site that met the relevant criteria for development.

The Project site that is currently under development is the land that was offered by the Government during tender process.

### 3.8.5. Design Alternatives

The AYG-1 site has developed through several iterations. Initially, the design assumed that the full site will be cleared and levelled, and the site usage would be maximized (which is the most optimal solution, performance wise). The initial plant layout/design was developed assuming the entire area on the site will be cleared (i.e. all rocks / stones will be removed) and levelled (but using cut and fill strategy, whereby the natural slopes of the land is evened out to a more flat profile) to optimize the usage of the land and maximize the placement of panels and generation output (Figure 12).



Based on current understanding of site constraints, the design has carefully considered the plant layout to maximize the site usage and minimize the disturbances of archaeological features which includes the following:

- minimizing the site clearance activities and levelling,
- re-routing roads and cable trenches and re-positioning tracker tables to avoid archaeological features to the extent possible.

The minimisation of levelled areas, in addition to enhancing the conservation of archaeological sites also minimise damage to vegetation and favours re-growth during operations (Figure 13).

The design optimisation has achieved a highly effective avoidance of direct impacts on archaeological features, exceeding 99% avoidance.



Figure 8 Site Alternative on Privately Owned Agricultural Land

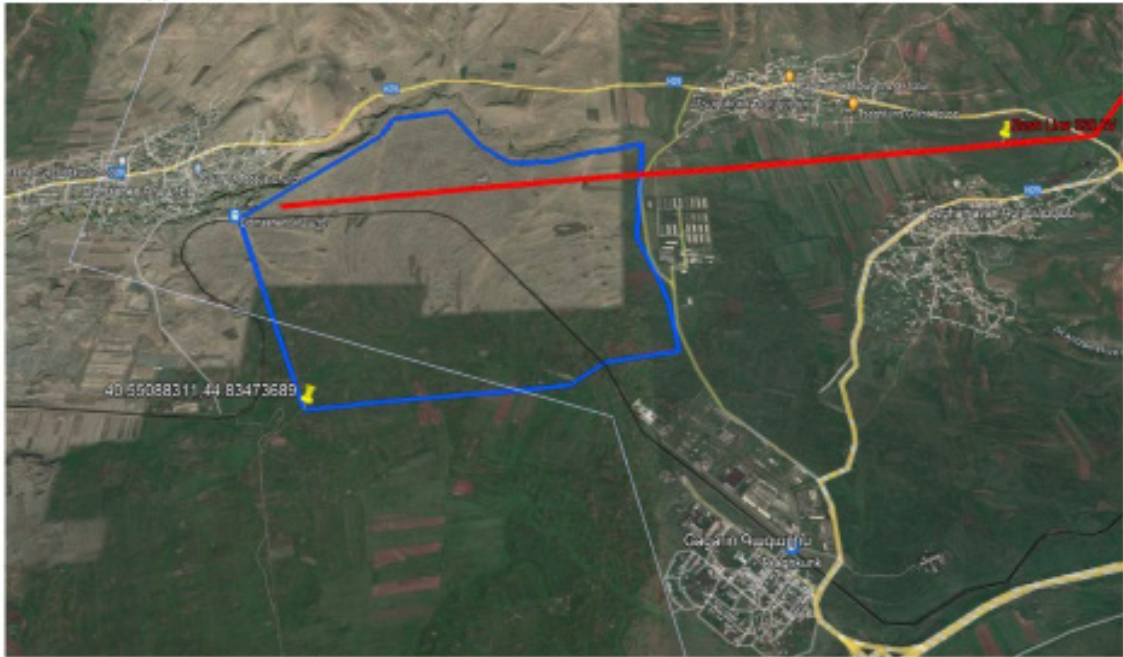


Figure 9 Site Alternative on Lands Used by Government



Figure 10 Site Alternative on Lands Used by the Government





Figure 11 Design of AYG-1 Bid Submission

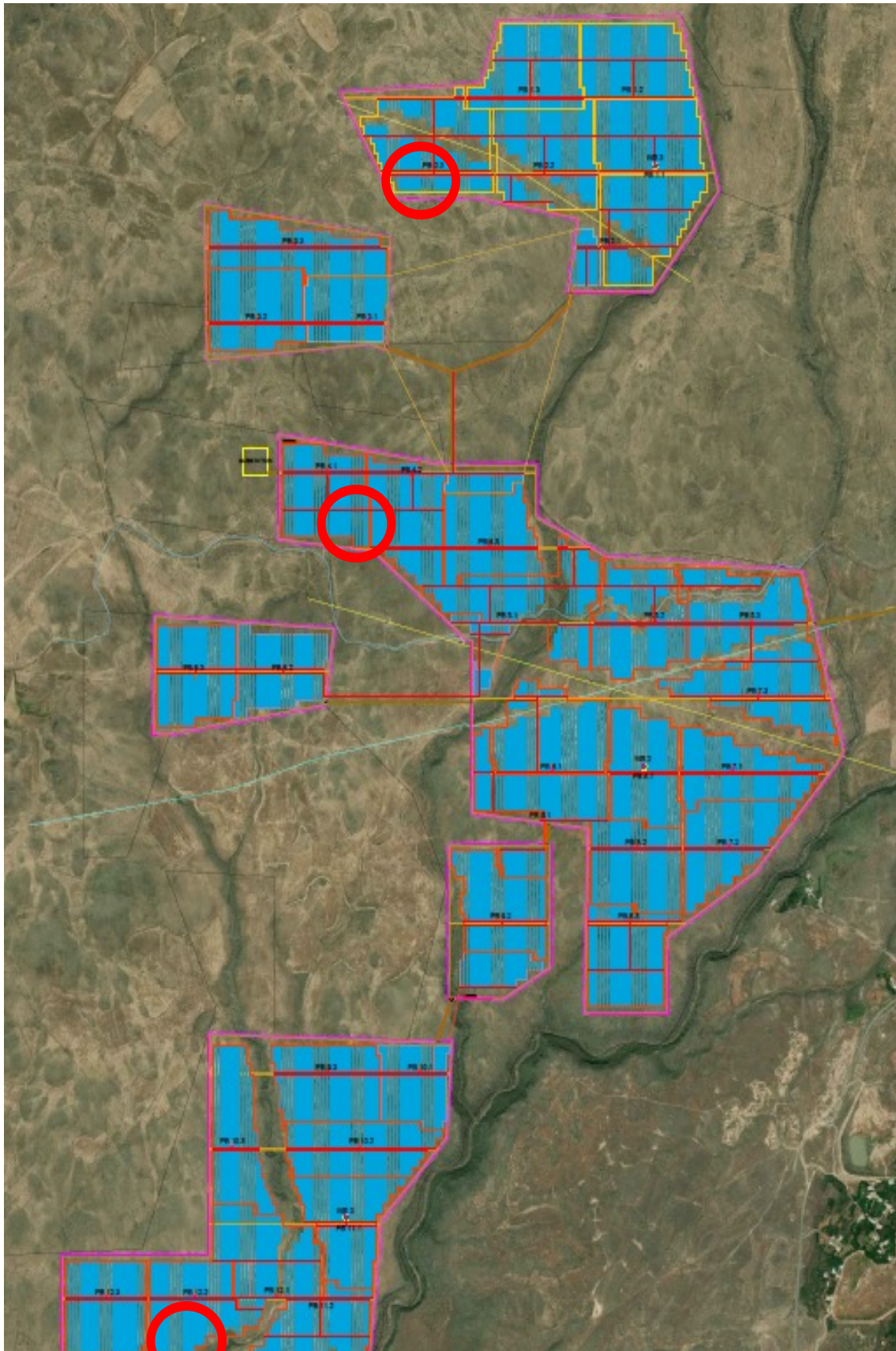
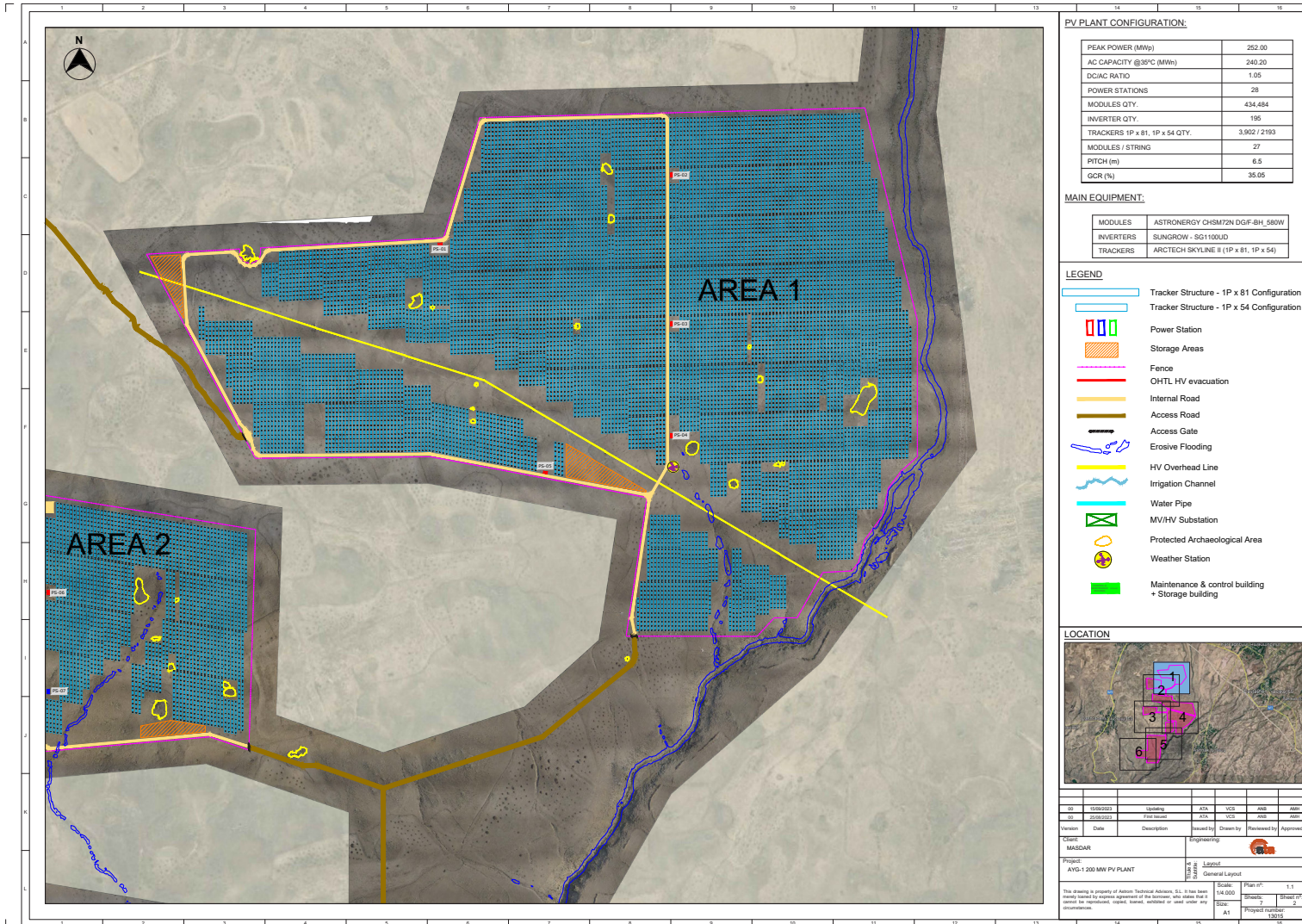
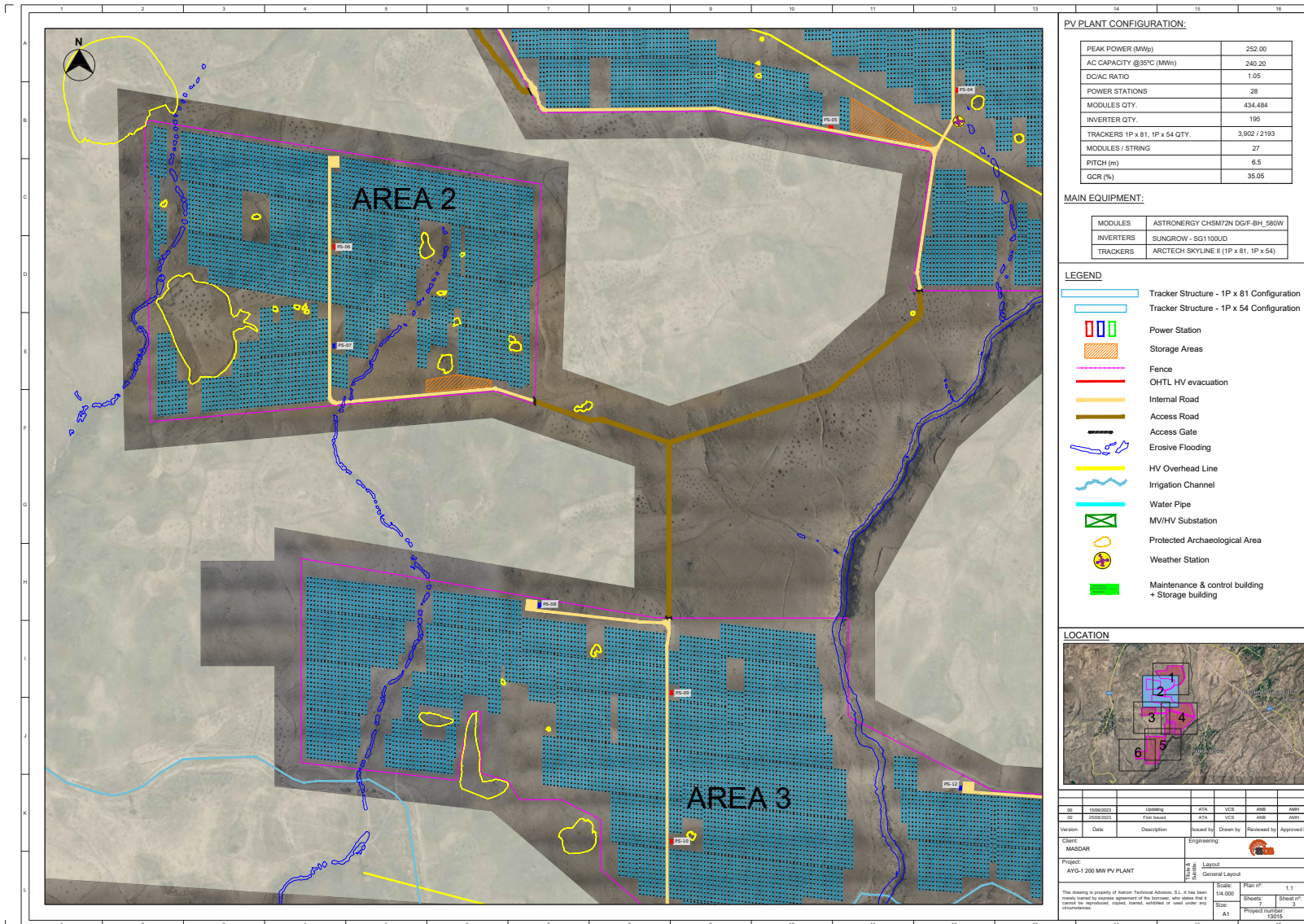




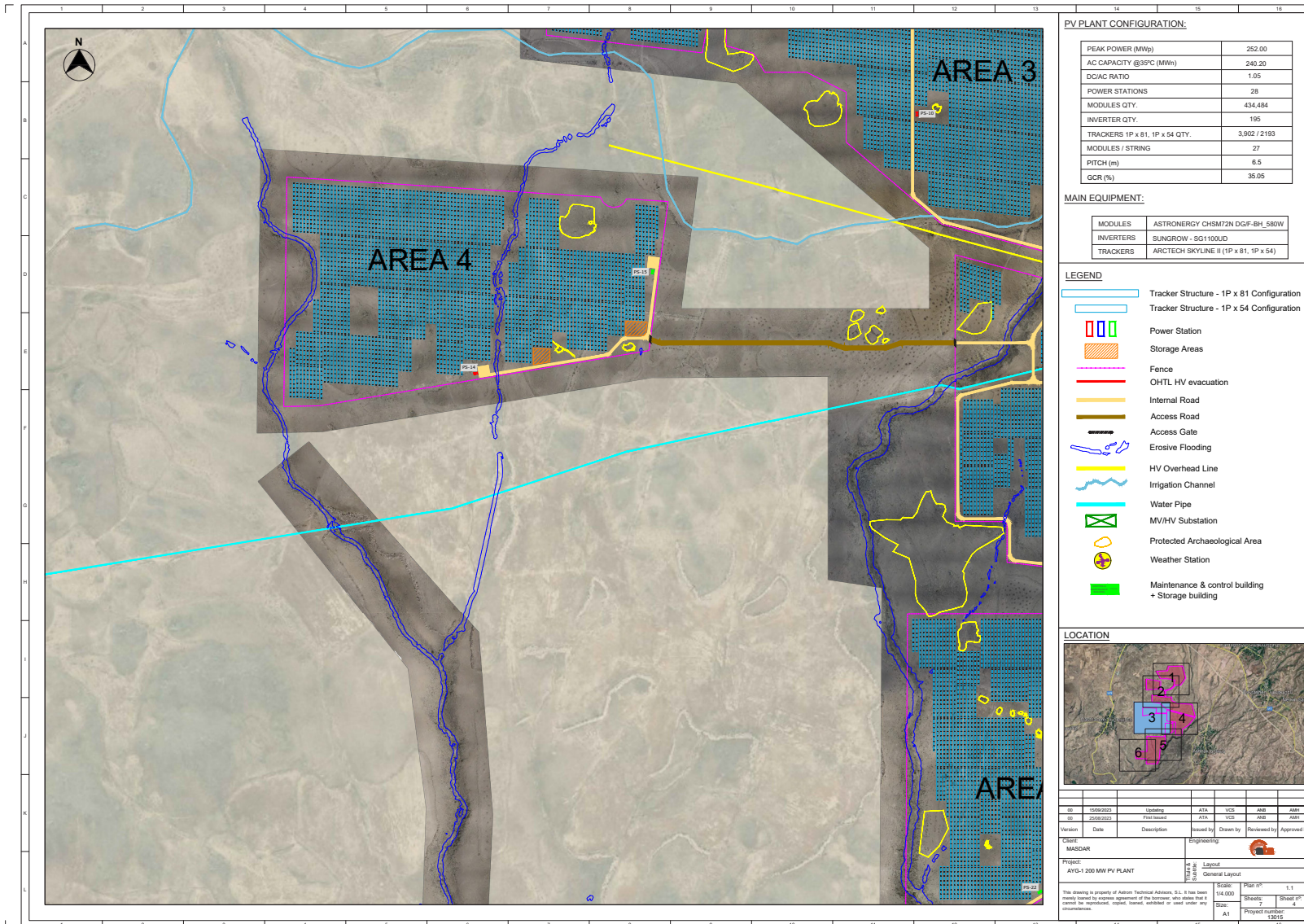
Figure 12 Optimised design for Avoidance of Archaeological Features



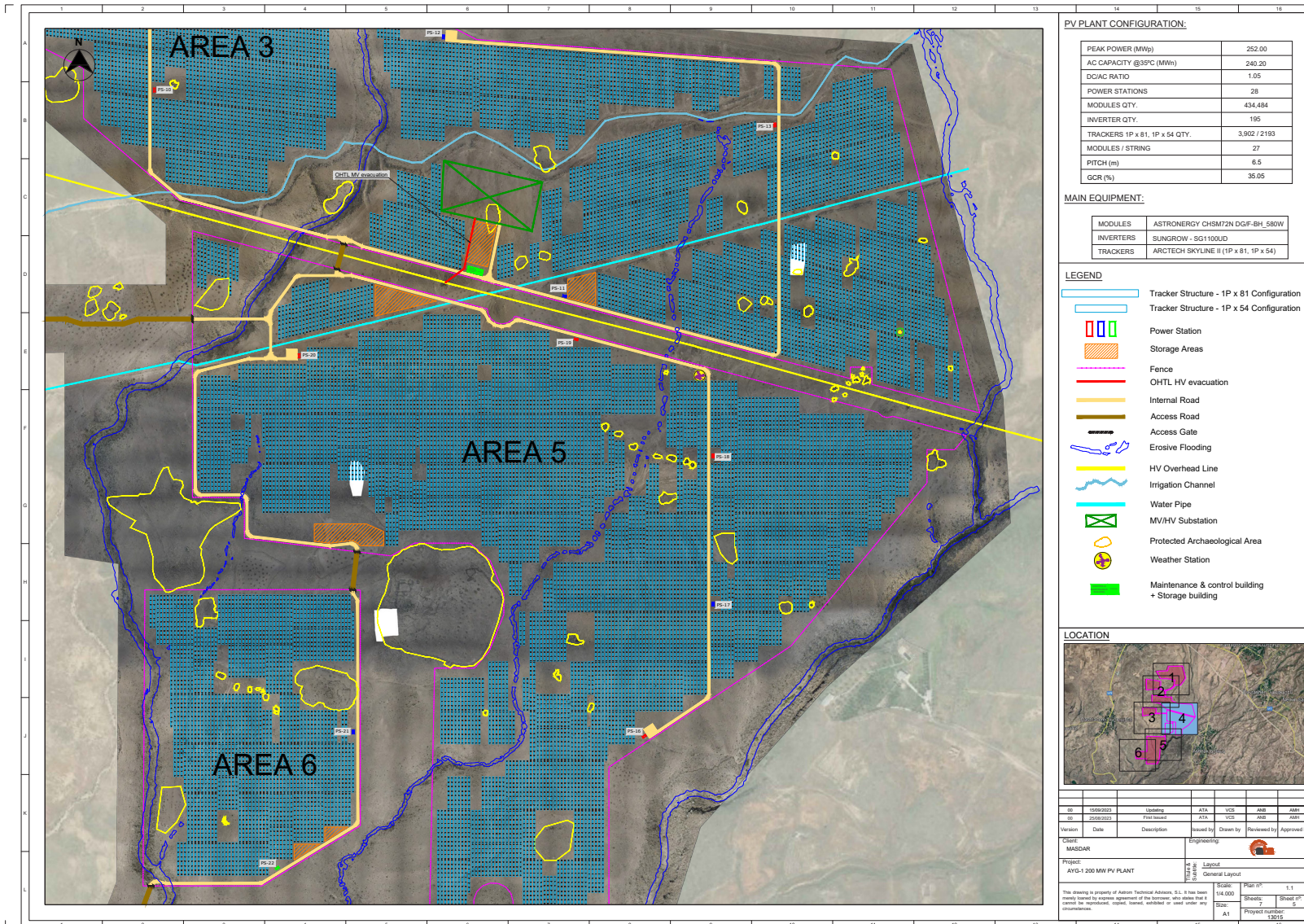




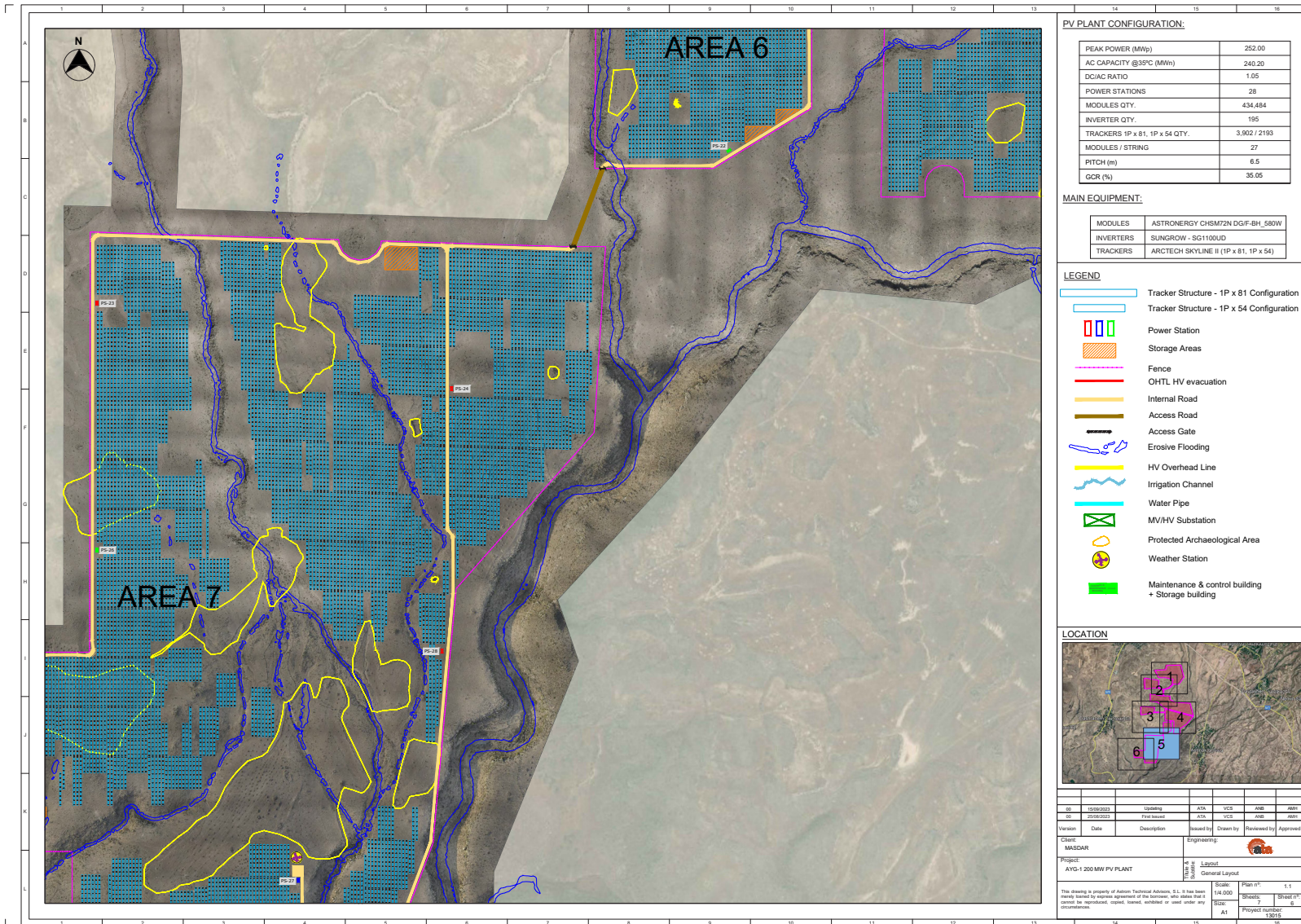




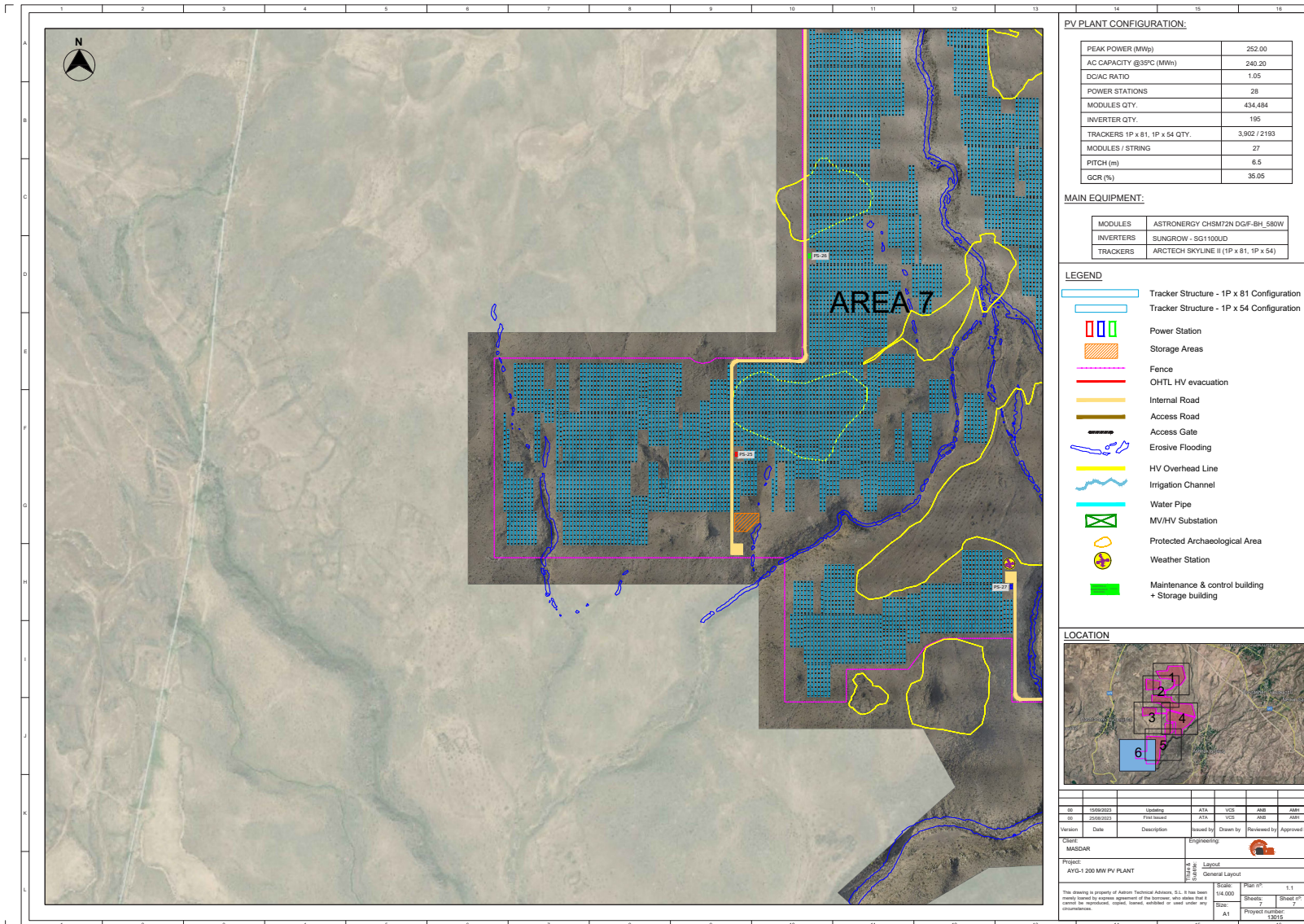












**PV PLANT CONFIGURATION:**

PEAK POWER (MWp)	252.00
AC CAPACITY @35°C (MWh)	240.20
DC/AC RATIO	1.05
POWER STATIONS	28
MODULES QTY.	434,464
INVERTER QTY.	195
TRACKERS 1P x 81, 1P x 54 QTY.	3,902 / 2193
MODULES / STRING	27
PITCH (m)	6.5
GCR (%)	35.05

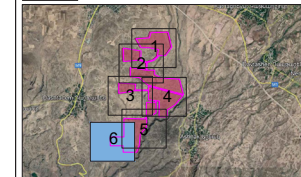
**MAIN EQUIPMENT:**

MODULES	ASTRONERGY CHSM72N DGF-BH_580W
INVERTERS	SUNGROW - SG1100UD
TRACKERS	ARCTECH SKYLINE II (1P x 81, 1P x 54)

**LEGEND**

- Tracker Structure - 1P x 81 Configuration
- Tracker Structure - 1P x 54 Configuration
- Power Station
- Storage Areas
- Fence
- OHTL HV evacuation
- Internal Road
- Access Road
- Access Gate
- Erosive Flooding
- HV Overhead Line
- Irrigation Channel
- Water Pipe
- MV/HV Substation
- Protected Archaeological Area
- Weather Station
- Maintenance & control building  
+ Storage building

**LOCATION**



ID	1558/2023	Updating	ATA	VCS	AW	AW
ID	2558/2023	First Issue	ATA	VCS	AW	AW
Version	Date	Description	Issued by	Drawn by	Reviewed by	Approved by
Client	MASDAR		Engineering			
Project	AYG-1 200 MW PV PLANT		Layout			
Scale	1:4,000		Sheet n° 7			
Size	A1		Project number: 13016			



## 4 E&S Regulatory Framework

This Chapter presents the policy, legal and administrative framework for environmental and social management in the Republic of Armenia. The Project must conform to applicable local/ national and international environmental and social legislation, regulations and guidelines as well as specific procedures and policies of State Authorities, IFC Performance Standards, IFC Guidelines, EBRD performance requirements, ADB E&S safeguards and other Lender requirements and other available best practices.

The following national policies, laws, regulations and lender requirements are applicable E&S obligations for the Project, and therefore shall be complied with and taken into consideration during the design, construction, operational and decommissioning phases of the Project.



## 4.1. Constitution of Armenia (1995)

The Constitution of Armenia is the core document and tool that governs Armenia and is committed to nurturing and protecting the well-being of the individual, the family, communities and the nation and recognizing the aspirations of all Armenians for a government based on the essential values of human rights, equality, freedom, democracy, social justice and the rule of law.

It also advocates for the respect of the environment, which is our heritage, and is determined to sustain it for the benefit of future generations. Since it was adopted in 1995, the constitution has highlighted the basic human rights and fundamental freedoms of Armenian people.

According to the constitution, everyone shall have the freedom to choose his/her occupation. Everyone shall have the right to fair remuneration in the amount no less than the minimum set by the law, as well as the right to working conditions in compliance with the safety and hygiene requirements.

The employees shall have the right to strike for the protection of their economic, social and employment interests, the procedure and limitations thereof shall be prescribed by the law. The children under the age of 16 shall not be allowed to work full time. The procedure and conditions for their hiring to a part-time job shall be defined by the law. Compulsory employment shall be prohibited.

Everyone shall have the right to live in an environment favourable to his/her health and well-being and shall be obliged to protect and improve it in person or jointly with others. The public officials shall be held responsible for hiding information on environmental issues and denying access to it.



## 4.2. Armenian Laws, Policies, Codes and Standards

### 4.2.1. Land Code

The Land Code of Armenia which is outlined in the constitution of the Republic of Armenia was accepted on the 2nd of May, 2001. Taking into account the nature protection, economic and social significance of the land, for which it is used and protected as the warranty of vital activity of the population of the Republic of Armenia, the Land Code defines the basic directions of State regulatory system improvement concerning land relations, development of various organizational and legal forms of land economy, fertility of land, land use efficiency raise, protection and improvement of an environment – favourable for human vitality and health and the legal framework concerning the protection of the rights on land.

Ownership, use and disposition of land must not harm the environment, security and defensibility of the State; must not violate rights and legally defined interests of citizens and other entities

The preamble of the Land Code stipulates that the possession, disposition and use of lands shall not cause damage to the environment, defensibility and security of the country shall not

violate the rights and lawful interests of citizens and other persons. The Land Code defines the main directions for use and disposition of the state lands, included those allocated for various purposes, such as agriculture, urban construction, industry and mining, energy production, transmission and communication lines, transport and other purposes. The Code also defines the lands under the specially protected areas as well as forest, water and reserved lands. It also establishes the measures aimed to the land's protection, as well as the rights of state bodies, local authorities and citizens towards the land.

The Government of Armenia directly or by means of the authorized bodies implements the State management of the land resources of the Armenia. Following the requirements of this Code, the decree on the establishment of technical regulations for general requirements for protection of lands from pollution, list of substances polluting the lands, and assessment of level of land pollution was adopted by the Government of the Republic of Armenia.

Article 8 in the Land Code is of particular importance to the proposed development. It states that permitted land use is the use of land for its intended and operational purpose, including defined rights and restrictions.

#### 4.2.2. Water Code

The water code was accepted by National Assembly of the Republic of Armenia on June 4, 2002. The main purpose of the Water Code is to provide the legal basis for the protection of the country's water resources, the satisfaction of water needs of citizens and economic sectors through effective management of water resources and safeguarding the protection of water resources for future generations.

The Water Code addresses the following key issues:

- Responsibilities of state/local authorities and public;
- Development of the National Water Policy (2005) and National Water Program (2006);
- Water cadaster and monitoring system;
- Public access to the relevant information;
- Water use and water system use permitting systems;
- Trans-boundary water resources use;
- Water quality standards;
- Hydraulic structures operation safety issues;
- Protection of water resources and state supervision.



Article 21 is of particular relevance to the Project. It states that everyone is obliged to obtain a water use permit for any type of water use, except for the cases provided by the code.

#### 4.2.3. Labour Code

The Labour Code of the Republic of Armenia, adopted on 9 November, 2004, protects the rights and interests of employees and employers in collective and individual employment relationships, establishes state guarantees for labour rights and freedoms, and promotes the creation of favourable conditions of work. The Labour contract must comply with the rules established by the law or other normative legal acts in force at the time of concluding it. The labour relations between the employee and employer are originated on the basis of labour contract concluded in a procedure established by the Labour Code and other normative legal



acts containing norms on labour Code. Article 3:1 state that discrimination is prohibited by the Labour Law. The employer obliged to provide safe working conditions for its employees.

The probation period may not exceed three months, except in the cases provided for in the Labour Code. The duration of daily working hours may not exceed eight working hours, except for the cases provided by this Code, law, other legal acts and the collective agreement. The maximum duration of working hours, including overtime work, cannot exceed 12 hours per day (including break for eating), and during the week - 48 hours. In case of termination of the labour contract, the employer must notify the employee in writing no later than two months in advance.

The salary is calculated every month and is paid to the employee at least once a month on working days until the 15th of the following month. In the cases defined by the Labour Code the severance package is equal to the average monthly salary.

Activities and operations of the Project shall be implemented in accordance with the mentioned Code in order to assure the protection of the rights and interests of the workers that will be employed by the Project.

#### 4.2.4. Code on Subsoil

The principles and order of subsoil use in the territory of the Republic of Armenia, the nature of subsoil use and the problems of protecting the environment from harmful effects, ensuring the safety of works, as well as the relations related to the protection of the rights and legal interests of the state and individuals during subsoil use are regulated by the Law of the Republic of Armenia (November 28, 2011) with the code of conduct.



If due to the construction works it will be more appropriate to carry out the inert materials' (sand, gravel) supply from their own mine, all registrations will be done according to the requirements of this Code.

#### 4.2.5. Forest Code

This Code governs the relations connected with steady management of the woods and the forest lands of the Republic of Armenia - protection, protection, recovery, afforestation and rational use, and also the relations connected taking into account, monitoring of the woods with forest control and forest lands.

#### 4.2.6. Norms N2-III-11.3 Noise at Workplaces, Residential, Public Buildings and Urban Areas

Maximum allowable noise levels are prescribed within the Sanitary Norms N2-III-11.3 “Noise at workplaces, residential and public buildings, and urban areas” approved by the Armenian Ministry of Health (Order No 138 dated 6 March 2002).

This is of particular relevance to the Project and will be complied with seeing as there will be noise emitted mainly during the construction and decommissioning phases of the Project.



These maximum allowable noise levels are shown in the table below.

**Table 6 Maximum Allowable Noise Levels as per Armenian Legislation**

Type of receptor	Hours	Noise Thresholds	
		dB <sub>LEQ</sub>	dB <sub>LMAX</sub>
Near residential dwellings and public buildings	06:00-22:00	5	70
	22:00-06:00	45	60

#### 4.2.7. Law on Transport

It regulates the legal, economic and organizational provisions in the sphere of transport activity, rights and responsibilities of participants engaged in the process of transport activity and carries out the protection of their legal interests. In particular, the law defines the main conceptions of transport and transport activity, transport system and transport services, State regulation in the spheres of Transport activity and Transport system, Licensing of Transport activity, Main Transport activity provisions, Security and responsibility in the process of transportation.

This law is of relevance to the Project seeing as transport of the PV panel components to the site will be required

#### 4.2.8. Law on Automobile Roads

Regulates legal and economic relations of organization and implementation of vehicle transport activities in Armenia, vehicle exploitation, transport of passengers, luggage and goods, relations connected with safety of services and transport and also rights and responsibilities of legal and physical entities engaged in this process. In particular, the law defines the main concepts of Vehicle transport, Vehicle transport sphere, Vehicle transport activity, problems and principles of legislative regulations in the sphere of Vehicle transport, State regulation and management in the sphere of Vehicle transport, Licensing and insurance, organizational issues of transport of passengers, luggage and goods in Vehicle transport, rights, obligations and

responsibilities of ferryman and customer, Security requirements for transport by Vehicle transport.

This law is of relevance to the Project seeing as transport of components and staff components to the site will be required which may use roads near to communities. Access roads are also a component of the Project which will also be built and utilised.

#### 4.2.9. Law on Ensuring Sanitary-Epidemiological Security

The Law on Ensuring Sanitary-epidemiological Security of the Armenian Population was adopted in 1992 and outlines the regulations to ensure the safety of the population in terms of epidemiological security. This Law sets legal, economic and institutional bases for ensured sanitary and epidemiological safety of the population, as well as other guarantees provided for by the State to exclude influence of adverse and hazardous factors on human organism and ensure favourable conditions for vital capacity of the present and future generations

This law is of particular relevance to the Project considering there will be solid waste and waste water generated by the Project. Mitigation measures will be implemented to ensure high sanitation measures are employed throughout the Project to prevent potential adverse health impacts on employees and the local community.

#### 4.2.10. Law on Protection of Atmospheric Air

The Law on Protection of Atmospheric air was accepted by National Assembly of the Republic of Armenia on October 11, 1994.

Atmospheric air is one of the basic vital elements of the surrounding environment. Proceeding from interests of the present and future generations, the Republic of Armenia holds evidence-based events which purpose it is to warn and eliminate pollution of atmospheric air, other harmful effects on it, and also performs international cooperation in the field of protection of atmospheric air. It is a regulation which ensures purity of atmospheric air, decrease and prevention of harmful effects on atmospheric air.



Subjects of that law are prevention and elimination of atmospheric air pollution and realization of international cooperation within protection of atmospheric air. The main legislative issues in this domain are:

- Maintenance of improvement of purity and quality of atmospheric air
- Prevention and reduction of chemical, physical, biological and other influences over atmospheric air conditions
- Regulation of public relationships within that sphere
- Strengthening of legality within that sphere.

There are no Project specific requirements for the Project in relation to this law, as PV Projects do not have operational air emissions. However, the Project will be mindful of air pollution throughout all stages of the Project, ensuring conformance to this law at all times particularly vehicle emission and dust during construction.



#### 4.2.11. Law on Provision of Medical Care and Services

The Law on Provision of Medical Care and Services to the Population was accepted by National Assembly of the Republic of Armenia on March 4, 1996. This Law governs the relations connected with the organization of the medical care and servicing providing constitutional right of the person on health protection, prevention, legal and financial issues, and also turnover of medical products.

There are no Project specific requirements in relation to this law. However, the Project must be mindful of this law relating to medical care and services throughout all stages of the Project, especially for employees and ensuring adherence at all times ensuring medical screening of employees and an on-site clinic and ambulance during construction.

#### 4.2.12. Law on Conservation and Use of Historical, Cultural Monuments and Historic Environment

The Law on Conservation and Use of Historical and Cultural Monuments and Historic Environment was accepted by National Assembly of the Republic of Armenia on November 11, 1998. It focuses on the protection and use of immovable historical and cultural monuments and the historical circle. This law provides the legal and policy basis for the protection and use of such monuments in Armenia and regulates the relations between protection and use activities.

Article 15 of the Law describes procedures for, among other things, the discovery and state registration of monuments, the assessment of protection zones around them, and the creation

of historic-cultural reserves. Article 22 requires approval of the authorized body (Department of Historic and Cultural Monuments Preservation) before land can be allocated for construction, agricultural and other types of activities in areas containing monuments.

Article 22 is of particular importance in relation to the PV Plant development. Allocations of land for construction, agricultural and other types of works in the areas containing monuments are coordinated with the authorized body in accordance with the established procedure.

If the mentioned works can endanger the protection and safety of the monuments in specific areas, measures are outlined in advance to ensure the protection and safety of the monuments are carried out with the help of the Project by:

- Exploration
- Excavations
- Restoration works

In exceptional cases:

- Relocation and other works proposed by the authorized body.

#### 4.2.13. Law on Flora

The Law on Flora was adopted by the Republic of Armenia in 1999. The flora conditions human and animal vitality on the Earth. Flora is a national wealth and one of the most important preconditions for wellness, social and economic sustainable development of the Earth.



The law on Flora defines the State policy of the Republic of Armenia on scientifically motivated protection, maintenance, reproduction and use of natural flora.

On January 29, 2010 the Red Data Book of Plants was endorsed by the Government of Armenia through its decision 72–N. The RA Government adopted decree No. 781-N on “Establishing the procedure of utilization of items of flora for their protection and reproduction in natural conditions” in 2014, which defines measures to protect the newly detected species registered in the Red Data Book of Armenia including delineation of the protection zones and limitation of certain economic activities.

The law defines Armenian state policy in the field of maintenance, protection, usage and regeneration of flora. The law defines objectives of flora examination, state monitoring, state inventory, requirements and approaches of red book preparation on flora, conditions, peculiarities, limitations of allocation of flora objects for purposeful usage, basis of termination of the right to use, provisions on flora maintenance, and economic encouragement of usage and implementation of supervision. The law also defines the rights and obligations of the state governance and local governmental bodies in the field of flora maintenance, protection, reproduction and usage, mechanisms of state inventory, principles of deciding their indicator.

Article 14 may be of relevance in relation to the PV Plant development. Land users, in whose territories the species registered in the Red Book of Plants of the Republic of Armenia grow, are obliged to take measures for their protection in accordance with the legislation

of the Republic of Armenia. Any activity that leads to the reduction of the number of species registered in the Red Book of Plants of the Republic of Armenia and the deterioration of their habitats is prohibited.



#### 4.2.14. Law on Fauna

The Law on Fauna was adopted by The Republic of Armenia in 2000. The fauna of the Republic of Armenia is the national wealth. It is one of the most important factors that provide for the integrity of the nature, the guarantee of ecological balance and harmonic development. The fauna of the Republic of Armenia is its absolute property.

The law on fauna defines the State policy on protection, maintenance, reproduction and use of the wild species in the Republic of Armenia.

The law defines Armenian state policy in the field of maintenance, protection, usage and regeneration of fauna. On January 29, 2010 the Red Data Book of Animals of Armenia was endorsed by the Government of Armenia through its decision 71–N. The law defines the objectives of survey of the fauna, state monitoring, state inventory, requirements and approaches of red book preparation on fauna, conditions, peculiarities, limitations of allocation of fauna objects for purposeful usage, basis of termination of the right to use, provisions on fauna maintenance, and economic encouragement of usage and implementation of supervision. The law also defines the rights and obligations of the state governance and local governmental bodies in the field of flora maintenance, protection, reproduction and usage.

Article 18 in the Law on Fauna is of potential relevance to the development. Any activity that leads to a reduction in the number of species registered in the Red Book of the Republic of Armenia and the deterioration of their habitats is prohibited.

#### 4.2.15. Law on Waste

The law regulates legal and economic relations connected to the collection, transfer, maintenance, development, reduction of volumes, prevention of negative impact on human health and environment. The law defines the main principles and directions of state policy, the principles of state standardization, inventory, and introduction of statistical data, the implementation of their requirements and mechanisms, the principles of wastes processing, the requirements for presenting wastes for the state monitoring, activities to decrease the amount of the wastes, including nature utilization payments, as well as the compensation for the damages caused to the human health and environment by the legal entities and individuals, using the wastes, as well as requirements for state monitoring and legal violations. The law defines the rights and obligations of the state governmental and local governmental bodies, as legal entities and individuals.

Article 13 is of particular relevance to this Project. It states that hazardous waste generators, in accordance with the procedure established by the Government of the Republic of Armenia, compile and approve waste passports agreed with the authorized body in the field.

Legal entities generating hazardous waste and disposing of waste (including foreign and individual entrepreneurs) are obliged to submit

administrative statistical reports to the body authorized in the field in accordance with the law and other legal acts.

#### 4.2.16. Law on Minimum Wage

The Law on Minimum Wage was accepted by National Assembly of the Republic of Armenia on December 17, 2003. This law sets the minimum wage in Armenia, the minimum wage in Armenia is equal to 68,000 AMD.

This law is of particular relevance to the Project given the employment the Project will offer during the construction and operational phases. This law ensures all employees hired by the Project receive the minimum wage at the very least depending on job and experience.

#### 4.2.17. Law on Environmental Oversight

The Law on Environmental Oversight was accepted by National Assembly of the Republic of Armenia in 2005. The Law regulates the issues of organization and enforcement of oversight over the implementation of environmental legislation of the Republic of Armenia and defines the legal and economic bases.

Underlying the specifics of oversight, the relevant procedures, conditions and relations, as well as environmental oversight in the Republic of Armenia. The existing legal framework governing the use of natural resources and environmental protection includes a large variety of legal documents.

Governmental resolutions are the main legal instruments for implementing the environmental laws. Environmental field is also regulated by presidential orders, Prime-



Minister’s resolutions and ministerial decrees. The Law on Environmental Oversight is related to the project since it is subject to the oversight in accordance with the law. The Project will be in full compliance with the environmental legislation during construction and operation of the Project will be controlled by the Environmental Protection and Mining Inspectorate as per the provisions of this Law.

#### 4.2.18. Law on Specially Protected Natural Areas

The Law on Specially Protected Natural Areas was adopted by The Republic of Armenia in 2006. The law defines legal basis and relations of state policy for development, restoration, maintenance, reproduction and use of natural complex and separate objects, as well as ecosystems of specially protected natural areas of the Republic.

According to the law, specially protected natural areas are divided into four categories, National parks, State Reserves, Natural museums and the fourth category is divided into three separate types: areas of international, republican and local importance. Law defines concepts, regimes of maintenance, principles of preparation of specially protected natural areas management plans, monitoring, calculation and state registrar, as well as the requirements of usage, limitations and principles, rights and obligations of state governmental and local governmental bodies, maintenance bodies of the protected areas, the rights public to get an information on protected areas, financial sources of protected areas, requirement of supervision and responsibility for violating the Law on Specially Protected Natural Areas. The Project shall avoid impacts on Protected areas, in compliance with this Law.

#### 4.2.19. Law on Environmental Assessment and Expertise



The Ministry of Environment of the Republic of Armenia is the executive authority that has the legislative responsibility of administering the ESIA Process in Armenia.

The Law of the Republic of Armenia on Environmental Impact Assessment and Expertise from November 20th 1995 and its amendment approved in June 21st 2014 establishes that “socio-economic, energy, urban development, transport, communications, agriculture, mining, tourism, health care, environment, recreation, maintenance, forestry, waste utilization and water sectors” related activities and Projects are subject to Environmental Impact Assessment (Article 14, Chapter 3).

The assessment must cover a forecast, description and appraisal of possible direct and indirect impacts of the intended activity, encompassing all the different phases of the Project related to biodiversity, landscape, air, water, soil, cultural heritage, natural resources and the health and well-being of the population. Alternative solutions, measures for the elimination or minimization of the possible impacts, and a detailed appraisal of consequences for economic, social and environmental development in case of zero option due to hazardous impacts of the intended activities also need to be assessed.

According to the amendment of this law, the assessment and expert examination has to be carried out prior to the adoption of the mainframe paper and/or implementation of the planned activity.



Based on the type, scope and position of the planned activity and the full extent of the associated impacts, the assessment should be carried out in two phases:

- Initial phase, during which application for preliminary assessment is to be reviewed.
- Primary phase, during which the main assessment report shall pass expert examination.

The initial phase of expert examination has to be carried out within the first 30 days after the submission of the preliminary assessment application by the initiator to the authorized entity.

In the initial phase of assessment, the scope of potential environmental impact of the mainframe paper and/or planned activity is determined; the content and terms of the assessment report are established; a list of the participants of the process is prepared; and, based on all these activities, the terms of reference for the preparation of the consolidated impact assessment report is prepared and submitted to the initiator.

The exact contents that need to be included in the preliminary assessment are listed in Article 16, chapter 4 of the Law.

Article 17 of the law specifies the contents that need to be covered in the ESIA process, which needs to be included for expert examination in accordance with Article 18 of this Law.

According to Article 19, the review periods for SEEC should not exceed:

- Mainframe paper- up to 60 working days;
- Planned activity of category A- up to 60 working days;
- Planned activity of category B- up to 40 working days.



Expert examination conclusions are disclosed on the official website of the authorized entity.

Public Consultations are important in order to ensure public disclosure and participation, assessment processes and expert examination need to be subject to public notification and public consultations. Protection. Procedures on public discussions and consultations are established by Government decision (N 1325-N, 19 November, 2014)

Chapter 6 of the Law establishes that public notice has to be conducted by:

- Authorized entity – at least 7 working days before hearings of the application and reports submitted by initial and/or draft expert examination conclusion;
- Initiator – at least 7 working days before hearings of the mainframe paper and planned activity and assessments of their impacts;
- Territorial government bodies and head of community of the affected community at least 7 working days before hearings of the mainframe paper and planned activity and assessments of their impacts.

The notification needs to contain information on the initiator, brief description of mainframe paper or planned activity, place of implementation, place where public can read and discuss the above mentioned, conditions,

periods for submission of comments and recommendations and other information. Notification, together with mainframe and design papers, should be placed on the official website of the authorized entity at least 7 working days before hearings.

This law is of particular relevance to the Project as the stakeholder engagement process and subsequent public consultations are a key element of the ESIA process. Public engagement ensures the views of the affected and interested public helps to ensure the decision making process is equitable and fair and leads to more informed choice and better environmental and social outcomes.

#### 4.2.20. Law on Licensing

The Law on Licensing was accepted by National Assembly of the Republic of Armenia on May 30, 2001. It defines the types of activities subject to licensing and regulates the relations related to licensing.

This law is applicable to the Project as a construction license and hazardous waste use license will have to be obtained. The Project will also require a design license which is in accordance with this law.

#### 4.2.21. Government Decree N 1404-N on Soil

The decree on establishment of norms for excavation of fertile layer of soil and storage and use of excavated fertile layers was passed on the 2nd of November 2017. This legal act defines the requirements for establishment of norms for excavation of fertile layer of soil and storage and use of fertile layer of soil for improvement of less efficient soils. The validity

of this legal act shall extend on the excavation of soil fertile layer during construction works and mineral resource extraction works in the area of the Republic of Armenia and use of soil fertile layer for improvement of less efficient soils. The fertile and possibly fertile soil layer is removed separately. The topsoil is used to soil low-yield arable lands for biological reclamation of disturbed soils, and the potentially fertile layer is used only for biological reclamation of disturbed soils.

When doing earthworks, the possible fertile layer of soil is removed separately from the possible fertile rocks. The fertile layer of soil is removed during the hot and dry periods of the year. Before removing the fertile layer, preparations are made to remove trunks, bushes and large stones from the soil surface.

This Decree may be applicable to the Project seeing as there will be targeted leveling of the sites.

#### 4.2.22. Armenian Health Minister's N 01-N Order on Soil

The Armenian order on approving sanitary rules and norms of soil quality hygiene requirements determine the hygienic requirements of soil quality, such as the hygienic evaluation of land sanitary condition, soil quality monitoring, assessment of main indicators of the sanitary condition of the soil, depending on their functional significance, as well the degree of soil pollution on land use proposals.

This order is of particular relevance to the Project given its focus on soil and soil quality. This order will be applied to the Project in the



event that soil pollution occurs during different phases of the project, particularly during construction phases.

#### **4.2.23. Armenian Health Ministers N 533-N Order on Vibration**

The hygienic norms determine the vibration classification, regulation standards, the maximum permissible level of vibration at workplaces, as well as the permissible levels of vibration at residential and public buildings.

This order is of particular relevance to the Project seeing as the order defines maximum permissible level of vibration at workplaces and will be implemented and respected during the construction/decommissioning works where noise levels are likely to be at their highest.

#### **4.2.24. Energy Security Concept**

Energy Security Concept of the Republic of Armenia (adopted by the President of Armenia, 2013).

Energy Security Concept of the Republic of Armenia is aimed to ensure the energy security of the Republic of Armenia in conformity with the provisions of the national security strategy. According to this concept energy security is a complex of political, economic, legal, organizational and other measures which aim to provide reliable and high-quality power supply on daily basis, as well as in emergency situations and in times of war.

The document also has an objective to ensure RA's proper engagement in regional programs organized by international organizations, the European Union, the Russian Federation and

the United States of America and finally by the importance of creating long term strategic supply (stock) of fuel and energy resources.



### **4.3. Institutional Framework**

In 2001, the Government established the administrative structures to implement the Environmental Management and Coordination Cap 387, (herein referred to as the Act). The definition of environment includes all issues relating to the interdependency of all organisms and their natural and built environment, so it considers the social well-being as well

#### **4.3.1. Ministry of Environment**

The Ministry of Environment of the Republic of Armenia is a central body of executive power that elaborates and implements the state policy in the field of environmental protection and rational use of natural resources. The ministry deals with a wide variety of environmental issues in Armenia including but not limited to; climate change, biodiversity, the atmosphere, water, waste, forests, soil, subsoil, protected areas of nature, environmental monitoring. The main function of the Ministry of Environment is to exercise general supervision and coordination over all matters relating to the environment and to be the principal instrument of the Government in the implementation of all policies relating to the environment.

The Authority gives licenses to any development Project once it reviews the environmental impact assessment reports prepared to assess the possible impacts of the Project as well as give mitigation measures to ensure protection and sustainability of the environment and the development.

### 4.3.2. Ministry of Culture

The Ministry of Culture is a state authorized body in the sphere of culture that develops and implements the Republic of Armenia policy in the sphere of culture and information. Together with the territorial bodies of public administration it ensures the implementation of state cultural territorial policy. Develops programs for the creation, preservation, protection, study, use and popularization of the Republic of Armenia cultural heritage, the principles, rules, norms and criteria for the registration, preservation, and use and restocking of the historical and cultural heritage, approves the Projects for the monuments' preservation zones and defined their preservation regime. The Armenian Ministry of Culture carries out the above-mentioned functions through the respective deputy minister coordinating the historical and cultural heritage sphere, structural and separated divisions.

### 4.3.3. Ministry of Territorial Administration and Infrastructure

The MTAI is a state body of executive authority, which elaborates and implements the policies of the Republic of Armenia Government in the energy and natural resources management sector.

The ministry implements the obligations through the following structural departments:

- Subsoil Concession Agency,
- Mineral Resources Agency,
- State Energy Inspectorate – the inspectorate issues start-up conclusion for the power plants,

- State Subsoil Inspection Agency,
- State Committee of Water Economy.



### 4.3.4. Ministry of Health

The Ministry of Health of the Republic of Armenia is a republican body of the executive power, which develops and implements the policy of the Government of the Republic of Armenia in the field of health care.

The Ministry consists of specialized departments of staff:

- Department of Health Programs and Quality Management
- Department of Maternal and Child Health Care
- State health agency of RA Ministry of Health
- Hygienic and anti-epidemic inspection of RA Ministry of Health

### 4.3.5. The Agency for the Protection of Monuments of History and Culture

The Agency for the Protection of Monuments of History and Culture organizes the state registration, preservation and use of the Republic of Armenia historical and cultural immovable monuments and specially preserved historical and cultural sites. Approves the preservation zone Projects for the immovable monuments and especially protected historical and cultural sites and determines their protection regimes in the prescribed manner. After receiving the approval from the scientific-methodological board acting under the Minister, provides permits (agreement) for the planning and construction of settlements with immovable historical and cultural monuments, as well



as for the reinforcement, rehabilitation, and alteration and improvement Projects for individual constructions and complexes that are immovable historic and cultural monuments.

#### 4.3.6. Ministry of Energy and Natural Resources

The Ministry of Energy and Natural Resources (MoE) is a state body of executive authority, which elaborates and implements the policies of the Republic of Armenia Government in the energy and natural resources management sector. The MoE implements the functions related to natural resources management through the following structural departments:

- Geological Agency
- Mineral Resources Agency

#### 4.3.7. Public Services Regulatory Commission

Construction and operation of the solar power plants are regulated by the Power Generation License issued to the IE. According to the local legislation, the RA Public Services Regulatory Commission issues Power Generation License to the legal entity in accordance with the PSRC Resolution N374 dated November 1, 2013.

### 4.4. International Conventions Ratified by Armenia



In addition to the above presented list of laws, numerous strategies, concept frameworks, and national programs related to the nature protection have been developed, as well as a number of international agreements and conventions have been signed and ratified by the Republic of Armenia.

In compliance with its commitment to work for environmental conservation, the Republic of Armenia has signed and/or ratified the following conventions in the environmental sector. The conventions include:

- Convention on Long-range Transboundary Air Pollution adopted on 30 November 1979 and ratified on 21 February 1997.
- Protocol to the 1979 Convention on Long-range Transboundary Air Pollution on Persistent Organic Pollutants adopted on 24 June 1998 and signed on 18 December 1998.
- Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Heavy Metals adopted on 24 June 1998 and signed on 18 December 1998.
- Protocol to the 1979 Convention on Long-range Transboundary Air Pollution to Abate Acidification, Eutrophication and Ground-level Ozone signed on 1st of December 1999.
- Vienna Convention for the Protection of the Ozone Layer adopted on 22 March 1985 and ratified on 1 October 1999.

- Montreal Protocol on Substances that Deplete the Ozone Layer adopted on 16 September 1987 and ratified on 1 October 1999.
- Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer that was ratified on the 26th of November 2003.
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal adopted 22 March 1989 and ratified on 1 October 1999
- Convention on Environmental Impact Assessment in a Transboundary Context adopted 25 February 1991 and ratified on 21 February 1997.
- Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes adopted 17 June 1999 and signed on 17 June 1999.
- Convention on the Transboundary Effects of Industrial Accidents was ratified on the 21st of February 1997.
- United Nations Framework Convention on Climate Change adopted on 9 May 1992 and ratified on 14 May 1993.
- Kyoto Protocol to the United Nations Framework Convention on Climate Change adopted on 11 December 1997 and ratified on 25 April 2003.
- Convention on Biological Diversity adopted on 5 June 1992 and ratified on 14 May 1993.
- Cartagena Protocol on Biosafety to the Convention on Biological Diversity was ratified on the 30th of April 2004.
- United Nations Convention to Combat Desertification adopted on 17 June 1994 and ratified on 24 June 1997.
- Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters adopted on 25 June 1998 and ratified on 1 August 2001.
- Protocol on Pollutant Release and Transfer Registers was signed on the 21st of May 2003.
- Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade was signed on the 11th of September 1998 and ratified on the 26th of November 2003.
- Stockholm Convention on Persistent Organic Pollutants adopted on 22 May 2001 and ratified on 26 November 2003.
- Protocol on Civil Liability and Compensation for Damage Caused by the Transboundary Effects of Industrial Accidents on Transboundary Waters to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes and to the 1992 Convention on the Transboundary Effects of Industrial Accidents was signed on the 21st of May 2003.



## 4.5. Lender Requirements

Masdar are currently in active discussion with various DFIs interested in lending to the Project. The lender group shall be chosen once discussions have been finalized. The Project is expected to comply with IFC, EBRD and ADB requirements regardless of the lender that is chosen. The overall approach for the ESIA, reporting and public and stakeholder consultation activities have been based on the IFC Performance Standards (PSs), EBRD Performance Requirements (PRs) and the ADB Environmental and Social Safeguard Policy Statement.

### 4.5.1. IFC Performance Standards

The IFC Environmental and Social Sustainability Framework defines the IFC's approach towards sustainability and the environment and describes the best practices for managing the environmental and social risks associated with asset development. The Performance Standards and how they apply to the proposed project are outlined below in table 5.

### 4.5.2. EBRD Performance Requirements

EBRD-financed projects are expected to be designed and operated in compliance with good international practices relating to sustainable development. As a signatory to the Equator Principles, EBRD is committed to ensuring that projects meet EU environmental principles, practises and substantive standards where these can be applied at project level, regardless of the geographic location. EBRD has defined 10 performance requirements covering the key environmental and social issues and impacts. These are outlined below in table 6.

### 4.5.3. ADB Safeguard Policy

ADB's Safeguard Policy Statement (SPS) (2009) builds on three previous safeguard policies on the environment, involuntary resettlement and indigenous peoples, bringing them into one policy to more comprehensively address environmental and social impacts and risks. The SPS aims to promote sustainability of project outcomes by protecting the environment and people from projects' potential adverse impacts by avoiding adverse impacts of projects on the environment and affected people, where possible; minimizing, mitigating, and/or compensating for adverse project impacts on the environment and affected people when avoidance is not possible; and helping borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.





**Table 7 IFC Performance Standards**

Performance Standard Requirements	Applicability
<p><b>Performance Standard 1. Assessment and Management of Environmental and Social Risks and Impacts</b></p>	
<p>Underscore the importance of managing environmental and social performance throughout the life of a Project and require that the environmental and social assessment for Projects are undertaken to an International Best Practice and the implementation of an Environmental and Social Management System (ESMS) to manage those risks. Specifically, the objectives of PS 1 are:</p> <ul style="list-style-type: none"> <li>• To identify and evaluate environmental and social risks and impacts of the Project;</li> <li>• To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance with not possible, minimize, and where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities and the environment;</li> <li>• To promote improved environmental and social performance of clients through the effective business activities with significant implementation of a management system;</li> <li>• To ensure that grievances from Affected Communities, external communications and stakeholders are responded to and managed appropriately; and</li> <li>• To promote and provide means for adequate engagement with Affected Communities throughout the Project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.</li> </ul>	<p>Performance Standard 1 applies to all business activities with significant environmental and/or social risks and/or impacts. This Project presents a number of social risks and environmental risks.</p> <p>The Project will prepare a detailed ESIA and an ESMS and deploy sufficient capacity for their implementation. The Project will also inform and consult with stakeholders, specifically consider the needs of vulnerable groups and set up a grievance mechanism.</p>
<p><b>Performance Standard 2. Labor and Working Conditions</b></p>	
<p>Aims to promote the fair treatment, non-discrimination, and equal opportunity of workers; to establish, maintain, and improve the worker-management relationship; to promote compliance with national employment and labor laws; to protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain; to promote safe and healthy working conditions, and the health of workers and to avoid the use of forced labor. This Performance Standard requires overall alignment to the following conventions:</p>	<p>Performance Standard 2 applies to workers directly engaged by the Project, workers engaged through third parties as well as workers engaged by the Project's primary suppliers. PS2 requirements are addressed on the labour and working conditions and occupational health and safety chapters of this ESIA.</p>





Performance Standard Requirements	Applicability
<ul style="list-style-type: none"> <li>• ILO Convention 87 on Freedom of Association and Protection of the Right to Organize;;</li> <li>• ILO Convention 29 on Forced Labour;</li> <li>• ILO Convention 105 on the Abolition of Forced Labour;</li> <li>• ILO Convention 138 on Minimum Age (of Employment);</li> <li>• ILO Convention 182 on the Worst Forms of Child Labour;</li> <li>• ILO Convention 100 on Equal Remuneration;</li> <li>• UN Convention on the Rights of the Child, Article 32.1; and</li> <li>• UN Convention on the Protection of the Rights of all Migrant Workers and Members of their Families.</li> </ul>	<p>Performance Standard 2 applies to workers directly engaged by the Project; workers engaged through third parties as well as workers engaged by the Project’s suppliers.</p> <p>The ESMS will include a Labour and Working Conditions Management Plan and an Occupational Health and Safety Management Plan aligned with PS2. The ESMS will be applicable to contractors and subcontractors, and where relevant to the key supply chain.</p>
<p><b>Performance Standard 3. Resource Efficiency and Pollution Prevention</b></p>	
<p>Aims to avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from Project activities; to promote more sustainable use of resources, including energy and water; and to reduce Project-related GHG emissions.</p>	<p>Solar Projects may cause pollution during the construction phase that need to be controlled or mitigated. Other aspects relevant to resource efficiency like the management of waste, wastewater and resource use will also be considered in the ESIA and ESMS.</p>
<p><b>Performance Standard 4. Community Health, Safety, and Security</b></p>	
<p>Aims to anticipate and avoid adverse impacts on the health and safety of the Affected Community during the Project life from both routine and non-routine circumstances and to ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.</p> <p>The IFC’s Guidance Note 4 requires that the exacerbation of impacts caused by natural hazards, such as flooding, landslides or fire that could arise from land use changes or the loss of natural buffer areas should be avoided or minimized.</p>	<p>Traffic during construction can potentially pose a threat to the safety of local communities. Other risks (security staff, diseases, conflicts) also need to be assessed and managed.</p> <p>COVID 19 needs to be considered and all relevant plans adapted to minimize associated risks.</p>



Performance Standard Requirements	Applicability
<p><b>Performance Standard 5: Land Acquisition and Involuntary Resettlement</b></p> <p>This PS recognizes that Project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use the area. A Land Acquisition Review / Plan and a Livelihood Restoration Plan shall be prepared to assess, anticipate and avoid, or where avoidance is not possible, minimize adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected; to improve, or restore, the livelihoods and standards of living of displaced persons; and to improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites..</p>	<p>Performance Standard 5 will be triggered since the Project causes minor economic displacement by impacting grazing areas used in pastoral agriculture. This Project does not cause physical displacement.</p> <p>Economic displacement caused by Land Acquisition is assessed in the standalone LRP prepared as part of the ESIA package.</p>
<p><b>Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources</b></p> <p>IFC Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. The requirements set out in this Performance Standard are guided by the Convention on Biological Diversity.</p> <p>This standard aims to:</p> <ul style="list-style-type: none"> <li>Protect and conserve biodiversity;</li> <li>Maintain the benefits from ecosystem services; and</li> <li>Promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.</li> </ul>	<p><b>Critical Habitat: Not Triggered</b></p> <p>The initial site visit indicated the Project area has low biological value given the overgrazed shrubs and lack of agricultural farming practiced. There are, however, evidence of several species of animals on-site. Mitigation measures will need to be implemented to conserve biodiversity in the area during site clearance. A flora and fauna management plan will be prepared as part of the ESMS.</p>



Performance Standard Requirements	Applicability
<p><b>Performance Standard 7: Indigenous People</b></p>	
<p>PS 7 aims to ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples; to anticipate and avoid adverse impacts of Projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts; and to promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner. It requires the developer to establish and maintain an ongoing relationship based on Informed Consultation and Participation with the Indigenous Peoples affected by a Project throughout the Project’s life cycle.</p>	<p>Performance Standard 7 is not triggered by the Project, as the desk study, site visit and consultations have confirmed that there are no indigenous peoples living on or using the Project area.</p>
<p><b>Performance Standard 8: Cultural Heritage</b></p>	
<p>The PS aims to protect cultural heritage from the adverse impacts of Project activities and support its preservation and to promote the equitable sharing of benefits from the use of cultural heritage.</p>	<p>Critical Cultural Heritage is not triggered, as the structures within the Project site are not internationally recognized or legally protected cultural heritage.</p> <p>The available information indicates that the archaeological sites in the area can be classified as both replicable and non replicable, in as much as Archaeological or historical sites may be considered replicable where the particular eras and cultural values they represent are well represented by other sites and/or structures.</p> <p>The Project will prepare a Cultural Heritage Management Plan in alignment with International Good Practice.</p>

**Table 8 EBRD Performance Requirements**



Performance Requirements	Applicability
<b>Performance Requirement 1. Assessment and Management of Environmental and Social Risks and Impacts</b>	
<p>This Performance Requirement (PR) recognises the importance of an integrated assessment to identify the environmental and social risks and impacts associated with projects and the client’s management of environmental and social performance throughout the life of the project. A successful and efficient environmental and social management system (ESMS) promotes sound and sustainable environmental and social performance, and can lead to improved financial, environmental and social outcomes. It is a dynamic, continuous process, initiated and supported by management, and involves meaningful communication between the client, its workers, the local communities affected by the project and, where appropriate, other stakeholders.</p> <p>This PR outlines the responsibilities of the client in the process of assessing the potential environmental and social risks and impacts associated with the project, and developing and implementing procedures for managing and monitoring these risks and impacts. The objectives of this PR are to:</p> <ul style="list-style-type: none"> <li>• Identify and assess environmental and social risks and impacts of the project;</li> <li>• Adopt a mitigation hierarchy approach to address environmental and social risks and impacts from project activities on workers, affected communities, and the environment;</li> <li>• Develop an ESMS commensurate to the environmental and social risks and impacts of the project in a manner consistent with the relevant PRs; and</li> <li>• Promote continuous improvement of the client’s environmental and social performance through the effective use of management systems.</li> </ul>	<p>This PR applies to all Projects financed by EBRD and is applicable seeing as EBRD are the lender for AYG-1. The detailed ESIA fulfils the requirement to identify and assess environmental and social risks and impacts from the Project, as well as ensuring the Client has adequate organisational capacity to manage the risks and impacts identified.</p> <p>The Project will prepare a detailed ESMS, based on Masdar’s corporate template, and deploy sufficient capacity for its implementation. The Project will also inform and consult with stakeholders, specifically consider the needs of vulnerable groups and set up a grievance mechanism.</p>





Performance Standard Requirements	Applicability
Performance Requirement 2. Labour and Working Conditions	
<p>This PR recognises that for clients and their business activities, the workforce is a valuable asset, and that good human resources management and a sound worker-management relationship based on respect for workers’ rights, including freedom of association and the right to collective bargaining, are key ingredients to the sustainability of business activities. Its key objectives are to:</p> <ul style="list-style-type: none"> <li>• Respect and protect the fundamental principles and rights of workers;</li> <li>• Ensure fair treatment, non-discrimination, and equal opportunities of workers in accordance with the decent work agenda;</li> <li>• Establish, maintain and improve a sound worker management relationship;</li> <li>• Ensure compliance with national labour and employment laws and any collective agreements to which the client is a party;</li> <li>• Protect women and men at work, including vulnerable workers such as young workers, persons with disabilities, migrant workers and refugees, workers engaged by third parties, and workers in the client’s supply chain;</li> <li>• Prevent the use of forced labour and child labour (as defined by the International Labour Organisation (ILO)); and</li> <li>• Ensure that accessible and effective means to raise and address workplace concerns are available to workers.</li> </ul>	<p>This PR applies to the Project as it will involve the use of a workforce, including full-time, part-time, temporary, fixed term, seasonal and migrant workers, whether engaged directly by the Client or by a third party, and sets out specific requirements for primary suppliers.</p> <p>The ESMS will include a Labour and Working Conditions Management Plan and an Occupational Health and Safety Management Plan aligned with PR2. The ESMS will be applicable to contractors and subcontractors.</p>



Performance Standard Requirements	Applicability
<p><b>Performance Requirement 3. Resource Efficiency and Pollution Prevention and Control</b></p>	
<p>This PR outlines a project-level approach to climate impacts and greenhouse emissions, resource management and pollution prevention and control. It builds on the mitigation hierarchy, the principle that environmental damage should as a priority be rectified at its source, and the “polluter pays” principle. The project related risks and impacts associated with resource use, and the generation of waste and emissions need to be assessed in the context of project location and local environmental conditions. Appropriate mitigation measures, technologies and practices should be adopted for efficient and effective resource use, pollution prevention and control and avoidance, minimisation and reduction of greenhouse gases (GHG) emissions.</p> <p>This PR also recognises the emerging concept and practice of Circular Economy and or resources recovery where usable and valuable products can be created or derived from what has been previously viewed as waste. This PR recognises the importance of using best available techniques and good international practice to optimise resource use and efficiently prevent and control pollution. The objectives of this PR are to:</p> <ul style="list-style-type: none"> <li>• Adopt the mitigation hierarchy approach to addressing adverse impacts on human health and the environment arising from the resource use and pollution released from the project;</li> <li>• Avoid, minimise and manage project-related GHG emissions;</li> <li>• Avoid, minimise and manage the risks and impacts associated with hazardous substances and materials, including pesticides; and</li> <li>• Identify, where feasible, project-related opportunities for resource efficiency improvements.</li> </ul>	<p>This PR applies to the Project because it will involve the use of resources such as materials, water, fuel for vehicles and equipment, etc. PR3 also applies to the Project as waste and noise/air emissions are expected to be generated and hazardous materials and substances will be used during the construction phase.</p> <p>Other aspects relevant to resource efficiency like the management of waste, wastewater and resource use will also be considered in the ESIA and ESMS.</p>



Performance Standard Requirements	Applicability
Performance Requirement 4. Health, Safety, and Security	
<p>This PR recognises the importance of managing health, safety and security risks to workers, project-affected communities and consumers associated with project activities, in accordance with the hierarchy of risk control. By providing workers with safe, healthy and secure working conditions, clients may create tangible benefits, such as enhancement of the efficiency and productivity of their operations.</p> <p>Project activities, equipment, and infrastructure may increase the potential for worker and community exposure to health, safety and security risks, including those associated with mobilisation, construction, commissioning, operation, maintenance, decommissioning or closure, reinstatement and the transport of goods and services. The client has the primary responsibility to provide safe and healthy conditions for their workers and informing, instructing, training, supervising and consulting workers on health and safety. Workers have the responsibility to cooperate actively with their employer and take care of their own health and safety and the health and safety of others. While acknowledging the role of relevant authorities in protecting and promoting the health and safety of the public, the client has the duty to manage health, safety and security risks to project-affected communities.</p>	<p>This PR applies as the Project will use road vehicles to transport personnel and materials, generating risks to community’s health and safety, and the workforce. The Project involves construction, operation, maintenance, and decommissioning activities where health and safety hazards create uncontrolled risks to the workforce or local communities. There is the potential for an emergency event to occur that could impact the health of the workforce and local communities. This PR is also applicable as the Project will use security personnel.</p>



Performance Standard Requirements	Applicability
Performance Requirement 5. Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	
<p>This PR addresses impacts of project-related land acquisition, including restrictions on land use and access to assets and natural resources, which may cause physical displacement (relocation, loss of land or shelter), and/ or economic displacement (loss of land, assets or restrictions on land use, assets and natural resources leading to loss of income sources or other means of livelihood). The term “involuntary resettlement” refers to both of these impacts and the processes to mitigate and compensate these impacts. Resettlement is considered involuntary when affected persons or affected communities do not have the right to refuse land acquisition or restrictions on land use, other assets and natural resources, even if compulsory acquisition is used only as a last resort after a negotiated process.</p> <p>Unless properly managed, involuntary resettlement may result in long-term hardship and impoverishment for affected persons and communities, as well as environmental damage and adverse socio-economic impacts in areas to which they have been displaced. The client shall consider feasible alternative project designs and sites to avoid or minimise land acquisition or restrictions on land use, other assets and natural resources while balancing environmental, social, and financial costs and benefits, and paying particular attention to gender impacts and impacts on vulnerable persons. Where it cannot be avoided through design, displacement shall be minimised and appropriate measures to mitigate adverse impacts on affected persons and host communities shall be carefully planned and implemented.</p>	<p>PR 5 is triggered since the Project will cause minor economic displacement by impacting grazing areas formerly used in pastoral agriculture. The communal land used for the Project site was also acquired before EBRD's involvement. This Project does not cause physical displacement.</p> <p>Economic displacement caused by Land Acquisition is assessed in the standalone LRP prepared as part of the ESIA package.</p>





Performance Standard Requirements	Applicability
<p><b>Performance Requirement 6. Biodiversity Conservation and Sustainable Management of Living Natural Resources</b></p>	
<p>This PR recognises that the conservation of biodiversity and sustainable management of living natural resources are fundamental to environmental and social sustainability. This PR recognises the importance of maintaining the core ecological function of habitats, biodiversity and ecosystem services. All ecosystems support a complexity of living organisms and vary in terms of richness, abundance and importance of species.</p> <p>A key objective of PR6 is to ensure that biodiversity conservation and sustainable management of living resources must be balanced with the potential for utilising the multiple economic, social and cultural values of biodiversity and living natural resources in an optimised manner.</p> <p>The potential positive role of Project affected communities, including indigenous peoples, in biodiversity conservation and sustainable management of living natural resources is also considered in this PR.</p>	<p>PR6 applies to all Projects where there is a potential impact or risk to biodiversity. This PR is applicable to the Project as it has the potential to impact biodiversity including different species and habitats.</p> <p>Priority Biodiversity Features (PBFs) have been identified during the baseline surveys and will be managed as per PR6 requirements.</p>



Performance Requirement 7. Indigenous Peoples	
<p>In this PR, the term “indigenous peoples” is used in a technical sense to refer to a social and cultural group, distinct from dominant groups within national societies, possessing all of a set of characteristics that are defined in PR7 (e.g. selfidentification as members of a distinct indigenous ethnic and cultural group, collective attachment to geographically distinct habitats, traditional lands or ancestral territories, customary cultural, economic, social, or political institutions, laws or regulations that are separate from those of the dominant society or culture, a distinct language or dialect).</p> <p>PR7 also applies to a group, or members of a group, that lead a nomadic or transhumant way of life, live in mixed or urban communities and/or only visit their traditional lands on a seasonal basis, who may also experience forced severance.</p>	<p>PR 7 is not triggered by the Project, as the desk study, site visit and consultations have confirmed that there are no indigenous peoples living or using in the Project area.</p>
Performance Requirement 8. Cultural Heritage	
<p>This PR recognises the importance of cultural heritage for present and future generations. The aim is to protect cultural heritage and to guide clients to avoid or mitigate adverse impacts on cultural heritage in the course of their business operations. The clients are required to be precautionary in their approach to the management and sustainable use of cultural heritage. Both tangible and intangible cultural heritage are important assets for economic and social development, and are an integral part of the continuity of cultural identity and practices (including traditional skills, knowledge, beliefs and/or minor dialects and languages). In pursuing these aims of protection and conservation, this PR is guided by applicable international conventions and other instruments. It also recognises the need for all parties to respect the laws and regulations that pertain to cultural heritage that could be affected by a project and the obligations under relevant international treaties and agreements ratified by host countries.</p>	<p>The cultural remains identified onsite require management as per PR8. The Project will prepare a Cultural Heritage Management Plan in alignment with EBRD PR8.</p>



Performance Standard Requirements	Applicability
<b>Performance Requirement 9. Financial Intermediaries</b>	
<p>This Performance Requirement (PR) recognises that financial intermediaries (FIs) are a key instrument for promoting sustainable financial markets and provide a vehicle to channel funding to the micro, small and medium sized enterprise sector. FIs include a variety of financial service providers including, inter alia, private equity funds, banks, leasing companies, insurance companies and pension funds.</p> <p>The objectives of this PR are to:</p> <ul style="list-style-type: none"> <li>• FIs will assess and manage environmental and social risks and impacts associated with the sub-projects they finance;</li> <li>• Promote good environmental and social management practices in the sub-projects financed by FIs; and</li> <li>• Promote good environmental and sound human resources management within FIs.</li> </ul>	<p>PR 9 is not triggered by the Project as the company will not act as a financial intermediary.</p>
<b>Performance Requirement 10. Information Disclosure and Stakeholder Engagement</b>	
<p>This PR recognises the importance of an open and transparent engagement between the client, its workers, worker representatives, local communities and persons affected by the project and, where appropriate, other project stakeholders as an essential element of good international practice and corporate citizenship. Such engagement is also a way of improving the environmental, social and overall sustainability of projects. In particular, effective community engagement, appropriate to the nature and scale of the project, promotes sound and sustainable environmental and social performance, and can lead to improved financial, social and environmental outcomes, together with enhanced community benefits.</p>	<p>This PR applies to all projects. This project will carry out stakeholder identification, assessment, engagement and develop and implement a grievance mechanism. Further stakeholder engagement as outlined in this PR, shall be undertaken, proportionate to: the nature and scale of the project, its stakeholders and its potential environmental or social risks and impacts.</p>

## 4.6. Other International Guidelines

In addition, the following guidelines will be used as benchmarks of international good practice for the Project. The applicability of these guidelines depend on the Project activities.

- IFC Performance Standards 2012;
- IFC General EHS Guidelines (April 2007);
- IFC EHS Guidelines for Electric Power Transmission and Distribution (April 2007);
- IFC Good Practice Note on Managing Contractor's E&S Performance;
- IFC Good Practice Note on Non-Discrimination and Equal Opportunity;
- IFC Good Practice Note – Managing Retrenchment;
- IFC Handbook- ESMS Implementation;
- IFC Stakeholder Engagement- Good Practice Handbook for Companies Doing Business in Emerging Countries;
- IFC Good Practice Note – Addressing Grievances from Project-Affected Communities;
- IFC Good Practice Manual- Doing Better Business Through Effective Public Consultation and Disclosure;
- IFC Handbook for Labour and Working Conditions – Measure & Improve Your Labour Standards Performance;
- ILO International Labour Standards;
- ILO Connections and ILO Declaration on Fundamental Principles and Rights at Work;
- ILO Convention 87 on Freedom of Association and Protection of the Right to Organize;
- ILO Convention 98 on the Right to Organize and Collective Bargaining;
- ILO Convention 29 on Forced Labour;
- ILO Convention 105 on the Abolition of Forced Labour;
- ILO Convention 138 on Minimum Age (of Employment);
- ILO Convention 182 on the Worst Forms of Child Labour;
- ILO Convention 100 on Equal Remuneration;
- ILO Convention 111 on Discrimination (Employment and Occupation);
- UN Basic Principles on the Use of Force and Firearms by Law Enforcement Officials;
- UN Code of Conduct for Law Enforcement Officials;
- UN Guiding Principles on Business and Human Rights;
- UN Voluntary Principles on Security and Human Rights;
- EBRD Guidance Note on Grievance Mechanism;
- EBRD Guidance for Clients – Non-discrimination and Equal Opportunity;
- EBRD and IFC Guidance Note on Workers Accommodation;
- Equator Principles III;
- OECD Common Approach for ECA ESDD;
- OECD Guidelines on Multinational Enterprises;
- World Bank Group General EHS Guidelines;





- World Bank Group/ IFC EHS Guidelines for Electric Power Transmission and Distribution;
- Armenian Constitution;
- ADB Handbook on Resettlement: A Guide to Good Practice
- ADB Evaluation Methods and Guidelines
- ADB Procurement Guidelines and Best Practices
- ADB Health Impact Assessment: A Good Practice Sourcebook
- Law on Environmental Impact Assessment and Expertise (2014);
- Labour Code (2004), Water Code (2002), Land Code (2001);
- Law on Flora (1999), Law on Fauna (2000), Law on Wastes (2004), Law on Protected Natural Areas (2006);
- Law on the Protection and Use of Fixed Cultural and Historic Monuments and Historic Environment (1998).

## 4.7. Project Categorisation

### 4.7.1. IFC Categorization

Utility scale PV Projects fall within the following IFC Performance Standards categories:

- Category A: Business activities with potential significant adverse environmental or social risks and/or impacts that are diverse, irreversible, or unprecedented.
- Category B: Business activities with potential limited adverse environmental or social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.

The most relevant foreseen Project impacts include minor economic displacement of pastoral farmers who use the communal land on site for grazing activities and archaeological sites of cultural significance. The Project does not foresee any major environmental or social impacts. There are other environmental and social risks but all can be avoided or managed by following good practice and preparing and implementing a comprehensive ESMS.



PV Plant impacts are well understood and generally present lower risk level than other renewable energy Projects. The Project is expected to be graded as category B seeing as the Projects business activities will incur limited adverse environmental or social risks.

### 4.7.2. EBRD Categorization

The project's environmental and social impacts have been evaluated appropriately based on EBRD's project categorization as outlined in the ESP 2014.

Category A: Projects that could result in potentially significant adverse future environmental and/or social impacts which cannot readily be identified or assessed and will require the client to carry out a comprehensive Environmental and Social Impact Assessment (ESIA) that meets EBRD's applicable PR's.

These are shown as follows:

- Solar projects that include construction of high voltage overhead electrical power lines;
- Projects likely to have a perceptible impact on sensitive locations of international, national, or regional

importance;

- Projects that result in significant adverse social impacts to local communities or other project affected parties;
- Projects which may involve significant involuntary resettlement;
- Projects that may result in significant cumulative impacts in combination with impacts from other existing facilities, reasonably foreseeable developments and/or unplanned but predictable activities enabled by projects that may occur later or at a different location.

Category B: Projects which involve potential adverse future environmental and social impacts that are typically site specific and/or readily identified and addressed through mitigation measures. Category B Projects projects should include an environmental and social assessment that is proportionate to the project’s nature, size and location, as well as the characteristics of the potential impacts and risks. The assessment will characterise potential future adverse impacts associated with the project, identify potential improvement opportunities, and recommend any measures needed to avoid, or where avoidance is not possible, minimise and mitigate adverse impacts

Category C: Projects that are likely to have minimal or no adverse future environmental and social impacts and that are readily identified and addressed through mitigation measures. Category C Projects projects should include monitoring and reporting on the project’s compliance with EBRD’s PRs.

The Project does not foresee any major environmental or social impacts. The project causes economic displacement, but it is expected to be minor. The ESIA process has enabled identification of any potential environmental and social impacts which are detailed in the chapters below. The ESIA details mitigation, management and monitoring measures throughout in order to minimize any potential adverse impacts that may incur as a result of the Project. A comprehensive ESMS has also been prepared to further avoid any potential environmental and social risks.

The Project is expected to be graded as category B seeing as the Projects business activities will incur limited adverse environmental or social risks.

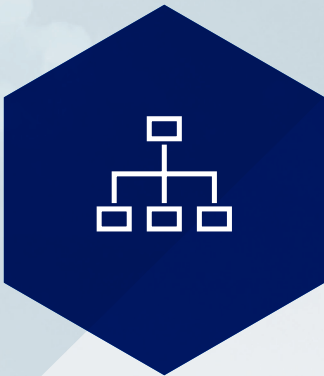


## 5 ESIA Process & Methodology

The Environmental and Social Impact Assessment (ESIA) is a process that aims to identify, predict and evaluate the environmental and social impact of the proposed Project. It will provide information on the environmental consequences for decision making and promote environmentally and socially sound and sustainable development through the identification of appropriate alternatives, mitigation measures and monitoring plans.

The ESIA process is the first step in the development of the Environmental and Social Management System for the Project. The ESMS will be the main tool to ensure that the environmental and social aspects of a Project are managed in compliance with its E&S obligations during the Project construction, operation and decommissioning.

Stakeholder Engagement is an integral part of the ESIA process. It is the systematic effort to identify and involve any persons, communities, or groups who are directly or indirectly affected by the Project, as well as those who may have interests in a Project and/or the ability to influence its outcome. Stakeholder engagement involves a range of activities such as public disclosure of Project information and information about



the Project’s E&S impacts, consultation with stakeholders, and mechanisms by which people can make comments and raise grievances. The ESIA process is documented through a number of reports that are prepared at different stages of the process and have defined aims. The ESIA process for the AYG-1 PV Plant commenced with the preparation of the scoping report and APA. Following this, the official ESIA report (this document) has been prepared. The ESIA will then be submitted to the Ministry of Environment where it will await approval and issue of the environmental permit. The following documents have been prepared as part of the ESIA process:

- Environmental and Social Impact Assessment Report for submission to seek an environmental permit and for the Lenders Due Diligence (this document).
- Stakeholder Engagement Plan.
- Livelihood Restoration Plan.
- Environmental and Social Management System.

The specific objectives of each of these reports within the ESIA process and the relevant methodological considerations are described below.

## 5.1. Scoping Report

The primary objective of the Scoping Report is to ensure that the key environmental and social aspects and sensitive receptors associated with the Project’s construction, commissioning, operation and decommissioning phases are identified at an early stage to determine the studies and assessment methodologies (‘Terms of Reference’) which are required for the ESIA.

To elaborate further, the Scoping Report had the following key objectives:

- Identification of relevant local, national and international environmental standards and legal requirements;
- Identification of relevant environmental planning policies;
- Identification of areas where data required for the E&S assessment is available, or conversely, where it is lacking or insufficient;
- Identification of the key environmental and social constraints and opportunities, including the collection of site specific environmental and social baseline data to identify the issues that require additional surveys during the preparation of the full ESIA;
- Identification of required studies, surveys, investigations and environmental assessment for the study area;
- Establishment of assessment criteria and methodologies for each of the environmental and social aspect;
- Scoping out of any issues unlikely to be significant; and
- Inform the Stakeholder Engagement Plan and provide technical input for the scoping consultations with stakeholders and consultees. The stakeholder consultations are outlined in the scoping report, but documented in detail in the Stakeholder Engagement Plan.

For each of the identified environmental and social aspects, the available baseline information, the potential impacts and the required surveys and studies are described in the relevant chapter of this ESIA report. The scoping phase for the Ayg-1 Project started in September 2021 and was completed in 2022





following submission and approval of the APA by the Ministry.

## 5.2. ESIA Report

The ESIA report documents the findings of the ESIA process. For each significant E&S aspect it describes the identified impacts, the baseline information (desktop research, surveys, monitoring, sampling and analysis), impact prediction, impact assessment, mitigation and monitoring measures.

The baseline surveys and impact prediction methodologies for each significant E&S aspect are described in the following chapters of this report. The ESIA impact assessment methodology is described below.

## 5.3. Armenian EIA Process

The planned implementation of any activity in Armenia that may cause environmental impacts requires a positive conclusion of an Environmental Impact Assessment (EIA) expertise. All environmental impacts of planned physical activities or sectoral/ regional development plans/ programs have to be assessed during the EIA preparation period. The Republic of Armenia's Law on Environmental Assessment and Expertise of 2014 stipulates provisions regarding environmental impact assessment, realization and terms, thus being the most important national law for carrying out an EIA.

According to this law, activities are classified into three categories: A, B and C. The categories are defined on the basis of the volume of the activity, characteristics and the level of impact on environment. The length and the complexity of the procedure depend on the categorization

of the planned activity. According to the Law, Solar Power Plants are included in category C, if the plants occupy an area of 40 hectares and more. The Project has been categorised as B from the EIA perspective by the Ministry of Environment due to the OHTL.

The steps for obtaining environmental approval, as set forth in the national legislation, are described below.

- Preliminary stage: During this stage, preliminary information regarding the projects activities was presented to the head(s) of the affected communities in August of 2021, public hearings were organized by the project proponent jointly with the head(s) of communities in December 2021. The general information about the project and a meeting notice was displayed at the Community Hall and Regional Administration Office, the Official Webpage of the Ministry of Environment, and Facebook Pages of the affected communities. Community meeting information was also distributed through the public media seven days prior to the date of the public hearing. The notice and project information was published on public websites 7 days prior to the meeting.
- An application was submitted to the Ministry of Environment on the 23rd of December 2021. This request included a general description of the project, measures for mitigation/ compensation and the results of a first public hearing organized by the community head(s) and the project owner.
- Within 30 working days the Ministry of Environment provided comments on



the application which were adhered to. The ministry also provided an impact category to the project (A, B, C). The Ministry provided a list of activities, and volume and depth of the works for the development of the Environmental Impact Assessment Report (provides the ToR for the EIA) on the 20th of July 2022. While awaiting the ToR, the execution of a second public hearing was completed on the 1st of July 2022 and was conducted jointly by the project proponent, head(s) of affected municipalities and the Ministry of Environment. The same rules for disclosure as for the first public hearing were applied.

- The EIA Report has been submitted to the Ministry of Environment following a third public hearing on December 19th 2022 which adhered to the same rules for disclosure of information as for the first and second public hearing.
- Following EIA submission, the Ministry of Environment shares the EIA report with all involved and specialized parties (e.g., to its departments, to the relevant departments of Academy of Science, the Ministry of Healthcare, the Ministry of Emergency Situations, State Committee for Water Resources, etc.) as an internal procedure of the Ministry. During this stage the Project proponent, jointly with the head(s) of community and the Ministry, organizes the 3rd public hearing, during which the draft EIA report is introduced to the general public. The Ministry provides all the comments and recommendations from all parties involved in the revision of the draft EIA, as well as main comments and recommendations which may have been highlighted during the 3rd public

hearing. The Project proponent then makes amendments to the draft EIA or justify the rejection of amendments.

- Following this, the Ministry organizes the final public hearing, during which it represents all the comments and recommendations provided, the results of these comments and recommendations (if the proposed changes were adopted or not) and gives an opinion on the EIA report (approval or rejection).
- Based on this, the Ministry provides the final approval or rejection of the project, signed by the Minister. Steps 5-7 are included in the total duration outlined by the Ministry (40 working days for Category B & C and 60 working days for Category A). A period of expert examination can be extended for 20 working days for Category B & C and for 30 working days for Category A.



## 5.4. Impact Assessment Methodology

The systematic assignment of impact significance to every identified impact allows for a consistent and transparent assessment process. Impact significance is the result of an interaction between three primary factors:

- The sensitivity of the receptors relative to the change;
- The magnitude of the impact;
- The likelihood of the impact occurring.

A four-step approach has been used to determine the significance of E&S effects, as follows:

- Evaluation of receptor sensitivity;
- Assessment of the magnitude of the impact on the receptor;
- Evaluation of the likelihood of the impact actually taking place;

- Determination of impact significance.

An overview of the different aspects contributing to impact assessment is displayed in the figure below.



The impact assessment methodology is presented below in a linear fashion, but it should be noted that it is an iterative process e.g. potential impacts and receptors were identified during the initial site visit and desktop research, the stakeholders are consulted and their feedback is incorporated into the process, additional information on potential impacts and receptors is obtained during the baseline surveys, etc.

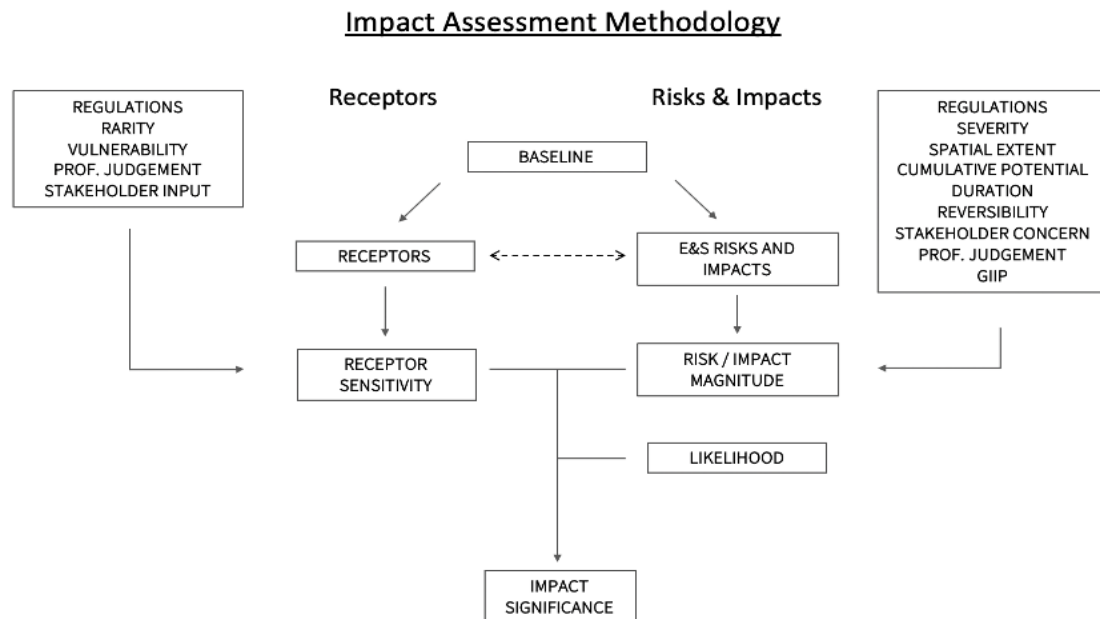
### 5.4.1. Identification of Potential Risks & Impacts

The following types of impacts have been considered for evaluation:



Project Site- Scoping Phase Site Visit

Figure 13 Impact Assessment Methodology



- Direct Impacts – result from Project activity directly affecting an environmental or social receptor (e.g. removal of vegetation during earthworks, congestion in local roads due to Project traffic);
- Indirect Impacts – result of a complex pathway originating from a Project activity, often mediated by a number of processes before the impact is noticeable (e.g. dust deposition on vegetation which causes reduction in photosynthetic rates, job availability encourages immigration into the project area and informal settlements);
- Secondary Impacts – result from the implementation of mitigation measures for potential direct impacts (e.g. measures to maximise local employment could create conflicts if the recruitment criteria are not clear, transparent and disclosed, water spraying on roads for dust suppression has an impact on water availability)
- Beneficial Impacts – occur when Project activities have a positive or desirable effect on sensitive receptors (e.g., reduction of GHG emissions, job creation during construction and operations);
- Adverse Impacts – occur when Project activities have a negative or undesirable effect on sensitive receptors (e.g., destruction of habitat of sensitive species during land clearing);
- Cumulative Impacts – result from the accumulation of potential impacts of the planned Project in addition to the potential impacts of anticipated future Projects or the impact of existing similar Projects (e.g. cumulative impact of PV Plants on the community or habitat);
- Residual Impacts – remain after mitigation measures have been incorporated into the Project activity (e.g., residual construction noise after silencers are incorporated with generators)
- Event Related Impacts – result from an unintentional or accidental event (e.g., fire or oil spill).



### 5.4.2. Identification of Sensitive Receptors

Sensitive receptors may be defined as:

- Environmental receptors:
  - Aspects of the environment that contribute to the healthy functioning of natural systems, including the physical environment, biogeochemical cycles and biodiversity;
- Social receptors:
  - Individuals, households, communities, sociocultural groups, organizations or entities such as service users, community residents, a neighbourhood, or visitors (social receptors).
  - Aspects of social life that the Project can have an impact upon, including but not limited to employment, economic transactions, resource use rights, safety, resilience, security, health, accessibility, social infrastructure, decision making systems, archaeological remains, items or aspects of cultural importance, etc.

### 5.4.3. Evaluation of Receptor Sensitivity

The following criteria will be considered when determining the sensitivity of identified environmental and social receptors:

- National and international regulations;
- The rarity of the receptor;
- The vulnerability of the receptor to the impact under consideration;
- Professional judgement based on past impact assessment experience; and
- Input from key stakeholders.



Fruit and Vegetable Shop in the Community

**Table 9 Receptor Sensitivity Classification**

Sensitivity	Description
<b>Very High</b>	<p>Carrying capacity of the receptor has already been reached. As such, further impact on the receptor will likely lead to excessive damage to the system that it supports.</p> <p>High international rarity and importance with limited to no potential for substitution. Designated and protected by National Law or International Standards (IUCN species conservation categories, protected areas, UNESCO sites, etc.).</p> <p>Groups or locations that are highly vulnerable to the impact in question and/or critical to the functioning of society (e.g. emergency centers, hospital facilities, water sources in water scarce regions, indigenous peoples).</p>
<b>High</b>	<p>Carrying capacity of the receptor has almost been reached. Further impact may lead to a significant damage to the system that it supports.</p> <p>High national importance and rarity with limited potential for substitution.</p> <p>Groups, locations or societal functions that are key to the functioning of the socioeconomic system and vulnerable to the impact in question (e.g., residential areas, vulnerable groups, water sources, food sources).</p>
<b>Medium</b>	<p>Carrying capacity of the receptor has not been reached, but the receptor has been significantly impacted. Further impacts will get increase the stress of the underlying system but not to a critical point.</p> <p>Medium to high regional rarity and importance with limited potential for substitution.</p> <p>Groups or locations that are vulnerable to the impact in questions relative to other receptors (e.g., commercial areas usually are more sensitive than industrial areas).</p>
<b>Low</b>	<p>Carrying capacity of the receptor is not close to being reached and is not significantly impacted. Further impacts are unlikely to result in any noticeable stress in the system.</p> <p>Low to medium local rarity and importance with potential for substitution.</p> <p>Groups or locations that have low vulnerability to the impact in question (e.g., industrial areas).</p>
<b>Very Low</b>	<p>Carrying capacity of the receptor is very far from being reached and is not impacted. Further impacts are very unlikely to result in any noticeable stress in the system.</p> <p>Very low local rarity and importance with high potential for substitution.</p> <p>Groups or locations that have a very low vulnerability to the impact in question</p>



#### 5.4.4. Evaluation of Impact Magnitude

The magnitude of an impact will be defined in quantitative terms wherever possible. The following criteria will be considered when determining impact magnitude:

- National and international regulations;
- Severity of change resulting from the impact;
- Spatial extent of change resulting from the impact;
- Duration of the impact;

- Reversibility (or irreversibility) of the impact;
- Cumulative potential of the impact;
- Professional judgement based on past
- impact assessment experience;
- Concerns from stakeholders; and
- Good international industry practice



**Table 10 Impact Magnitude Classification**

Magnitude	Description
<b>Major</b>	Beneficial: Significant improvement in resource and/or attribute quality; extensive enhancement or restoration. Adverse: Significant loss in resource and/or attribute quality or integrity; extensive damage to key characteristics or features; often large scale, permanent and irreversible.
<b>Moderate</b>	Beneficial: Improvement in resource and/or attribute quality; moderate addition of / positive effect on key characteristics or features. Adverse: Significant loss in resource and/or attribute quality, but no adverse effect on integrity; partial loss of/damage to key characteristics or features; usually extend beyond the site boundary; often permanent, irreversible and/or cumulative.
<b>Minor</b>	Beneficial: Minor positive effect on attribute; slight reduced risk of negative impact occurring; minor addition of / positive effect on one or more key characteristics or features. Adverse: Measurable decrease in attribute quality or increase in vulnerability; minor loss of / negative effect on one or more key characteristics or features; usually only noticeable within site boundaries; often temporary and reversible.
<b>Negligible</b>	Beneficial: Very slight addition of / positive effect on one or more characteristics or features. Adverse: Very slight loss / negative effect on one or more characteristics or features.
<b>No Change</b>	No discernible beneficial or adverse impacts.

### 5.4.5. Impact Likelihood

Defined as how likely an impact is to occur during the life-cycle of the Project, impact likelihood is an important aspect in determining impact significance. The table below outlines the classification.

**Table 11 Impact Likelihood Classification**

Likelihood	Description
<b>Certain</b>	The event will certainly occur during normal conditions.
<b>Likely</b>	The event is more likely than not to occur during normal conditions.
<b>Possible</b>	The event is about as likely as it is unlikely to occur during normal conditions.
<b>Unlikely</b>	The event is unlikely but may occur under normal conditions.
<b>Very Unlikely</b>	The event is very unlikely to occur under normal conditions but may occur in exceptional circumstances, e.g. emergency conditions.

### 5.4.6. Impact Significance

As previously discussed, impact significance is a combination of the sensitivity of a receptor, impact magnitude, and impact likelihood. The classification of the different levels of impact significance used throughout this ESIA is provided in the table below.



**Table 12 Impact Significance Classification**

Significance	Description
<b>Major</b>	Key factors in the decision-making process. These impacts are usually associated with sites or features of regional, national, or international value that are likely to suffer a significantly damaging impact and/or loss of integrity. Under the right circumstances, a major change in a site or feature of local importance may also have its significance placed in this category. Only adverse impacts will be assigned this level of significance.
<b>Moderate</b>	Important to consider on a local scale. If the impact is adverse in nature, it will pose potential concern to the Project and may become a key factor in the decision-making process.
<b>Minor</b>	Important to consider on a local scale, but unlikely to become key factors in the decision-making process. The accumulation of minor impacts may result in an increase in the overall impact on a particular receptor.
<b>Negligible</b>	Impact is local and unlikely to be a key factor in the decision-making process. Impact does not exceed statutory limits. Negligible impacts are still relevant in the alteration and enhancement of Project design and are worthy of consideration when determining mitigation and/or compensation measures.
<b>Neutral</b>	Either there is no discernible impact or there is a slight impact that is beneath the level of detection, within normal boundaries of variation or within the margin of error. No mitigation measures are necessary.

The table below presents values used to calculate impact significance and their correlation with the varying classifications of receptor sensitivity, impact magnitude, and impact likelihood.

**Table 13 Significance Criteria Ranking**

Numeric Value	Criteria		
	Receptor Sensitivity	Impact Magnitude	Impact Likelihood
<b>5</b>	Very High	Major	Certain
<b>4</b>	High	Moderate	Likely
<b>3</b>	Medium	Minor	Possible
<b>2</b>	Low	Negligible	Unlikely
<b>1</b>	Very Low	No Change	Very Unlikely

Using the above numbers assigned to each criterion, impact significance ranking is determined using the following formula:



**Impact Significance Ranking** = Receptor Sensitivity x Impact Magnitude x Impact Likelihood

The impact significance ranking number is then compared with the table below to determine impact significance.



**Table 14 Impact Significance Determination**

Impact Significance Ranking Number	Impact Significance
$x \geq 80$	<b>Major</b> – impact is regarded as significant
$79 \leq x \leq 30$	<b>Moderate</b> – impact is regarded as significant
$30 \leq x \leq 10$	<b>Minor</b> – impact is regarded as significant
$10 \leq x \leq 5$	<b>Negligible</b> – impact is regarded as non-significant
$x \leq 5$	<b>Neutral</b> – impact is regarded as non-significant

It should be noted that the numeric value for impact significance does not intend to present an accurate quantification of the impact or risk, but to ensure that a systematic process is followed that specifically takes into consideration the magnitude of the impact, its likelihood and the sensitivity of the receptor. This systematic analysis ensures that mitigation is designed for all the relevant aspects of the risk / impact and reduces to some extent the subjective factor of the assessment process.

#### 5.4.7. Management Measures

In addition to an in-depth assessment of potential E&S impacts, the ESIA report includes measures to manage these impacts.

The management strategy will follow the mitigation hierarchy. The hierarchy begins from the most beneficial method of management and goes on to the least beneficial method of management.

Avoidance is the first step in the management hierarchy. It is the complete management of an impact, by preventing it from happening. It is obviously the most preferred form

of management, because it ensures no damage. The second step in this hierarchy is minimization. The E&S impact cannot be completely avoided, but steps are taken to reduce the magnitude of the impact, the vulnerability of the receptor or the likelihood of the impact occurring, overall reducing the significance of the risk or impact.

If the impact cannot be avoided or minimized to reasonable levels, compensation is required. For environmental impacts, environmental offsets are the most common kind of compensation for environmental impacts. Offsets are defined as actions taken, often outside of the development site, to compensate for environmental impacts at the development site. In effect, this means that the developer undertakes environment conservation activities to compensate for what they do in order to achieve “no net environment loss”. For social impacts, compensation involves implementing actions that have a positive effect on the social receptors affected by negative impacts, in order to ensure that they are better off as a result of the Project and that the Project has a “net social benefit”.

The mitigation measures are subject to a public consultation process as per the Stakeholder Engagement Plan (SEP). For each mitigation measure this ESIA specifies an implementation schedule, the party responsible for its implementation, and where relevant the associated cost.

#### 5.4.8. Residual Impacts

The Project’s residual impact significance are considered following the assessment of the likely effectiveness of the proposed mitigation measures. The impact significance classification and criteria outlined above are applied to residual impacts.

#### 5.4.9. Monitoring Measures

A monitoring plan focused on residual impacts and risks is included in this ESIA to allow for comparison with the baseline environmental and social conditions and with predicted effects.

As the Project progresses, the monitoring parameters could be reviewed and changed in accordance with their relevance to the site conditions and ongoing activities.



### 5.5. Cultural Heritage

#### 5.5.1. Determining Cultural Heritage Significance

The heritage significance (or heritage ‘value’ or ‘sensitivity’) of an asset is determined by its scientific, historical, or cultural importance. The level of importance is calculated using a combination of the significance as evidenced in the Archaeological Survey Report (ASR), professional judgement and the assigned IFC category which is described in the table below.

**Table 15 IFC Cultural Heritage Categories**

<b>Replicable Cultural Heritage (Low)</b>	<b>Non-Replicable Cultural Heritage (Medium)</b>	<b>Critical Cultural Heritage (High)</b>
<p>Living heritage sites that can easily be moved or replaced with another structure or appropriate natural feature.</p> <p>Archaeological or historical sites may be considered replicable where the particular eras and cultural values they represent are well represented by other sites or structures or are already well understood.</p>	<p>Archaeological or historical sites that reflect in detail the economic, cultural, environmental, and climatic conditions of past peoples, their evolving ecologies, adaptive strategies, and early forms of environmental management, where cultural heritage is unique or relatively unique either (i) for the period it represents, or (ii) in linking several periods in the same site.</p>	<p>Includes (i) the internationally recognised heritage of communities who use, or have used within living memory the cultural heritage for long-standing cultural purposes; or (ii) [nationally or internationally] legally protected cultural heritage areas, including those proposed by host governments for such designation.</p>

The assessment takes into consideration:

- Whether a heritage asset can be moved to another location or replaced by a similar site, or is of a type that is common in the surrounding region (replicable, non-replicable or critical);
- The extent of the heritage asset’s cultural value to local, national, or international stakeholders; and/or
- The asset’s scientific value based on a combination of factors including likely date, condition and rarity.

Each asset is evaluated against the range of criteria listed above on a case by case basis. Unless the nature and exact extent of buried archaeological remains within any given area has been determined through prior investigation, significance is often uncertain.

### 5.5.2. Determining Magnitude of Impact

The determination of the ‘magnitude of impact’ upon the significance of known or potential heritage assets is based on the severity of the likely impact to that asset. Impacts, relating to heritage, are typically physical disturbances which will cause irreversible damage. The magnitude of the impact is best characterized by the extent of the damage in comparison to the whole asset. Limitations on access to assets, either permanent or temporary, are another form of impact to be considered. Table 15 below describes the criteria used in this assessment to determine the magnitude of impact.

### 5.5.3. Significance of Effect

The assessment of likely significant effects has considered the Construction, Operational, and Decommissioning stages. The significance level attributed to each effect has been assessed based on the heritage significance of the affected heritage asset and the magnitude of impact to the heritage significance of the asset – as a result of the Project.

Table 16 describes the outcome of the Significance of Effects may be either negative (adverse) or positive (beneficial) and are defined initially without mitigation. The table is essentially a guide only, so that the process is transparent and the rationale for the effect scores is provided in the relevant sections. Where the resulting effect comprises two separate levels (i.e. ‘moderate or minor’ or ‘minor or negligible’), professional judgement has been applied to select the most appropriate significance of effect. Where information is insufficient to be able to quantify either the asset significance or magnitude of impact with any degree of certainty, the effect is given as ‘uncertain’. This might be the case for possible buried heritage assets where the presence, nature, date, extent and significance is uncertain due to the absence of any reliable detailed information (i.e. absence of site-based investigation).



**Table 16 Magnitude of Impact Criteria**

Significance	Description
<b>High</b>	Complete removal of asset. Change to asset significance resulting in a fundamental change in our ability to understand and appreciate the resource and its historical context, character and setting. The scale of change would be such that it could result in a designated asset being undesignated or having its level of designation lowered
<b>Medium</b>	Change to asset significance resulting in an appreciable change in our ability to understand and appreciate the asset and its historical context, character and setting or the unrecorded loss of archaeological interest.
<b>Small</b>	Change to asset significance resulting in a small change in our ability to understand and appreciate the asset and its historical context and character.
<b>Negligible</b>	Negligible or no discernible change in the physical condition, setting or accessibility of the site



**Table 17 Table of Significance of the Effects Outcomes**

Significance	Very Low	Low	Medium Low	Medium High	High
Impact					
<b>Negligible</b>	Negligible	Negligible	Negligible	Negligible	Negligible
<b>Small</b>	Negligible	Negligible	Minor	Minor	Moderate
<b>Medium</b>	Minor	Minor	Moderate	Moderate	Major
<b>High</b>	Moderate	Moderate	Major	Major	Major

The following terms have been used to define the significance of the effects identified:

**Major effect:** where the Project could be expected to have a considerable effect (either positive or negative) on heritage assets (receptors). For the cultural heritage resource this equates to substantial harm to, or loss of, significance of an asset of high or medium heritage significance.

**Moderate effect:** where the Project could be expected to have a noticeable effect (either positive or negative) on heritage assets

(receptors). For the cultural heritage resource this equates to less than substantial harm to the significance of an asset of high or medium heritage significance.

**Minor effect:** where the Project could be expected to result in a small, minimally noticeable effect (either positive or negative) on heritage assets (receptors). For the cultural heritage resource this equates to less than substantial harm to the significance of an asset of medium heritage significance or substantial harm to, or the loss of, significance of an asset of low heritage significance.



**Negligible:** where no discernible effect is expected as a result of the Project on the cultural heritage resource (i.e. the effect is insignificant), or less minimal harm to the significance of an asset of very low heritage significance

## 5.6. Vulnerable Groups

Vulnerable Groups include people who, by virtue of gender, ethnicity, age, physical or mental disability, economic disadvantage or social status may be more adversely affected by Project impacts and risks than others and who may be limited in their ability to claim or take advantage of the Project's benefits.

The following vulnerable groups / vulnerability criteria have been identified during the ESIA phase of the Project:

- Women;
- People living in poverty;
- People with disabilities;
- The Elderly;
- The Youths;
- Internally displaced people (due to war).

The information gathered during scoping phase and during the ESIA social survey indicates that religion, ethnicity, nationality, legal/residency status and language are not causes for significant differences or marginalisation within the community that could lead to vulnerability, because the communities are fairly homogeneous on these aspects. Community characteristics are further described in the social chapters of this report.

Gender discrimination and the vulnerability of women presents a number of characteristics that set it apart from other vulnerability criteria.

Gender has played and continues to play a central role in the definition of social roles and expectations, with men holding a disproportionate amount of power and predominance in roles of political leadership, moral authority, social and economic privilege. These differentiated roles and expectations, giving predominance to men, occur at different levels, from political power and control of corporations globally to the reproduction of traditional wage-earner versus carer roles and decision making at the household level.

Even now, in all societies, women are subject to different levels of discrimination in all stages of life, in income, education, health and participation in society, and they are particularly vulnerable to specific violations such as gender-based violence, trafficking and sex discrimination. Women are more affected by poverty and more likely to be deprived of the chance to reach their full potential than men are. At the root are a range of causes based on gendered cultural norms, from poor education and limited access to finance.

Contributing to gender equality is one of the objectives of this ESIA process, because the ESIA aims to promote human rights, and gender equality is at the very heart of human rights. Additionally, gender equality benefits sustainable economic growth through productivity gains, by magnifying development effects for future generations and through a multiplier effect on other development.



Gender stands apart from other vulnerability criteria for the following reasons:

- All Projects that have significant social impacts will affect women.
- When there are other vulnerable groups, women will also be part of those groups, generating an additional layer of vulnerability.
- While some vulnerability criteria apply to specific activities (e.g. illiterate persons will not be able to interpret written announcements, review documents or contracts), gender discrimination is multifaceted and affects all social aspects.

For these reasons, while the identified vulnerable groups are highlighted when relevant during the ESIA process, gender aspects are systematically considered for each aspect, risk and impact. More specifically, this approach to gender main streaming has the following impacts on the ESIA process and documentation:

- Social Survey: Gender disaggregated data is gathered for all parameters, differentiating between female respondents and Women Headed Households as relevant.
- ESIA report: Gender aspects are specifically discussed for each impact and considered for each mitigation and monitoring measure.
- Stakeholder Engagement: Specific arrangements are made to ensure the meaningful participation of women on the scoping and ESIA consultations.
- The ESMS will include all relevant measures from the ESIA, which incorporates gender aspects. In addition, a

Gender Management Plan will be prepared outlining the Project's Gender Policy, its objectives, the management measures to achieve the desired results and monitoring measures to track progress on achieving the gender objectives.



## 5.7. Stakeholder Engagement

Stakeholder engagement can be described as the systematic effort to identify and involve any persons or groups of communities who are directly or indirectly affected by the Project, as well as those who may have interests in a Project and/or the ability to influence its outcome. Stakeholders include locally affected communities or individuals and their formal and informal representatives, national or local government authorities, politicians, religious leaders, civil society organizations and groups with special interests, the academic community and other businesses.

Stakeholder involves a range of activities such as public disclosure of Project information, consultation with stakeholders, and mechanisms by which people can make comments and raise grievances. The main objectives for stakeholder engagement are to:

- Identify and prioritize key stakeholder groups;
- Keep the relevant stakeholders informed about the construction of the Project;
- Capture views and concerns of the relevant stakeholders about the Project;
- Understand the needs of the communities and capture valuable information to make an informed decision;

- Enhance ownership of the Project within the host communities;
- Provide a basis for stakeholder participation in impact identification and mitigation, as impacts not captured in the ESIA may arise;
- Managing and respond to grievances from the local communities and other stakeholders, and
- Provide a strategy and timetable for sharing information and consulting with each of these groups.

The stakeholder engagement process is documented in the Stakeholder Engagement Plan of the ESIA report process.

The Stakeholder Engagement Plan is part of the Environmental and Social Management System (ESMS).

## 5.8. Environmental and Social Management System

A comprehensive Environmental and Social Management System (ESMS) will be prepared for the construction, operational and decommissioning phases of the Project.

The ESMS will be the main tool to ensure compliance with the Project's E&S obligations, and it will include all identified environmental and social risks and impacts, mitigation measures, and monitoring activities. Training, inspection, internal and external reporting, review procedures and resourcing requirements will also be described to ensure the successful implementation of the E&S management

measures throughout the different phases of the Project.

### 5.8.1. Construction Phase ESMS

The Construction phase ESMS includes the detailed binding E&S requirements for the EPC, its contractors, suppliers and the Project Company. The scope of the management system will include all the processes and activities that will be undertaken by during the construction phase of the Project.

The ESMS will cover both onsite and off site environmental and social risks (including both communities and employees) arising directly and indirectly from construction activities and potential emergencies. When these risks are deemed significant, the ESMS will put in place procedures to manage them to the extent that the Project can exercise influence over them.

The ESMS will be aligned with EBRD PR's, ADB regulations and the IFC Handbook on Management Systems and broadly aligned with the ISO 14001 Standard. The Management System will consider and, where relevant, manage risks arising from entities under the direct management control of the Project Company such as the EPC contractor, and those under the direct management of the Project's contractors (i.e. subcontractors, direct suppliers and other third parties in the core supply chain).

The ESMS will include an ESMS Manual, outlining the policy, approach, structure, components and overarching management tools to be applied to the management of all E&S aspects. The ESMS Manual will facilitate implementation and streamline compliance management and reporting. The ESMS will



also include Management Plans to address significant E&S impacts with specific mitigation and monitoring measures. The Plans will follow a common structure and streamline monitoring and reporting to facilitate their systematic implementation.

The following ESMS documents will be prepared for the construction phase of the Project:

- E&S Policy;
- ESMS Manual;
- Permits Register;
- Stakeholder Engagement Plan;
- Labour and Working Conditions Management Plan;
- Gender Management Plan;
- Community Development Plan.
- Emissions and Resource Management Plan;
- Biodiversity Management Plan;
- Hazardous Materials, Waste and Hazardous Waste Management Plan;
- Emergency Preparedness and Response Plan;
- Transport Management Plan;
- Occupational Health and Safety Management Plan;
- Contractor and Supplier Management Plan;
- Worker Accommodation Management Plan; and
- Cultural Heritage Management Plan.

It is considered that the ESIA functions as an up to date Legal Register, Construction Phase Aspects Register and Construction Phase Risk Register. Given the relatively short duration of the construction phase, these items will not be prepared as standalone documents for the construction phase ESMS. The first version of the ESMS will be prepared upon completion of this ESIA report.

Once the EPC contractor is given Notice to Proceed, the ESMS will be updated with relevant input from the EPC that will only be available after NTP, including but not limited to details on the selected subcontractors and suppliers, detailed design information, details on the worker accommodation facilities, selected locations for lay-down areas, hazardous material storage, emergency assemblage point, names of EPC E&S team members, etc.

### 5.8.2. Operational ESMS and Decommissioning Phase ESMS

The ESMS will be updated before the operational phase of the Project, two months before Commercial Operation Date or as otherwise required in the Environmental and Social Action Plan, and before the decommissioning phase.







PV Panel Installation



Cultural Heritage Feature (Off-Site)



## 6 Climate Change

Anthropogenic climate change poses a risk to ecosystems and socioeconomic systems alike. The transition to low carbon electricity generation technologies is one of the key activities to reduce anthropogenic climate change.

This chapter outlines and assesses the contribution of the Project to climate change mitigation.

This chapter focuses on Green House Gas generation, electricity generation and climate change. When climate change is likely to exacerbate environmental or social risks, this is discussed in the relevant chapter that addresses the specific E&S aspect.

### 6.1. Baseline and Policy Targets

#### 6.1.1. Global Climate Change

The Intergovernmental Panel on Climate Change (IPCC) reports that Impacts on natural and human systems from global warming have already been observed. Many land and ocean ecosystems and some of the services they provide have already changed due to global warming. Future climate-related risks depend on the rate, peak and duration of warming.



In the aggregate, they are larger if global warming exceeds 1.5°C than if global warming gradually stabilizes at 1.5°C, especially if the peak temperature is high (e.g., about 2°C). Some impacts may be long-lasting or irreversible, such as the loss of some ecosystems.

Adaptation and mitigation are already occurring. Future climate-related risks would be reduced by the up scaling and acceleration of far-reaching, multilevel and cross-sectoral climate mitigation and by both incremental and transformational adaptation.

The recent G20 summit recognized the need for global climate change mitigation, nations recognized the importance of strengthening national climate action this decade. Following this, Cop26 also recognized the need to reduce carbon emissions with many countries pledging to reach net-zero emissions targets in the future. The results of these conferences demonstrate that fossil fuel consumption cannot continue at the rate it is at now and therefore, renewable energy sources must increase to accelerate the transition to a sustainable economy.

### 6.1.2. Climate Change Impact in Armenia

The regional climate change in RA is noticeable. As a mountainous country with arid climatic conditions, Armenia’s entire territory is vulnerable to global climate change. According to the Second National Communication of Armenia on Climate Change, Armenia is among one of the most sensitive countries in the Europe and Central Asia region in regard to climate change. With a population of around 3 million (2020), Armenia contributes as little as 0.02% to the total global greenhouse gas emissions and is in the lower range of per capita

footprint with 3.33 t CO<sub>2</sub>e (UNDP, 2021). In its updated Nationally Determined Contribution (NDC) 2021-2030, Armenia sets the economy wide GHG emission reduction single year target of 40% by 2030 compared with the base year 1990. Energy and agriculture are the two sectors with the largest GHG emission shares, and therefore this is where the majority of the mitigation potential lies.

Climate change is already affecting Armenia, with an annual temperature increase higher than the global average accompanied by a significant decrease in precipitation. As a result of increased temperatures and reduced precipitation, the desertification process is accelerated and will have a negative impact on public health and sectors which depend on the climate. Climate change will result in changes to natural ecosystems, resulting in impacts on biodiversity and forest, alpine, sub-alpine and wetland ecosystems of Armenia. Climate change is increasing the vulnerability of Armenia, with an increase in the frequency of extreme weather events, worsening desertification and land degradation. The most vulnerable sectors are agriculture, human health, water resources, forestry, transport and energy infrastructure. Significant changes have taken place in Armenia with regard to legislation and institutional structure of governance during recent years - after the preparation of the First National Communication of Armenia on Climate Change.

If business-as-usual greenhouse gas emissions continue worldwide over the next century (RCP 8.5 scenario), it is likely Armenia’s average annual temperature increase will be as high as 4.5°C in the lowlands and 7.0°C in the highlands. It should be emphasized that these



are enormous climatic changes: if temperatures in certain regions of the world were to rise by just 2°C, these regions would face impacts detrimental to society.

Changes in average annual temperature and precipitation often disguise some of the most devastating effects of climate change: temperature extremes and changes in weather patterns. Increased average temperatures heat waves result in detrimental health impacts and will become more common. Already at lower elevations summers are longer and warmer, averaging around 25°C, winter temperatures drop to -5°C in the foothills, rather than -12°C as in the highlands. The increase in Armenia’s average annual temperature under the high emissions scenario is expected to take place throughout the year. In this scenario, Yerevan’s average annual temperature will climb from 11.6°C today to 16.6°C by the end of this century. In Vayk, where the greatest temperature increases in Armenia are expected, the average annual temperature under the business-as-usual scenario are Projected to rise to 19.2°C.

With a continuation of global business-as-usual emissions, Armenia’s average annual precipitation is expected to decrease by as much as 9% over the next century. Expected changes to precipitation vary enormously across the nation, but even in areas that are expected to have an increase in precipitation, higher temperatures can mean increased evaporation and decreases in run-off. The consequences of increased evaporation are less soil moisture and large reductions in river flows.

The biggest reductions in precipitation are predicted for Yerevan and the Ararat Valley

with 30% less precipitation Projected for 2100. In these mountainous areas that will see a reduction in precipitation, like the eastern slopes of Lake Sevan, decreases in snow cover can be expected, which will greatly reduce spring run-off and river flow. Higher air temperatures, increased evaporation, and greater concentrations of water vapour increase the likelihood of severe storms that, in the Armenian context, may result in natural disasters like floods, landslides and mudflows.

### 6.1.3. Climate Change Mitigation Targets

Armenia is a country with an ambitious climate change agenda, which makes significant efforts towards a low carbon development through increasing the share of renewable energy, promoting energy efficiency, preserving and enhancing forest-covered areas and reporting regularly to the UNFCCC. Armenia cooperates with the EU in meeting climate change targets through ‘The Eastern Partnership’ which is the eastern regional dimension of the EU’s European Neighbourhood Policy.

The 2018 EU-Armenia Comprehensive and Enhanced Partnership Agreement (CEPA) includes transport, energy and environment, climate amongst etc. Environment and adaptation to climate change are supported by improving water resources management and transboundary cooperation, main streaming environmental goals, developing sounder environmental governance, enhancing environmental awareness, improving the sustainable management of key natural resources and promoting climate change resilience. Armenia is moving forward on its sustainable energy commitments and climate resilience pathway with strong support from





the EU and international financing institutions.

The EU4Climate Program, funded by the European Union, aims to support the development and implementation of climate-related policies by countries involved in The Eastern Partnership. EU4Climate supports Armenia’s commitment to update and enhance the country’s NDC in 2020, with an ultimate goal to identify a realistic implementation strategy for the limitation of GHG emissions. The EU4Climate and Armenia are also working together to prioritize adaptation measures for coping with climatic changes that pose significant risks to the country’s sustainable development. The main tool for the successful implementation of the Armenian NDC, as well as the Climate Action SDG, is a long-term Low Emission Development Strategy (LEDS), including the development of energy and agriculture sectoral strategies. A robust domestic emissions measurement, reporting and verification (MRV) system will be established, to inform the government and the international community of the progress of its NDC implementation. Throughout the program, the best international and EU practices will be applied, including alignment with EU Acquis laws in accordance with the CEPA.

Armenia has also implemented a strategy for the Development of the Energy Sector in the Context of Economic Development of Republic of Armenia (2005). This is planned until 2025 and addresses the facilitation of sustainable economic development and energy security in Armenia, including: diversification of imported and domestic energy resources; maximum utilization of the potential of renewable and non-traditional sources of energy; promotion of energy efficiency/conservation; environmentally viable power supply in line

with Armenian international obligations. The strategy describes Projected indicators for energy consumption in different sectors of the economy, and plans to create power, gas and heat supply Projects according to the implementation timeline.

The Renewable Energy Development Roadmap was first introduced in 2011 by Armenia. The roadmap describes the technical accessibility, and the economic, financial feasibility and benefits of renewable energy potential, and evaluates renewable energy potential in transport, electrical and thermal energy generation in the short term (until 2013), midterm (until 2015), and long term (2020 and after). The roadmap refers to investment needs and costs according to RE types and sector. The future share of RE generation in long-term plans is estimated at 16.3%.

The National Program for Energy Saving and Renewable Energy in Armenia was introduced in 2007. This program provides an assessment for energy saving potential in electric and thermal energy, gas-supply systems, manufacturing, transport, and residential and public buildings, as well as assessment of renewable energy potential and measures for the effective utilization of the energy-saving potential.

Armenia has already implemented legislation, policies and created programs and road maps aiming to promote renewable energy and mitigate the effects of climate change with further plans in place enabling Armenia to reach their net zero emissions target.



## 6.2. Sensitive Receptors

Table 18 Climate Change - Sensitive Receptors

Receptor	Sensitivity	Justification
<b>GHG Concentrations</b>	Medium	Emission reduction target have already been exceeded and climate change impacts are already being felt worldwide.



## 6.3. Impacts

### 6.3.1. Construction Phase

Greenhouse gasses are expected to be produced during the construction phase. The level of greenhouse gas emitted is expected to be low, caused only by vehicles and machinery.

Only well-maintained vehicles will be used and measures to minimize excess production of GHG will be utilized.

Table 19 Climate Change – Construction Impact Magnitude

Impact / Risk	Impact Magnitude	Likelihood	Justification
<b>GHG Emissions</b>	Negligible Negative	Certain	The Project will generate small amounts of GHG due to the use of fossil fueled power vehicles and generators during construction.



Hrazdan Power Plant

### 6.3.2. Operational Phase

The Project will generate electricity without burning fossil fuels, so no greenhouse gases will be released as a result of the electricity generation process. This contributes to meet Armenia’s international commitments on climate change mitigation and to minimize the negative environmental and social impacts associated with Climate Change.

The plant has been designed to operate within expected climate and weather conditions, including climate change predictions. The plant is located in a plateau and areas prone to flooding have been avoided, so impacts from climate change related extreme weather events are not considered to pose a significant risk to the Project.

As mentioned, the GHG produced during the operational phase are expected to be negligible. Most of this carbon footprint is generated during manufacturing, transport and decommissioning phases of the Project when heavy machinery is used.

### 6.3.3. Decommissioning Impacts

The production of GHG and effects on the climate during the decommissioning phase are expected to be similar to the construction phase. The use of heavy machinery is expected to cause some level of emissions to be produced. Only well-maintained vehicles will be used and measures to minimize excess production of GHG will be utilized.



**Table 20 Climate Change - Operation Impact Magnitude**

Impact / Risk	Impact Magnitude	Likelihood	Justification
<b>Avoided GHG Emissions</b>	Moderate Positive	Certain	The Project will generate electricity without emitting GHGs, thus contributing to the decarbonization of the Armenian Power Sector.



## 6.4. Impact Assessment

Table 21 Climate Change- Impact Assessment- Construction Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>GHG Emissions &amp; Energy Efficiency</b>	Negligible Negative	Certain	Target GHG Emission Reductions	Medium	Minor Negative

Table 22 Climate Change- Impact Assessment- Operational Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>Avoided GHG Emissions</b>	Moderate Positive	Certain	Target GHG Emission Reductions	Medium	Moderate Positive

Decommissioning phase impacts minor negative and caused by energy consumption during material recovery.

## 6.5. Management Measures

Table 23 Climate Change- Management Measures- Construction Phase

Impact / Risk	Management Measure
<b>Carbon &amp; Energy Efficiency</b>	Train site workers on carbon and energy efficiency management measures, including turning lights off when not required, keeping doors closed on rooms with A/C, etc.
	Well and adequate maintained fuel efficient vehicles will be used, and regular maintenance of this vehicles will be ensured.
	In order to minimise air emissions sourced from construction; relevant provisions of the Air Quality Regulations will be complied with.





Impact / Risk	Management Measure
	Construction vehicles will not be permitted to keep engines running while waiting to enter to the site or waiting on-site.
	Use of modern equipment and vehicles meeting appropriate emissions standards and fuel efficiency, and regular preventative maintenance (in line with manufacturer’s recommended maintenance schedules, taking into account intensity of use and operating environment).

**Table 24 Climate Change- Management Measures- Operational Phase**

Impact / Risk	Management Measure
<b>Carbon &amp; Energy Efficiency</b>	Well and adequate maintained fuel efficient vehicles will be used, and regular maintenance of this vehicles will be ensured.
	In order to minimise air emissions sourced from machinery; relevant provisions of the Air Quality Regulations will be complied with.
	Project vehicles will not be permitted to keep engines running while waiting to enter to the site or waiting on-site.
	Use of modern fuel efficient equipment.

The management measures listed for the construction phase will be applied during decommissioning, as relevant.



## 6.6. Residual Impact

Table 25 Climate Change- Management Measures- Construction Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
<b>GHG Emissions &amp; Energy Efficiency</b>	Minor Negative	Yes	Minor Negative

Table 26 Climate Change- Management Measures- Operational Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
<b>Avoided Emissions &amp; Energy Efficiency</b>	Moderate Positive	Yes	Moderate Positive

## 6.7. Monitoring Measures

Table 27 Climate Change- Residual Impacts- Construction Phase

Impact / Risk	Monitoring Measure
<b>Carbon &amp; Energy Efficiency</b>	Monitoring of fuel use will be carried out in accordance with the ESMS prepared for the Project.
	Monitoring of energy consumption will be carried out in accordance with the ESMS prepared for the Project.

Table 28 Climate Change- Monitoring Measures- Operational Phase

Impact / Risk	Monitoring Measure
<b>Carbon &amp; Energy Efficiency</b>	Monitoring of fuel use will be carried out in accordance with the ESMS prepared for the Project.
	Monitoring of energy consumption will be carried out in accordance with the ESMS prepared for the Project.



The monitoring measures listed for the construction phase will be applied during decommissioning, as relevant.

## 7 Biodiversity & Protected Areas

PV Plants tend to have higher impacts on terrestrial ecology during the construction phase than other electricity sources in terms of land required for the development. However, re-vegetation usually takes place during operations. The mortality of birds and bats caused by operational PV Plants is extremely low. There are, however, potential risks other than mortality caused by habitat loss and bird collision / electrocution on overhead transmission lines.

This chapter assesses the potential impacts of the Project on local habitats, terrestrial fauna and flora, and describes the nearby protected areas and ecosystem services.





## 7.1. Observations and Baseline Conditions

### 7.1.1. Initial site evaluation



This section describes the initial site evaluation undertaken during scoping. The results of the ESIA baseline surveys are outlined in the following sections.

The PV plant site belongs to the floristic region of Shirak. The site is situated on a south facing slope of light steepness close to the Aragats Mountains. The prevalent form of vegetation in the area are small shrubs which have been degraded due to harsh weather conditions, soil infertility and extensive pastoralism activities. The site which lies on the dry and rocky substratum also has semi-desert elements and species which are typical of phrygana vegetation. Upon investigation, it is thought the presence of Hollyhock Herb-sophia (*Alcea sophiae*), Colhicum (*Merendera*) and Wilde Beet (*Beta Lomatogona*) plant species can potentially to occur throughout the site.

During scoping site investigations and walkovers, no plant species registered in the Red Book of Armenia were detected at the site or in the surrounding area.

The desk study and early site investigations identified the potential presence of several animal species present in the area. Insects, reptiles, and birds are potentially present at the site of the “Ayg-1” solar power plant.

During field works, it became clear that the area has been cleared in previous decades / centuries for agricultural purposes. It is evident that as a result of this, the flora and fauna in the area is very poor. The sites terrain is rocky

in some areas with a mostly vegetation-free landscape.

Given the baseline conditions of the site, it is not expected that bat colonies will be present at the Project site, baseline surveys have been conducted to verify this. Bats tend to prefer dark, covered areas for roosting. The site does not appear to have preferable conditions for bat roosting sites. There is evidence of suitable nesting areas for ground nesting birds and suitable areas for specific types of insects and reptiles.

There are rock outcrops and piles of stones adjacent to the surveyed area where the lizards and birds typical to the region were detected. Of the small rodents, only the common field mouse (*Microtus Arvalis*) was found during the preliminary site visits. This is due to the poor vegetation of the area, especially the scarcity of cereals. Several species of vertebrates, membranous and scaly insects were identified. During the scoping field works, in the area requested for “Ayg-1” solar power plant, no animal species registered in the Red Book of Armenia were detected. Results from the biodiversity survey is detailed below.

In the region there is “Aragats’s Alpine” state sanctuary that is situated in the vicinity of Stone Lake and “Vordan Karmir” state sanctuary near Yeghegnut village of Armavir region. The Project is not close to any Protected areas, there are only 3 protected areas within a 40km distance from the Project site and no impacts are expected on any of them.

**Table 29 Types of Protected Areas & Internationally Recognized Areas**

Type	Category	Sub-category	Definition
<b>Protected Areas</b>	Nationally Protected Areas	IUCN Category II - National Park	Category II protected areas are large natural or near natural areas set aside to protect large scale ecological processes, along with the species.
		IUCN Category IV - Habitat / Species Management Area (Areas)	Category IV protected areas aim to protect particular species or habitats which require priority management. Many Category IV protected areas will need regular, active interventions to address the requirements of particular species or to maintain habitats.
		IUCN Category VI – Managed Resource Protected Area	Category VI protected areas aim to conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems. Therefore, this category of protected areas tends to be relatively large (although this is not obligatory).
	Internationally Protected Areas	Ramsar Sites	Ramsar sites are wetlands recognized as internationally important sites for biodiversity conservation. The criteria used for their inclusion on the list include irreplaceable and vulnerable species and habitats, and therefore many of these areas are likely to be of high global high global biodiversity value.
<b>Internationally Recognized Areas</b>	Priority Sites for Biodiversity	Important Bird & Biodiversity Areas	Globally important sites for the conservation of bird species. These sites are considered to be important to ensure the survival of viable populations of most of the world’s bird species.
		Alliance for Zero Extinction Sites	Global list of sites focusing on the conservation of the remaining population of one or more species listed as endangered or critically endangered on the IUCN Red List of Threatened Species.
	Regions of Conservation Importance	Endemic Bird Areas	Critical regions of the world for the conservation of restricted-range bird species.
		Biodiversity Hotspots	Biodiversity hotspots are a method to identify those regions of the world where attention is needed to address biodiversity loss and to guide investments in conservation. Hotspots are not formally recognized or governed areas.



Table 30 Protected Areas (40km Buffer)

Protected Area/Internationally Recognized Area	Designation of the Area	Distance to Closest Project Component	Description
<b>Nationally and Internationally Protected Areas</b>			
<b>IUCN Category II - National Park (Areas)</b>	Aragats Alpine Sanctuary	15.5 km	This sanctuary was established in 1959 for the preservation of the alpine flora of the area and Lake Qar. The total area is 300 hectares and is situated on the southern slope of Mount Aragats. The glacial Lake Kari and adjacent alpine meadows are considered protected areas by the Ministry of Environment.
<b>IUCN Category Not Reported - Forest Reserve</b>	N/A	N/A	There are no Forest Reserves within a 40km distance of the Project site.
<b>Ramsar sites</b>	N/A	N/A	There are no Ramsar Sites within a 40km distance of the Project site.
<b>Conservancies IUCN Category VI - Managed Resource</b>	Arzakan-Meghradzor Sanctuary	38 km	This sanctuary was established in 1971 for the protection of the following species: the brown bear, the Caspian snowcock, wild boar, roe deer and the caucasian black grouse. The surface area is 13,532 hectares.
<b>Important Bird &amp; Biodiversity Areas</b>	Metsamor Important Bird Area	27 km	The IBA is one of 18 designated Important Bird and Biodiversity areas located in Ararat Plain of Armenia and is represented by combination of wetlands, semi-desert, and mosaic arable lands. Overall there are 225 bird species recorded in this area, including 92 breeding species and 133 migratory and wintering ones.
	Arax River KBA	5km	The Arax River KBA is approximately 5 km to the south-west at its closest point. The site is designated for supporting populations of Marbled Teal, Great Bustard, Eurasian Otter, Mehely's Horseshoe Bat, Tigran's Elder and Common Tortoise.



## 7.2. Site Survey

### 7.2.1. Methodology

The detailed biodiversity survey report is available in the annexes. Biodiversity site assessment field surveys were conducted on

15th June –10th August 2022. Field surveys involved a number of techniques including a habitat assessment, different survey techniques for flora and fauna, and an assessment of the ecosystem in and around the Project site. In particular, the following key activities were undertaken during site surveys:

- Validation of desktop findings;
- Characterization of different habitat types in the area;
- Assessment and verification of the floristic structure and composition of the vegetation communities present within the Project area to confirm current state;
- Description of fauna habitat present and recording of any incidental fauna sightings;
- Geospatial Research to identify vegetation types at the Project area;
- Review of Emerald and IBAT databases;
- Route Surveying of terrestrial vertebrates to determine species composition; and
- Identification of protected species (flora and fauna) as outlined in the Red Book of Armenia to understand if the Project would cause disturbance of potential vulnerable flora and fauna species.

### Flora Surveys

Floral surveys involved identification and mapping of vegetation communities within the Project site and surrounding areas. Geospatial research was conducted to assess vegetation types and the landscape at the Project site by assessing the Project area according to the main habitats present. All floral species were identified based on a number of manuals specialising in flora identification.

The assessments also included sampling of plants when their species was unknown. In these instances, the sample was preserved and analysed under laboratory conditions in order to correctly identify the flora species found on site. Surveying also involved site walkovers to sample vegetation. Photographic evidence was collected at each of the respective assessment points. This rapid assessment involved an

inspection of representative habitat types and focused on broad-scale vegetation community assessment including identifying potentially threatened floral species found in the area. Representative lists of flora species found within the surveying area at the Project site were then compiled for analysis. In addition to the flora surveying methods mentioned, a number of additional works were completed including research of published literature, comparing the information obtained in the field with the available data from the National Academy of Sciences Armenia. The status of rare and endangered species was determined according to the Red Books of Plants and Animals of Armenia (2010).



### Fauna Surveys

The assessments focused on vertebrates (small and big mammals, herpetofauna) taxonomic groups and occurrence of invertebrate species. Prior to conducting the fauna survey, all available scientific information which related to the location of the Project site was reviewed.

Surveys covering the Project area were conducted to record all fauna species present within the Project site and surrounding areas. The locations of the survey observations in each habitat type were selected considering natural conditions and site accessibility to cover representative areas of all habitats as far as practicable within the Project site. Stationary observation sites were also used during the survey to observe fauna activity in the area. Uses of various natural habitats by fauna (e.g. feeding, breeding, etc.) were documented during the surveys, and photos of species (fauna and flora) were taken in each sampling location for further interpretations and reporting. Fauna assessments were guided by the following:



- The Integrated Biodiversity Assessment Tool (IBAT) and Emerald database – used as an indication of the potential presence of species;
- Confirmed presence of fauna based on field sightings, evidence of presence (animal prints on the ground, feathers, burrows, faeces, bones etc.) and reliable reported presence (such as literature reports studying the surrounding areas of the Project);
- Assessment of herpetofauna based on opportunistic visual observations;

Emphasis focussed on the following fauna: (i) species of conservation concern, endemic, protected and migratory species which are included in the Red Book of Armenia, ; and (ii) species that are at risk and/or likely to beat risk during construction and operation of the Solar Plant.

### Mammal Surveys

Mammal surveys were conducted to observe and record mammal species within the Project site boundary. The IBAT database was reviewed to first determine if there were any endangered vertebrate species present at the Project site.

A route survey was conducted and traces of mammal activity were recorded throughout the survey. Animal footprints on the ground, traces of animal foraging (gnawing, leftovers etc), faeces and refuges such as dens were recorded during the route survey. The Kuznetsov B. Identifier of Vertebrate Animals of the Fauna of the USSR 1975 was used to identify small and medium-sized mammals.

### Vertebrate Surveys

Survey techniques used to detect terrestrial vertebrates were conducted in order to identify species which may reside at the Project site.

The IBAT database was reviewed to first determine if there were any endangered vertebrate species present at the Project site. Following this, route surveys were conducted to determine the species composition present at the site. Standard methods from Formozov (1951, 1976), Novikov (1953), Oshmarin (1990) and Romanov (2005) were used.

Traces of vertebrate activity were recorded throughout the survey. Animal footprints on the ground, traces of animal foraging (gnawing, leftovers etc), faeces and refuges such as dens were recorded during the route survey.

### Invertebrate Surveys

Surveys were carried out using transect counts along the route used at the Project site during the route survey. During the surveying period, traditional methods of entomological research were employed which involved mostly hand collection from under stones, from manure and collection using insect nets. Transect count and visual observation of butterfly species was also used along the routes.

### Herpetofauna Surveys

Survey techniques applied for detection of snakes and lizards included diurnal and nocturnal searches of appropriate habitats, and visual searches.



Visual searches were undertaken for species whose behaviour involved surface activity. Scanning areas of potential habitat from a distance using binoculars was undertaken, especially to detect species that are active on the surface during the day, particularly early in the day when reptiles emerge from cover (such as burrows) and bask in direct sunlight. Other species were detected by walking transects through areas of potentially suitable habitats and recorded through visual observations and inspections off habitats.

### Bird & Bat Surveys

The IBAT database was reviewed to determine if there were any endangered vertebrate species present at the Project site.



Observations of birds were mainly recorded "in the field" during the route survey. An android application program was utilised, namely, "of Observation.org" (<https://observation.org>).

**Table 31 Survey Criteria Used For Determining Breeding Status of Birds**

Non-Breeding
Species flying over
Species observed but suspected to be still on migration
Species observed but suspected to be summering non-breeder
Species observed hunting/feeding but suspected to breed in another square (or outside of study area)
Possible Breeder
Species observed in breeding season in suitable nesting habitat
Singing male present in suitable breeding habitat
Probable Breeding
Pair observed in suitable nesting habitat in breeding season
Permanent territory presumed through registration of territorial behavior (song, etc.) on at least two different days a week or more apart at the same place
Bird visiting probable nest site
Agitated behavior or anxiety calls from adults
Nest building or excavating nest-hole
Courtship and display in or near potential breeding habitat
Confirmed Breeding
Nest building
Adults entering or leaving nest-site in circumstances indicating occupied Nest
Recently fledged young (nidicolous species) or downy young (nidifugous species)
Adult carrying faecal sac or food for young
Nest containing eggs or young

The criteria contained in the Bird Atlas published by the British Trust for Ornithology 2007-2011 was slightly modified and adapted to the local needs of the project, were used to determine species status and criteria, as per the table above.

Traces of bird and bat activity were recorded throughout the survey. Footprints on the ground, traces of animal foraging (gnawing, leftovers etc), faeces and refuges such as nests and roosts were recorded during the route survey.

In order to determine the presence of bat species at the Project site, a Bat Detector – Fledermusdetektor was used. Bat detectors are devices used to detect bats by converting their echolocation ultrasound signals.

During the period of field surveys which took place at twilight and during night hours using the Fledermasdetektor detector, no bat species were recorded within the Project site. It should be noted that no bats were visually recorded during the surveying period.

**Ecosystem Services Assessment**

The collection of relevant information for the ecosystem services assessment for the Project area was performed following the World Resources Institute (WRI) approach, which is aligned to IFC Performance Standard 6 and EBRD PR6. Ecosystem Services observed during fieldwork were listed and described.

**7.2.2. Findings**

**7.2.2.1 Flora Species**



The Project site and surrounding area are comprised of different habitat types and types of vegetation. A habitat map is provided at the end of the section detailing the geographic distribution of different habitats within the Project area (Figure 15).

The vegetation within the Project site consists of wormwood semi-deserts, mountain steppes, steppe bushes, petrophilous vegetation, small patches of wetland vegetation and abandoned arable lands. During walkover surveys, it was clear that the Project site had undergone significant change driven by human activities. The habitat types observed during the surveying period are described below.



*Senecio Vernalis* at the Project Site

Plate 4 Plants identified in the Project area



*Acantholimon Glumaceum*

**Wormwood Semi-Deserts**

This habitat type is found mainly in low lying parts of the Project site and is dominated by species from the *Artemisia* Family. The habitat consists of herbaceous plants and shrubs. *Artemisia Fragrans* is the species which is observed most frequently in this area of the Project site. In addition the habitat also features six other plant families, namely, Poaceae, Capparaceae, Fabaceae, Brassicaceae, Euphorbiaceae and Cariophyllaceae.

**Mountain Steppes**

Mountain steppes are represented by several formations: between the former arable lands, there are small areas of sedge steppe with the dominance of *Stipa tirsia*, sedge grass (*Festuca valesiaca*) dominance, and heather-grass steppe, which also occur in sections between former agricultural arable lands, with limited presence of *Festuca valesiaca*.



*Thymus Collinus*

At a higher altitude, there are parts of sedge-grass steppes with the participation of *Stipa pennata*.

**Steppe Bushes**

There are steppe bushes present in several areas throughout the Project site. The presence of *Rhamnus pallasii* Fisch. et C.A. Mey., *Cerasus incana* (Pall.) Spach., *Astragalus microcephalus* Will., *Rosa mollis* Sm., *Prunus divaricata* Ledeb., *Acantholimon glumaceum* were recorded during the flora field survey's. In some parts of the surveyed area, the *Astragalus microcephalus* and *Acantholimon glumaceum* are dominant. However, these steppe bushes are not typical tragacanth. This may be the result of anthropogenic impacts.

**Petrophilous Vegetation**

Petrophilous plants were recorded on the Project site during field surveys. Petrophilous vegetation refers to plants that grow on rocks.





Various plants belonging to the Caryophyllaceae family were recorded including *Paronychia kurdica* Boiss., from Rosaceae - *Potentilla recta* L., from Fabaceae *Medicago sativa* L., from Brassicaceae - *Erysimum leptophyllum* (M. Bieb.) Andrz., from Apiaceae - *Prangos uloptera* DC.

### Wetland Vegetation

There is no typical wetland vegetation present at the Project site. There are streams that pass through the canyons around the site but these do not carry a significant flow of water during winter and are typically dried up in summer.

The small patches of wetland vegetation in the canyons are outside the Project site and footprint.

During the survey, dried up stream beds were examined, only plum, rosa and some meso-xerophilous herbs were recorded.



Plants from the Brassicaceae family were recorded during the surveying period. Plants from this family are Characteristics of Brassicaceae generally herbs, annuals, biennials, or shrubs they meet here *Capsella bursa-pastoris* (L.) Medik, *Melilotus officinalis* (L.) Ders., from Polygonaceae - *Rumex crispus* L., *Polygonum patulum* M.Bieb., from Ranunculaceae - *Thalictrum minus* L., *Adonis aestivalis* L., from Urticaceae - *Urtica dioica* L. ant ect.

### Plate 5 Steppe Bushes at the Project Site



Steppe Vegetation



Low Levels of Vegetation at Project Site

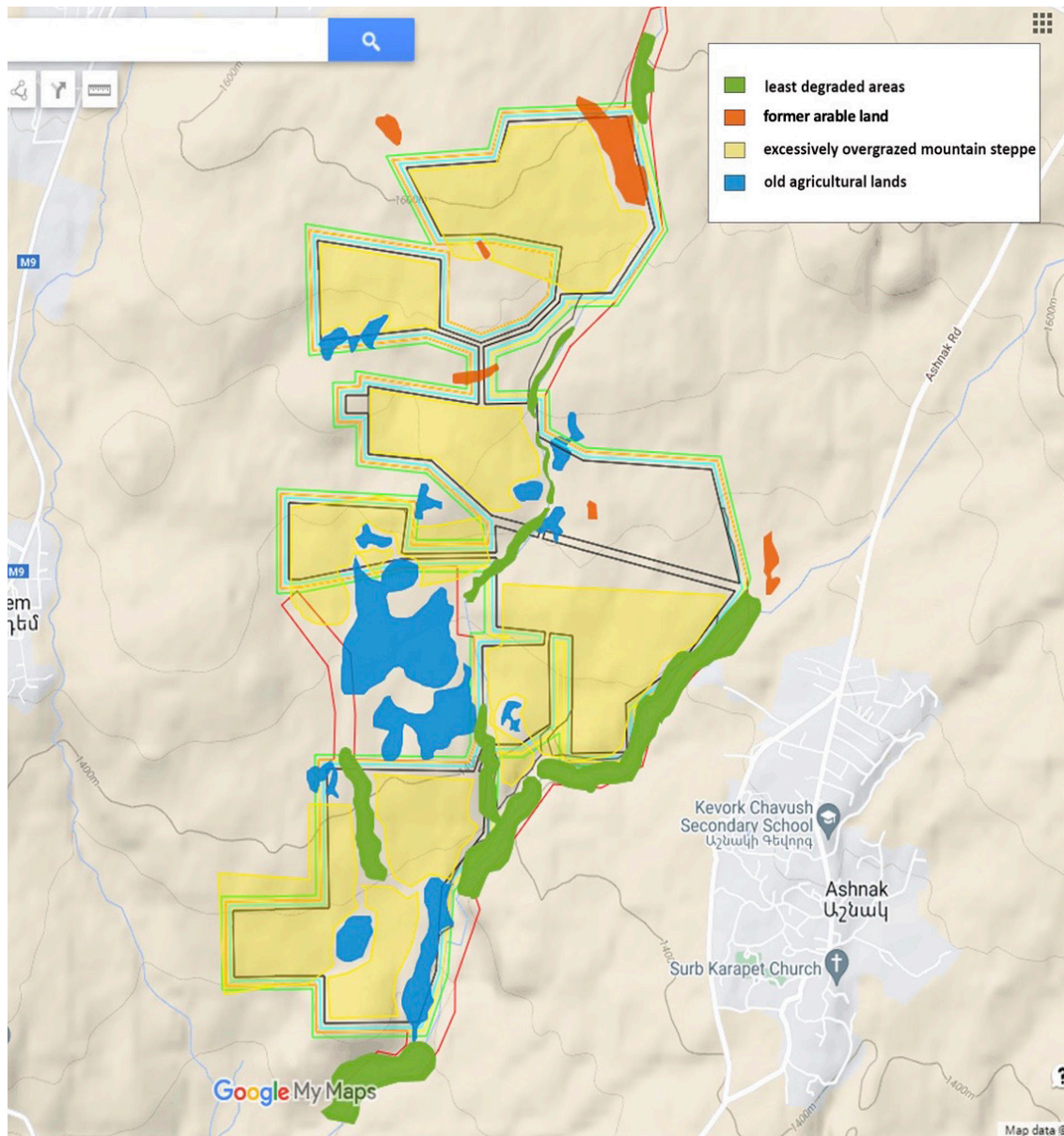
### Abandoned Arable Land

Former agricultural arable lands occupy large areas of the area surveyed at the Project site. During the Soviet years, wheat and barley were grown on reclaimed land and there was an irrigation system present to aid the growth of crops.

In recent years, these territories are no longer used as arable lands as there is no irrigation system available, and as a result of this, the land is eroded. The land once used as arable land is now used by the local community as pasture land.



Figure 14 Habitat Map



### 7.2.2.2 Fauna Species

#### Mammal Species



Based on the available literature and data obtained during field surveys, the table below was compiled which includes the presumed presence, visually observed and recorded signs of animal presence.

Species included in the IUCN list and the Red Book of Armenia are highlighted in red and a summary of each is given.

Prior to surveying, the IBAT database and interviews with local farmers indicated that four species of mammal potentially present at the Project site and surrounding areas which are included in the IUCN Red List and the Red Book of Armenia.

There was a total of 21 mammal species found at the Project site during the surveying period. There was 12 species of mammal that were found by visual observation and by signs of life (burrows, food remains and excrement). There was a jackal recorded during the site survey which had not been previously recorded at the Project area. This was recorded twice during the night.



Abandoned Arable Land



Abandoned Arable Land

Out of the 4 mammal species included in the IUCN Red List and the Red Book of Armenia, the presence of three out of four species was not detected during field surveys. There were no visual recordings or signs of life recorded for the Marbled polecat (*Vormela peregusna*), European wildcat (*Felis silvestris*) and Meadow mole (*Microtus arvalis*).

The field survey confirmed the presence of only one Red List species, namely, the Minor Ground Squirrel (*Spermophilus xanthoprymnus*) which was recorded during daytime. However, the Project site does not appear to be an important habitat to this mammal.



**Table 32 List of Mammals Recorded at the Project Site During Surveying**

English Name	Scientific Name	IUCN	Literature <sup>1</sup>	Site <sup>2</sup>	Red Book Status
<b>Erinacidae</b>					
Southern white-breasted hedgehog	<i>Erinaceus concolor</i>		+	+	
<b>Soricidae</b>					
Lesser white-toothed shrew	<i>Crocidura suaveolens</i>		+	-	
Eurasian pygmy shrew	<i>Sorex minutus</i>		+	-	
<b>Leporidae</b>					
European hare	<i>Lepus europaeus</i>		+	+	
<b>Mustelidae</b>					
Beech marten	<i>Martes foina</i>		+	+	
<b>Marbled polecat</b>	<b><i>Vormela peregusna</i></b>	<b>VU</b>	<b>+</b>	<b>-</b>	<b>VU A2c+B1</b>
Least weasel	<i>Mustela nivalis</i>		+	+	
European badger	<i>Meles meles</i>	LC	+	+	
<b>Canidae</b>					
Wolf	<i>Canis lupus</i>		+	-	
Jackal	<i>Canis aureus</i>		-	+	
Fox	<i>Vulpes vulpes</i>		+	+	
<b>Felidae</b>					
<b>Wildcat</b>	<b><i>Felis silvestris caucasica</i></b>	<b>LC</b>	<b>+</b>	<b>+</b>	<b>VU B1ab(iii)</b>
<b>Sciuridae</b>					
Asia Minor ground squirrel	<i>Spermophilus xanthoprymnus</i>	NT	+	+	EN B2ab (ii, iii, iv)
<b>Allactagidae</b>					
Williams jerboa	<i>Allactaga euphratica</i>		+	+	
<b>Spalacidae</b>					





English Name	Scientific Name	IUCN	Literature <sup>1</sup>	Site <sup>2</sup>	Red Book Status
Nehring's blind mole rat	<i>Nannospalax nehringi</i>		+	+	
Cricetidae					
English Name	Scientific Name	IUCN	Literature <sup>1</sup>	Site <sup>2</sup>	Red Book Status
Brandt's hamster	<i>Mezocricetus brandti</i>	NT	+	-	
Transcaucasian mole vole	<i>Ellobius lutescens</i>		+	-	
<b>Schidlovsky vole</b>	<b>Microtus schidlovskii</b>	<b>LC</b>	<b>+</b>	<b>-</b>	<b>EN B1ab (ii, iii, v)</b>
Common vole	<i>Microtus arvalis</i>		+	+	
Muridae					
Ural field mouse	<i>Sylvaemus uralensis</i>		+	+	
Brown rat	<i>Rattus norvegicus</i>		+	+	

1: Available Information from Sources, 2: Data Available from Surveys, Bold Font: Mammals Listed in IUCN Red List and Red Book of Armenia Section

**Marbled polecat-** In the past, this species was found at the Project site and surrounding area. Recordings of this species is always associated with the presence of the gopher, their main food source. During the surveying period, only two sightings of gophers were recorded at the Project site. It should be noted that the presence of grazing cattle and herding dogs has had a negative effect on gopher populations in the Project area which may explain the absence of Marbled polecats.

**Wildcat-** The survey did not record or observe any signs of this species at the Project site or surrounding areas. Interviews with two local Shepard's indicated that the European Wildcat was potentially present at the Project site. The Shepard's were provided a mammalian identifier in which they identified the cat they saw as the European Wildcat. The survey has not ruled out the possibility of sporadic visits by the European Wildcat from neighbouring territories, where it is present in small numbers.

**Asia Minor Ground Squirrel-** This species of mammal included in the IUCN Red List (NT) and the Red Book of Armenia were recorded in two areas close to the Project site. Their minimal presence at the Project site is not excluded. The Asia Minor Ground Squirrel is primarily herbivorous but they may also eat small invertebrates. Their absence from the Project site during the surveying period may be due to flora present on the Project site which holds little ecological or nutritional value.

**Schidlovsky Vole-** There is virtually no data on the presence of this species in the study area. The supposed presence of this species is based on outdated data of the 1950s. During the surveying period, only the Common Vole was observed which is not considered a Red List or Red Book species.

The survey findings indicate that the most representative fauna group are representatives of predators and rodents.

In the Project area, predators are distributed less evenly when compared to their main habitats.

Small marten, weasel, and badger are mostly distributed at the Project site where small rocky outcrops and stony areas of shallow ravines are present.

Wolves and foxes are transient to the area, meaning they can occur throughout the Project site and surrounding areas. Rodents are also distributed unevenly across the Project site. They were mostly found on small, ploughed land plots or on abandoned land plots which had not been cultivated for a number of years. Literature indicates that Arctic Hares are common at the Project and surrounding areas, but the survey recorded low numbers.

**Herpetofauna (amphibians and reptiles)**

Observations of reptiles and amphibians were recorded throughout the area surrounding the Project and the immediate Project site. There were very low numbers of reptiles recorded during the surveying period despite the availability of suitable habitats. The table below lists the herpetofauna species that have been recorded in literature, as well as species actually observed in the project area during the surveying period.

Prior to surveying, literature indicated that 15 species of herpetofauna were potentially present at the Project site and surrounding areas. During the survey, there was no observation of any reptile species during route surveys and at the stationary points. The field survey found 9 species out of the 15 present in the study area. The literature review indicated that 13 reptiles were potentially present in the surveying area while 7 were identified during the surveys.



Jackal Observed During Surveying



Asia Minor Ground Squirrel

The Spotted Whip Snake was not mentioned in the reviewed literature, however, it was recorded during the field survey.

Two amphibian species were observed, the Marsh Frog was observed in the same hollow where the Spotted Whip Snake was observed. The European Green Toad was recorded twice at dusk and at night.

The survey did not observe any herpetofauna species included in the IUCN Red List or the Red Book of Armenia.

**Invertebrates**

The order of beetles (*Coleoptera*) and the suborder of butterflies (*Lepidoptera: Rhopalocera*) were selected as representative groups for land invertebrates during the surveying period.

The survey focussed on detecting species of special concern from other taxonomic groups (molluscs, other insect orders) listed in the Red Book of Armenia, Appendix 2 of the Bern Convention and the IUCN Red List of Threatened Species.



**Table 33 Amphibians and Reptiles Recorded within the Survey Area**

Family	English Name	Scientific Name	Literature <sup>1</sup>	Site <sup>2</sup>
<b>Reptilia</b>				
<i>Agamidae</i>	Caucasian agama	<i>Laudakia caucasia</i>	+	+
<i>Lacertidae</i>	Snake-eyed lizard	<i>Ophisops elegans</i>	+	+
	Darevskia nairensis	<i>Darevskia nairensis</i>	+	-
	Darevskia armeniaca	<i>Darevskia armeniaca</i>	+	-
	Oriental green lizard	<i>Lacerta media</i>	+	+
	Strauch's racerunner	<i>Eremias strauchi</i>	+	-
<i>Colubridae</i>	Collared dwarf racer	<i>Eirenis collaris</i>	+	-
	Dotted dwarf racer	<i>Eirenis punctatolineatus</i>	+	+
	Dahl's whip snake	<i>Platyceps najadum</i>	+	+
	Schmidt's whip snake	<i>Dolichophis schmidtii</i>	+	-
	Spotted whip snake	<i>Hemorrhois ravergieri</i>	-	+
	Coin-marked snake	<i>Hemorrhois nummifer</i>	+	-
<i>Colubridae</i>	Lebetine viper	<i>Macrovipera lebetinus</i>	+	+
<b>Amphibia</b>				
<i>Bufonidae</i>	European green toad	<i>Bufo viridis</i>	+	+
<i>Ranidae</i>	Marsh frog	<i>Pelophylax ridibundus</i>	+	+

1: Available Information from Sources, 2: Data Available from Surveys



A total of 150 species of beetles belonging to 21 families were recorded during the surveying period. There were 28 species of diurnal butterflies belonging to 4 families recorded at the Project site which is detailed in the table below.

In general, the insect fauna at the Project site can be described as characteristic of the stony semi-desert and dry mountain steppe zones of Armenia; there are unique extra-zonal elements, especially characteristic of humid habitats (4 species). It should also be noted that the observation of multiple dung beetles (12 species) in the area is consistent with the identified grazing.

No species of invertebrates listed in the Armenia Red Data Book were recorded in the area. Other range-restricted species or species of special concern endemic to Armenia, Transcaucasia and Caucasus ecoregion were not observed either.

### Birds

As can be seen from Table 35 below, there is a total of 85 bird species that can be potentially present at the Project site and surrounding areas according to literature. Out of the 85 species outlined in the literature, 54 species were recorded during field surveys. Out of the 54 birds that were recorded, 20 of these species are nesting in the area.

**Table 34 Species Composition of Beetles and Butterflies According to Families at the Project Site**

English Name	Scientific Name	Number of Species
<b>Beetles</b>		
Family Ground beetles	<i>Carabidae</i>	12
Family Mimic beetles	<i>Histeridae</i>	3
Family Water scavenger beetles	<i>Hydrophilidae</i>	3
Family Carrion beetles	<i>Silphidae</i>	2
Family Rove beetles	<i>Staphylinidae</i>	6
Family Scarabs	<i>Scarabaeidae</i>	16
Family Click beetles	<i>Elateridae</i>	6
Family Jewel beetles	<i>Buprestidae</i>	12
Family Soldier beetles	<i>Cantharidae</i>	3
Family Darkling beetles	<i>Tenebrionidae</i>	14
Family Blister beetles	<i>Meloidae</i>	9
Family Ant-like beetles	<i>Anthicidae</i>	2
Family Checkered beetles	<i>Cleridae</i>	2





English Name	Scientific Name	Number of Species
Family Wedge-shaped beetles	<i>Rhipiphoridae</i>	1
Family Sap beetles	<i>Nitidulidae</i>	4
English Name	Scientific Name	Number of Species
Family Ladybugs	<i>Coccinellidae</i>	6
Family Soft-winged flower beetles	<i>Melyridae</i>	3
Family Leaf beetles	<i>Chrysomelidae</i>	12
Family Longhorn beetles	<i>Cerambycidae</i>	6
Family Brentidae	<i>Pelophylax ridibundus</i>	10
Family Weevils	<i>Curculionidae</i>	18
<b>Total</b>		150
Butterflies		
Skippers	<i>Hesperiidae</i>	3
White butterflies	<i>Pieridae</i>	8
Brush-footed butterflies	<i>Nymphalidae</i>	9
Blues	<i>Lycaenidae</i>	8
<b>Total</b>		28



*Leptidea Sinapis*



*Trachyderma Setosa*

It should be noted that nest are present mostly in the canyons, in small ravines, where there are small rocky outcrops, placers of stones, small groups of bushes and low trees which are suitable nesting grounds. There are only few birds that can nest in open steppe areas, namely, wheatears and larks. The largest group of birds outlined in the table below are representatives of birds of prey.

There were 18 birds of prey species outlined as potentially present during literature reviews. During field surveys, 10 out of the 18 species were observed and recorded. Out of the 10 birds of prey species that were recorded, only one is a breeding species, namely, the common kestrel. Other species only use the Project site and surrounding area in search of food or transit during their movements, they do not nest or breed at the Project site.



**Table 35 Estimated and Actual Species Composition of Birds**

English Name	Scientific Name	IUCN	S1	S2	S3	Red Book Status
<b>Accipitridae</b>						
European Honey-buzzard	<i>Pernis apivorus</i>			Nbr	v	
Black Kite	<i>Milvus migrans</i>		YrBr	Nbr	v	
<b>Egyptian Vulture</b>	<b>Neophron percnopterus</b>	<b>EN</b>	<b>Bbr</b>	<b>Nbr</b>	<b>v</b>	<b>EN A2bcde+3bcde+4bcde</b>
<b>Griffon Vulture</b>	<b>Gyps fulvus</b>	<b>LC</b>	<b>YrBr</b>	<b>Nbr</b>		<b>VU D1</b>
<b>Short-toed Snake-eagle</b>	<b>Circaetus gallicus</b>	<b>LC</b>	<b>Bbr</b>	<b>Nbr</b>	<b>v</b>	<b>VU D1</b>
Hen Harrier	<i>Circus cyaneus</i>		W	W		
<b>Pallid Harrier</b>	<b>Circus macrourus</b>	<b>NT</b>	<b>Yrnbr</b>	<b>Nbr</b>		<b>EN B1ab(iii)+2ab(iii); D</b>
Eurasian Sparrowhawk	<i>Accipiter nisus</i>		YrBr	Nbr	v	
Eurasian Buzzard	<i>Buteo buteo</i>		YrBr	Nbr	v	
Long-legged Buzzard	<i>Buteo rufinus</i>		YrBr	Nbr	v	
<b>Lesser Spotted Eagle</b>	<b>Clanga pomarina</b>	<b>LC</b>	<b>Bbr</b>	<b>Nbr</b>	<b>v</b>	<b>VU D1</b>
<b>Steppe Eagle</b>	<b>Aquila nipalensis</b>	<b>LC</b>	<b>Yrnbr</b>	<b>Nbr</b>		<b>VU C2a(i); D1:</b>
<b>Falconidae</b>						
<b>Lesser Kestrel</b>	<b>Falco naumanni</b>	<b>LC</b>	<b>Bbr</b>	<b>Nbr</b>		<b>VU A2bce+3bce+4bce</b>
Common Kestrel	<i>Falco tinnunculus</i>		YrBr	Bbr	v	
<b>Red-footed Falcon</b>	<b>Falco vespertinus</b>	<b>NT</b>	<b>Bbr</b>	<b>Nbr</b>		<b>VU B1ab(iii)+2ab(iii); D1</b>
<b>Merlin</b>	<b>Falco columbarius</b>	<b>LC</b>	<b>W</b>	<b>W</b>		<b>DD</b>
Eurasian Hobby	<i>Falco subbuteo</i>		YrBr	Nbr	v	
<b>Saker Falcon</b>	<b>Falco cherrug</b>	<b>EN</b>	<b>YrBr</b>	<b>Nbr</b>		<b>EN A2bcd+3cd+4bcd</b>
<b>Phasianidae</b>						
Chukar	<i>Alectoris chukar</i>		YrBr	Bbr		
Grey Partridge	<i>Perdix perdix</i>		YrBr	Nbr	v	
Common Quail	<i>Coturnix coturnix</i>		Bbr	Bbr	v	
<b>Gruidae</b>						

English Name	Scientific Name	IUCN	S1	S2	S3	Red Book Status
Common Crane	<i>Grus grus</i>	LC	Bbr	M	v	VU B1ab(iii)+2ab(iii)
Demoiselle Crane	<i>Anthropoides virgo</i>	LC	M	M		EN D
<b>Charadriidae</b>						
Northern Lapwing	<i>Vanellus vanellus</i>		YrBr	Nbr	v	
<b>Scolopacidae</b>						
Common Snipe	<i>Gallinago gallinago</i>		Yrnbr	Nbr		
Common Sandpiper	<i>Actitis hypoleucos</i>		Bbr	Nbr	v	
<b>Laridae</b>						
Black-headed Gull	<i>Larus ridibundus</i>		YrBr	Nbr		
Armenian Gull	<i>Larus armenicus</i>	LC	YrBr	Nbr	v	VU B1ab(iii)+2ab(iii)
White-winged Tern	<i>Chlidonias leucopterus</i>		Bbr	Nbr		
<b>Laridae</b>						
Black-headed Gull	<i>Larus ridibundus</i>		YrBr	Nbr		
Armenian Gull	<i>Larus armenicus</i>	LC	YrBr	Nbr	v	VU B1ab(iii)+2ab(iii)
White-winged Tern	<i>Chlidonias leucopterus</i>		Bbr	Nbr		
<b>Columbidae</b>						
Rock Pigeon	<i>Columba livia</i>		YrBr	Nbr	v	
Stock Dove	<i>Columba oenas</i>		YrBr	Nbr	v	
Common Woodpigeon	<i>Columba palumbus</i>		YrBr	Nbr	v	
<b>Cuculidae</b>						
Common Cuckoo	<i>Cuculus canorus</i>		Bbr	Nbr	v	
<b>Strigidae</b>						
Little Owl	<i>Athene noctua</i>		YrBr	Bbr	v	
Northern Long-eared Owl	<i>Asio otus</i>		YrBr	Nbr		
<b>Apodidae</b>						
Common Swift	<i>Apus apus</i>		Bbr	Nbr	v	
<b>Meropidae</b>						
European Bee-eater	<i>Merops apiaster</i>		Bbr	Bbr	v	
<b>Coraciidae</b>						
European Roller	<i>Coracias garrulus</i>	NT	Bbr	Nbr	v	VU B1ab(iii)
<b>Upupidae</b>						
Eurasian Hoopoe	<i>Upupa epops</i>		Bbr	Bbr	v	
<b>Alaudidae</b>						





English Name	Scientific Name	IUCN	S1	S2	S3	Red Book Status
Calandra Lark	<i>Melanocorypha calandra</i>		Bbr	Nbr		
Bimaculated Lark	<i>Melanocorypha bimaculata</i>		Bbr	Nbr	v	
Lesser Short-toed Lark	<i>Calandrella rufescens</i>		Bbr	Bbr	v	
Crested Lark	<i>Galerida cristata</i>		YrBbr	Bbr	v	
<b>Hirundinidae</b>						
Eurasian Crag-martin	<i>Hirundo rupestris</i>		Bbr	Nbr		
Barn Swallow	<i>Hirundo rustica</i>		Bbr	Nbr	v	
Northern House-martin	<i>Delichon urbicum</i>		Bbr	Nbr		
<b>Motacillidae</b>						
Tawny Pipit	<i>Anthus campestris</i>		Bbr	Nbr		
Yellow Wagtail	<i>Motacilla flava</i>		Bbr	Nbr	v	
White Wagtail	<i>Motacilla alba</i>		YrBr	Bbr	v	
<b>Troglodytidae</b>						
Winter Wren	<i>Troglodytes troglodytes</i>		YrBr	Bbr	v	
<b>Muscicapidae</b>						
Rufous-tailed Scrub-robin	<i>Erythropygia galactotes</i>		Bbr	Nbr		
European Robin	<i>Erithacus rubecula</i>		YrBr	Nbr	v	
Bluethroat	<i>Luscinia svecica</i>		Bbr	Nbr		
<b>White-throated Robin</b>	<b><i>Irania gutturalis</i></b>	<b>LC</b>	<b>Bbr</b>	<b>Bbr</b>	<b>v</b>	<b>DD</b>
Black Redstart	<i>Phoenicurus ochruros</i>		YrBr	Bbr	v	
Whinchat	<i>Saxicola rubetra</i>		Bbr	Nbr	v	
Common Stonechat	<i>Saxicola torquatus</i>		Bbr	Nbr		
Northern Wheatear	<i>Oenanthe oenanthe</i>		Bbr	Bbr	v	
Isabelline Wheatear	<i>Oenanthe isabellina</i>		Bbr	Bbr	v	
Black-eared Wheatear	<i>Oenanthe hispanica</i>		Bbr	Bbr		
Finsch's Wheatear	<i>Oenanthe finschii</i>		Bbr	Nbr	v	
Rufous-tailed Rock-thrush	<i>Monticola saxatilis</i>		Bbr	Bbr		
<b>Turdidae</b>						
Eurasian Blackbird	<i>Turdus merula</i>		YrBr	Bbr	v	
<b>Sylviidae</b>						
Common Whitethroat	<i>Sylvia communis</i>		Bbr	Bbr	v	
<b>Reguliidae</b>						
Goldcrest	<i>Regulus regulus</i>		M	M		





English Name	Scientific Name	IUCN	S1	S2	S3	Red Book Status
<b>Muscicapidae</b>						
Spotted Flycatcher	<i>Muscicapa striata</i>		Bbr	Nbr	v	
<b>Paridae</b>						
Great Tit	<i>Parus major</i>		YrBr	Bbr		
<b>Sittidae</b>						
Western Rock-nuthatch	<i>Sitta neumayer</i>		YrBr	Bbr	v	
<b>Laniidae</b>						
Red-backed Shrike	<i>Lanius collurio</i>		Bbr	Bbr	v	
Lesser Grey Shrike	<i>Lanius minor</i>		Bbr	Bbr		
<b>Corvidae</b>						
Black-billed Magpie	<i>Pica pica</i>		YrBr	Bbr	v	
Eurasian Jackdaw	<i>Corvus monedula</i>		YrBr	Nbr	v	
Rook	<i>Corvus frugilegus</i>		YrBr	Nbr	v	
Hooded Crow	<i>Corvus corone</i>		YrBr	Nbr	v	
Common Raven	<i>Corvus corax</i>		YrBr	Nbr	v	
<b>Sturnidae</b>						
Common Starling	<i>Sturnus vulgaris</i>		YrBr	Nbr	v	
Rosy Starling	<i>Sturnus roseus</i>		Bbr	Nbr	v	
<b>Passeridae</b>						
House Sparrow	<i>Passer domesticus</i>		YrBr	Bbr		
Eurasian Tree Sparrow	<i>Passer montanus</i>		YrBr	Bbr	v	
<b>Fringillidae</b>						
Eurasian Chaffinch	<i>Fringilla coelebs</i>		YrBr	Nbr		
European Goldfinch	<i>Carduelis carduelis</i>		YrBr	Bbr		
Eurasian Linnet	<i>Carduelis cannabina</i>		YrBr	Bbr	v	
<b>Emberizidae</b>						
Yellowhammer	<i>Emberiza citrinella</i>		W	W		
Rock Bunting	<i>Emberiza cia</i>		YrBr	Bbr		
Corn Bunting	<i>Miliaria calandra</i>		YrBr	Bbr	v	

1- Status of Stay in Armenia, 2- Status of Residence in the Surveyed area, IUCN- Red List Category, K.K- Species Present in Red Book of Armenia, YrBr- Present on Site all Year Round, Breeding, YrNbr- Present on Site all Year Round, Non-Breeding, Bbr- Breeding Bird, Absent During Non-Breeding Season, Nbr- Non Breeding Bird, M- Migrant Bird, W- Wintering Bird

Members of the birds of prey family such as Egyptian Vulture (*Neophron percnopterus*), Short-toed Snake Eagle (*Circaetus gallicus*) and Lesser Spotted Eagle (*Clanga pomarina*) frequent the Project area in search of food. These bird species do not use the Project site for nesting or breeding activities. Considering the absence of large rodent populations at the Project site and their rare sightings during surveying, the Project site and surrounding area is not regarded as the main forage ground for these bird species. Therefore, after the installation of solar panels, these Raptors can continue to use neighbouring areas where the population number of rodents as a food source is significantly larger.

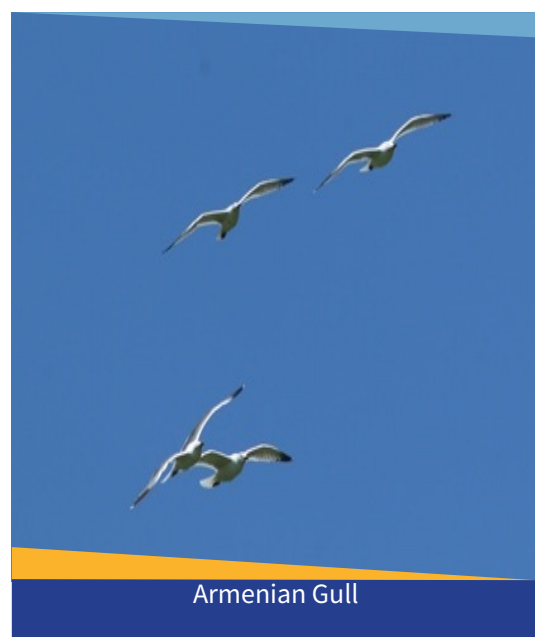
One of the seven species of bird observed and recorded are included in the IUCN Red List and in the Red Book of Armenia, the White Throated Robin (*Irania gutturalis*), is confirmed to be nesting close to the Project site. The areas favourable for nesting are ravines overgrown with a low shrubs which is outside the Project boundary. The White-Throated Robin can also be classified as breeding.

The remaining bird species such as Cranes, Gulls and Roller are classified as casual visitors to the Project site, they do not use the site for nesting or breeding purposes.

The seven identified bird species included in the IUCN Red List and in the Red Book of Armenia are outlined below:

- **Egyptian Vulture-** Recorded twice flying around the Project site in search of food.

- **Short-Toed Snake-Eagle-** Recorded flying around the Project site in search of food.
- **Lesser Spotted Eagle-** Recorded once flying around the Project site in search of food and recorded once eating food.
- **Common Crane-** A flock of 7 individuals was observed flying in late April during the migration period.
- **Armenian Gull-** This was recorded several times during flights over the Project site. This species was most likely traveling from one water body to another and did not use the Project site for any activities.
- **European Roller-** This species was observed in the early stages of surveying in May and early June.
- **White-Throated Robin-** This species was observed in two gullies periodically. It was first observed displaying mating behaviour, then occasionally carrying food.



Armenian Gull

## 7.3. Site Assessment

### 7.3.1. Ecological Status

The ecological systems of the Project site and surrounding areas mainly physical, biological and interactions that connect them are influenced both by biotic and abiotic factors.

Overall, the area has little ecological or nutritional value for fauna species because of intense anthropogenic activities leading to significant alteration of otherwise natural habitats. However, there are still areas that can support biodiversity and require management during the implementation of Project activities. The existing pockets of natural bushlands and vegetation mainly within the Project area have the potential to support different species of flora and fauna.

Key drivers of habitat transformation are mainly attributed to livestock grazing and clearing activities from USSR times. Generally, because of human activities, the area has been significantly altered as a result of former cultivation and current overgrazing.

The general landscape does not seem to have changed rapidly in recent years given the terrain and that rock piles and USSR activities are still visible and have not been moved. No flora of conservation concern was recorded in the area during the surveying period.

Most fauna species encountered within the Project area are common, widespread species, and include mainly generalist fauna species that are capable of tolerating disturbed habitats. The identified listed fauna species use the site mostly for foraging.

### 7.3.2. Critical Habitat Assessment



IFC Performance Standard 6 defines Critical Habitat as any habitat with high biodiversity conservation significance based on the existence of Critically Endangered (CR) or Endangered (EN) species, restricted range or endemic species, globally significant concentration of congregatory species or unique ecosystems with evolutionary processes. A sensitive habitat refers to habitats that are negatively affected either by natural or anthropogenic disturbances.

EBRD PR6 recognises that the conservation of biodiversity and sustainable management of living natural resources are fundamental to environmental and social sustainability. This PR recognises the importance of maintaining the core ecological function of habitats, biodiversity and ecosystem services. All ecosystems support a complexity of living organisms and vary in terms of richness, abundance and importance of species. The key objectives of PR6 are to protect and conserve biodiversity using a precautionary approach, adopt the mitigation hierarchy in the design and implementation of projects with the aim of achieving no net loss, and where appropriate, a net gain of biodiversity, maintain ecosystem services; and promote good international practice in the sustainable management and use of living natural resources.

A critical habitat assessment is presented below for flora and terrestrial fauna. The purpose of a critical habitat assessment is to determine if any features in the study area qualify as priority biodiversity features or critical habitat,

following EBRD’s definitions. These features will require attention in impact assessment and mitigation planning. This is an assessment of the context in which the development is proposed and therefore does not consider specific impacts at this stage of analysis. The CHA establishes how important the study area is for conservation and determines what PR6 requirements will apply.

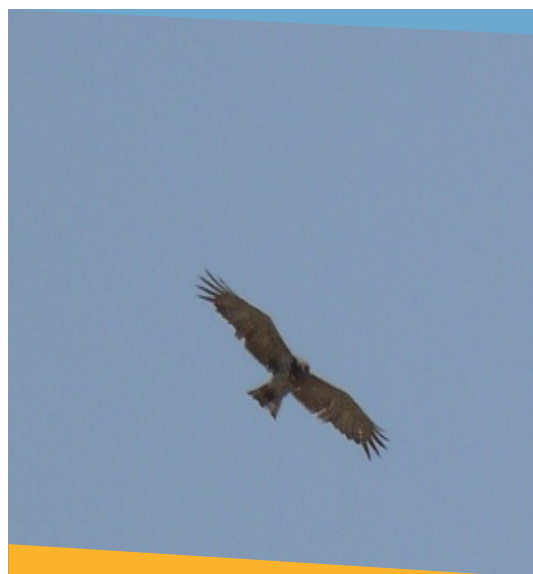
The first stage of the CHA is to undertake a screening exercise where the species of conservation concern that have been recorded within the Project AOI or those considered to be potentially present are rapidly assessed against the thresholds for determination of CH.

CHA screening has been undertaken for all species considered present or potentially present within the Project AOI that are of global conservation concern; Critically Endangered, Endangered and Vulnerable. Species with a global conservation status of Near Threatened or below have been excluded from the CHA screening unless they have a significant national or regional conservation status.

The species for which the screening exercise has been completed as well as the results of the screening are shown in the table below. Those species which are considered, at the screening stage, to potentially meet the CH thresholds or are of high international conservation concern are discussed later in this section.



White Throated Robin



Short-Toed Snake Eagle



Table 36 CHA Screening



Common Name	IUCN Status	National Status	Status	Status PS / PR 6 Criterion				
				1 / ii	2 / iii	3 / iv	4 / i	5 / v
Egyptian Vulture	EN	EN A2bcde+3 bcde+4bc de	Recorded twice in the air flying around the area in search of food	<p>Global population of 18,60054,000, meaning 93-270 individuals required to meet criteria.</p> <p>Currently 52-56 pairs in country and maximum of 2 pairs in the Arax River KBA.</p> <p>Recorded twice flying over the AOI during the surveys and not recorded breeding in Project AOI.</p> <p>Criteria 1 is not triggered – no further assessment required.</p>	<p>Global population resulting in a large Extent of Occurrence (EOO) so not range restricted.</p> <p>Criteria 2 is not triggered - no further assessment required.</p>	<p>Global population of 12,400-36,000 mature individuals meaning between minimum of 62 pairs required to meet congregatory criteria (with respect to colonial breeding), and between 186 and 540 individuals to meet congregatory criteria (with respect to migration).</p> <p>Recorded twice flying over the AOI during the surveys and not recorded breeding in Project AOI.</p> <p>The species is also not recorded in significant migratory numbers.</p> <p>Criterion 3 is not triggered – no further assessment required.</p>	-	-
Pallid Harrier	NT	EN B1ab(iii)+ 2ab(iii); D	Recorded once sitting on the ground and eating food and several times in the air looking for food	<p>Global population of 18,000-30,000 mature individuals, meaning minimum of 90-150 individuals required to meet criteria.</p> <p>Does not nest in Armenia but is widespread on passage.</p> <p>Recorded several times foraging over the AOI during the surveys.</p> <p>Criteria 1 is not triggered – no further assessment required.</p>	<p>Global population resulting in a large EOO so not range restricted.</p> <p>Criteria 2 is not triggered – no further assessment required.</p>	<p>Global population of 18,000-30,000 mature individuals meaning minimum of 180 individuals to meet congregatory criteria (with respect to migration).</p> <p>Recorded several times foraging over the AOI during the surveys.</p> <p>The species is also not recorded in significant migratory numbers.</p> <p>Criterion 3 is not triggered – no further assessment required.</p>	-	-



Common Name	IUCN Status	National Status	Status	Status PS / PR 6 Criterion				
				1 / ii	2 / iii	3 / iv	4 / i	5 / v
European Roller	NT	VU B1ab(iii)	Was observed in the early stages of studies, in May and early June.  Afterwards it was not recorded.	Global population of 100,000-499,999 mature individuals, meaning minimum of 500-2,499 individuals required to meet criteria.  Currently 300 - 650 pairs in country and is widespread on passage.  Recorded in the AOI during the early surveys but not later, indicating species does not nest in the AOI.  Criteria 1 is not triggered – no further assessment required.	Global population resulting in a large EOO so not range restricted.  Criteria 2 is not triggered – no further assessment required.	Global population of 100,000-499,999 mature individuals meaning between 1,000 and 4,999 individuals to meet congregatory criteria (with respect to migration).  Recorded on passage through the AOI during the surveys.  The species is also not recorded in significant migratory numbers.  Criterion 3 is not triggered – no further assessment required.	-	-
Saker Falcon	EN	EN A2bcd+3cd+4bcd	Not observed during the surveys but possible to occur over the Project Site	Global population of 12,200-29,800 mature individuals, meaning minimum of 61-149 individuals required to meet criteria.  Resident and passage migrant in Armenia but very rare nesting species.  Not recorded during the surveys and very unlikely to nest in the AOI.  Criteria 1 is not triggered – no further assessment required.	Global population resulting in a large EOO so not range restricted.  Criteria 2 is not triggered – no further assessment required.	Global population of 12,200-29,800 mature individuals meaning between 122 and 298 individuals to meet congregatory criteria (with respect to migration).  Not recorded during the surveys but potential for low numbers (individuals) to pass over on migration.  Criterion 3 is not triggered – no further assessment required.		



Common Name	IUCN Status	National Status	Status	Status PS / PR 6 Criterion				
				1 / ii	2 / iii	3 / iv	4 / i	5 / v
Demoiselle Crane	LC	EN D	Not observed during the surveys but possible movements over site	<p>Global population of 230,000-261,000 individuals, meaning 1,150-1,305 individuals required to meet criteria.</p> <p>Passage migrant in Armenia.</p> <p>Not recorded during the surveys and unlikely to use the AOI.</p> <p>Criteria 1 is not triggered – no further assessment required.</p>	<p>Global population resulting in a large EOO so not range restricted.</p> <p>Criteria 2 is not triggered – no further assessment required.</p>	<p>Global population of 230,000-261,000 individuals meaning between 2,300 and 2,610 individuals to meet congregatory criteria (with respect to migration).</p> <p>Not recorded during the surveys but potential for low numbers to pass over on migration.</p> <p>Criterion 3 is not triggered – no further assessment required.</p>		
Sociable Lapwing	CR	Unknown	Not recorded but possible movements over site	<p>Global population of 16,000-17,000 individuals, meaning 80-85 individuals required to meet criteria.</p> <p>Passage migrant in Armenia. Singular individuals are recorded in the Arax River area and the mountain grasslands of the Geghama Ridge.</p> <p>Not recorded during the surveys and unlikely to use the AOI.</p> <p>Criteria 1 is not triggered – no further assessment required.</p>	<p>Global population resulting in a large EOO so not range restricted.</p> <p>Criteria 2 is not triggered – no further assessment required.</p>	<p>Global population of 16,000-17,000 individuals meaning between 160 and 170 individuals to meet congregatory criteria (with respect to migration).</p> <p>Not recorded during the surveys but potential for low numbers to pass over on migration.</p> <p>Criterion 3 is not triggered – no further assessment required.</p>		



Common Name	IUCN Status	National Status	Status	Status PS / PR 6 Criterion				
				1 / ii	2 / iii	3 / iv	4 / i	5 / v
White-headed Duck	EN	Unknown	Possible use of airspace to fly over the site	<p>Global population of 7,900-13,100 individuals, meaning 39-65 individuals required to meet criteria.</p> <p>Resident breeding species and passage migrant in Armenia. Project AOI does not support habitat suitable for this species however transit over AOI is possible.</p> <p>Not recorded on any surveys and considered that any transitory movements highly unlikely to be of significant numbers.</p> <p>Criteria 1 is not triggered – no further assessment required.</p>	<p>Global population resulting in a large EOO so not range restricted.</p> <p>Criteria 2 is not triggered – no further assessment required.</p>	<p>Global population of 7,900-13,100 individuals meaning between 79 and 131 individuals to meet congregatory criteria (with respect to migration).</p> <p>Project AOI does not support habitat suitable for this species however transit through AOI is possible. Not recorded on any surveys and considered that any transitory movements highly unlikely to be of significant numbers.</p> <p>Criteria 3 is not triggered – no further assessment required.</p>		





Common Name	IUCN Status	National Status	Status	Status PS / PR 6 Criterion				
				1 / ii	2 / iii	3 / iv	4 / i	5 / v
Little Bunting	NT	Unknown	Not recorded on surveys however possible use of airspace to fly over the site	<p>Global population of 100,000,499,999 individuals, meaning 5002,499 individuals required to meet criteria.</p> <p>Passage migrant in Armenia.</p> <p>Not recorded during the surveys and unlikely to use the AOI.</p> <p>Considered that any transitory movements highly unlikely to be of significant numbers.</p> <p>Criteria 1 is not triggered – no further assessment required.</p>	<p>Global population resulting in a large EOO so not range restricted.</p> <p>Criteria 2 is not triggered – no further assessment required.</p>	<p>Global population of 100,000,499,999 individuals meaning between 1,000 and 4,999 individuals to meet congregatory criteria (with respect to migration).</p> <p>Project AOI does not support habitat suitable for this species however transit through AOI is possible. Not recorded on any surveys and considered that any transitory movements highly unlikely to be of significant numbers.</p> <p>Criterion 3 is not triggered – no further assessment required.</p>		
Great Bunting	VU	Unknown	Not recorded on Project Site however possible use of airspace to fly over the site (Arax River KBA)	<p>Global population of 44,000-57,000 individuals, meaning 220-285 individuals required to meet criteria.</p> <p>Passage migrant in Armenia, limited to just few individuals.</p> <p>Not recorded during the surveys and unlikely to use the AOI.</p> <p>Considered that any transitory movements highly unlikely to be of significant numbers.</p> <p>Criteria 1 is not triggered – no further assessment required.</p>	<p>Global population resulting in a large EOO so not range restricted.</p> <p>Criteria 2 is not triggered – no further assessment required.</p>	<p>Global population of 44,000-57,000 individuals meaning between 440 and 570 individuals to meet congregatory criteria (with respect to migration).</p> <p>Project AOI does not support habitat suitable for this species however transit through AOI is possible. Not recorded on any surveys and considered that any transitory movements highly unlikely to be of significant numbers.</p> <p>Criterion 3 is not triggered – no further assessment required.</p>		



Common Name	IUCN Status	National Status	Status	Status PS / PR 6 Criterion				
				1 / ii	2 / iii	3 / iv	4 / i	5 / v
Asia Minor Ground Squirrel	VU	VU A2c+B1 b(iii)	They are noted in two areas closely adjacent to the study area.	<p>Global population size has not been quantified.</p> <p>Whilst no individuals were recorded on site their rarity in the area and that the site may be suitable for species mean that there is potential for low numbers on the site. In absence of any recorded presence, and possible presence only in low numbers, criteria not met however species is VU (globally and in country) and is included as PBF and monitoring required.</p>	<p>Global population resulting in a large EOO so not range restricted.</p> <p>Criteria 2 is not triggered – no further assessment required.</p>	-	-	-
Common Tortoise	VU	Unknown	Not recorded on the Project Site however use of the site or adjacent habitats possible (Arax River KBA)	<p>Global population size has not been quantified.</p> <p>Site may be suitable for species.</p> <p>Potential to be present on the site. In absence of any data, criteria not met however species is VU (globally) and is included as PBF and monitoring required.</p>	<p>Global population resulting in a large EOO so not range restricted.</p> <p>Criteria 2 is not triggered – no further assessment required.</p>	-	-	-



Common Name	IUCN Status	National Status	Status	Status PS / PR 6 Criterion				
				1 / ii	2 / iii	3 / iv	4 / i	5 / v
Schid-lovsky Vole	LC	EN B1ab (ii, iii, v)	There is virtually no data on the presence of this species in the study area. The supposed presence of this species is based on rather out-dated data of the 50s.	Global population size has not been quantified.  Site has historic records but in its current form is not suitable for the species and is very unlikely to occur. In absence of any data, criteria not met however species is EN (in country) and is included as PBF and monitoring required.	The estimated EOO is 10,518 km <sup>2</sup> .  However, this species occurs in northeast to central Armenia, extending north into extreme south central Georgia and west into Turkey. It is separated in altitude from <i>Microtus socialis</i> and is found at higher elevations (above 1,400 m). The potential for the presence of the species is explored based on the historic records only, with local experts noting it is not likely to be present. Due to no presence confirmed during field surveys, the habitat being degraded and considered unsuitable for the species and the current known range, this species is considered not to occur on or in the vicinity of the Project AOI.	-	-	-

Based on the results of the CH Screening Exercise it has been determined that none of the species meets the thresholds for triggering Critical Habitat under the five CH criteria defined in IFC PS 6 GN and the six defined in EBRD PR 6 GN. However, a number of PBFs have been identified and these are discussed further in this section. The ESIA & BMP will adopt precautionary measures for those species studied during the CHA. This will include implementing impact avoidance measures for birds such as bird deflectors at transmission lines.

### 7.3.3. Priority Biodiversity Features

All species/habitats within the background data search and recorded on site, or those considered to be potentially present, have been assessed against the PBF guidelines, which provide a qualitative approach to the assessment. All criteria were considered for each species/habitat.

Species meeting the criteria for inclusion as Priority Biodiversity Features are presented in the table below and discussed in subsequent sections.

#### 7.3.3.1 Criterion 1: Threatened Habitat

No habitat types or ecosystems were present or identified as being potentially present, that would be considered as priority habitats as such Criterion 1: Threatened Habitat has not been triggered.

#### 7.3.3.2 Criterion 2: Vulnerable Species

**Plant Species:** No plant species were recorded which would be considered as Priority Biodiversity Features under PBF Criterion 2.

**Bird Species:** Sociable Lapwing is listed as IUCN Critically Endangered and Egyptian Vulture, Saker Falcon and White-headed Duck are listed as Endangered and Great Bustard is listed as IUCN Vulnerable. Whilst none of these species meet the thresholds for triggering Critical Habitat, they are all considered to be PBFs.

Additional bird species that are IUCN Near Threatened and Least Concern but are listed as ARDB Endangered that are considered to qualify as PBF under Criterion 2 are Pallid Harrier and Demoiselle Crane.

**Mammal Species:** Asia Minor Ground Squirrel is listed as IUCN Vulnerable and is present on habitats adjacent to the AOI and may be present on site. Schidlovsky Vole is listed as IUCN Least Concern but is listed as ARDB Endangered, although the supposed presence of this species is based on rather outdated data of the 50s and it is very unlikely to occur in the AOI. However, both are considered as Priority Biodiversity Features under PBF Criterion 2.

**Reptile Species:** Common Tortoise was the only IUCN Vulnerable species that is are considered to be possibly present in the area, based on it being in a nearby KBA, and is identified as being PBFs.

#### 7.3.3.3 Criterion 3: Significant feature as identified by stakeholders or governments

The Project AOI does not fall within any significant biodiversity features, nor is it within close proximity to nationally protected or internationally designated sites.



### 7.3.3.4 Criterion 4: Ecological structure and functions that are vital to maintaining the viability of priority biodiversity features

The Project Site does not contain areas of structure or function (e.g., major dispersal or migration corridors) vital for the maintenance of viable populations of Priority Biodiversity Features and as such Criterion 4 has not been triggered.

## 7.4. Impacts

The Project is not expected to have any direct impact on protected areas.

Direct impacts from the Project are likely to be limited to habitat loss within the PV site, although this is loss of modified and degraded habitat, as well as possible direct impacts on mammal and reptile species during the construction phase of the project.

Operational impacts of the project are limited to potential direct impacts on resident and

migratory species of birds through the collision with the OHL. However, the project's OHL required is limited (to less than 300 m) and will connect with an existing transmission line that crosses the site. Although this addition poses an extremely low increase of risk of collision, it should be mitigated for. The new, short, section of OHL route will therefore require bird deflectors to be installed and operational monitoring will need to be completed for bird carcasses along the route of the OHL.



Where possible enhancement of the area should be undertaken with addition of deflectors on the existing line where monitoring of the existing line in the vicinity of the Project shows impacts of collision.

All mitigation and monitoring will need to be included in a Biodiversity Management Plan which will also need to include a Adaptive Management Strategy should the results of monitoring indicate an impact on species of global conservation concern.

**Table 37 Species Considered to be Priority Biodiversity Features**

Species	Status (IUCN / ARBD)	Criterion
Egyptian Vulture	EN / EN	Criterion 2
Pallid Harrier	NT / EN	Criterion 2
Saker Falcon	EN / EN	Criterion 2
Demoiselle Crane	LC / EN	Criterion 2
Sociable Lapwing	CR / N/A	Criterion 2
White-headed Duck	CR / N/A	Criterion 2
Great Bustard	VU / N/A	Criterion 2
Asian Minor Ground Squirrel	VU / VU	Criterion 2
Schidlovsky Vole	LC / EN	Criterion 2
Common Tortoise	VU / N/A	Criterion 2



For the bird, mammal and reptile species that qualify as PBFs, the Project will need to achieve at least no net loss for PBFs over the lifespan of the scheme and measures, to achieve this will be set out in the Biodiversity Management Plan.

### 7.4.1. Construction Phase

The main impacts to biodiversity during the construction phase of the Project are caused by site preparation activities, which include the removal of vegetation for installation of solar panels, internal access roads, laydown areas and site facilities. This will include the grading and levelling of a limited number of areas to (internal roads, foundations), which will result in the loss of local flora and potentially the displacement of fauna. The features and habitat under the panels will be respected, only the direct footprint will have a direct impact on land. In addition, vehicles will minimise off-roading.

### 7.4.2. Operational Phase

The main potential impact to terrestrial ecology during the operational phase includes the permanent physical habitat and vegetation loss caused by Project structures (e.g. roads, foundations) during construction. In other areas, re-vegetation will occur naturally and result in a positive impact, since there will be no grazing onsite. The very limited length of the OHTL does not pose a significant risk of electrocution or collisions, and residual risks can be easily mitigated. The Project's operation is not expected to cause significant impacts to biodiversity.

### 7.4.3. Decommissioning Phase

The site has the potential for restoration once decommissioned seeing as the site will be cleared of any bedrock and obstructions present before the construction phase. If the land was restored correctly, it would enable recolonization of natural vegetation and may enable local communities to eventually allow local communities to use the land in agricultural farming. If the site is not adequately restored after decommissioning, the soil and drainage patterns can cause soil loss, that will in turn prevent the recolonization by natural vegetation.



## 7.5. Biodiversity Management

### 7.5.1. Biodiversity Management Plan (BMP)

All PBF species will need to be included in the Biodiversity Management Plan (BMP). The BMP will fully detail all relevant construction mitigation measures (Construction BMP) and habitat restoration and operation mitigation and enhancement measures (Operation BMP) which will be completed during and after the construction period to achieve the objectives of No Net Loss for PBFs. Preclearance surveys will be undertaken, and include but not be limited to the Asian Minor Ground Squirrel, Schidlovsky Vole and Common Tortoise. Measure will include, but not be limited to, the movement of individual reptiles and translocation of small mammals away from works areas during construction allowing them to remain in the area as the condition of habitats increase with fenced off areas being ungrazed and providing higher quality habitat.

## 7.5.2. Impact Assessment Summary

Table 38 Biodiversity - Impact Assessment- Construction Phase



Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>Habitat Destruction</b>	Medium	Certain	Local Habitat	Low	Minor
<b>Loss of local flora and fauna (including PBFs)</b>	Medium	Possible	Flora and Fauna	Medium	Medium
<b>Loss of site vegetation</b>	Low	Certain	Site Vegetation	Low	Minor
<b>Nest destruction or disturbance</b>	High	Low	Avifauna	Medium	Moderate

Table 39 Terrestrial Ecology- Impact Assessment-Operational Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>Loss of local flora and fauna</b>	Moderate	Very Low	Flora and Fauna	Medium	Minor
<b>Bird Collision</b>	High	Very Low	Avifauna	Medium	Moderate

Decommissioning phase impacts are similar to construction impacts but with a lower magnitude and duration.

### 7.5.3. Management Measures

Table 40 Biodiversity- Management Measures- Construction Phase



Impact / Risk	Management Measure
<b>Habitat Destruction</b>	Implement a Biodiversity Management Plan (BMP) including a precautionary method of working in relation to all biodiversity aspects, with special focus on PBFs. The management measures described below will be included in the BMP of the ESMS.
	Avoid any destruction to habitats other than those under the direct project footprint. Laydown areas and roads will be clearly demarcated to avoid unnecessary or accidental encroachment on natural habitats.
	Avoid dumping excavated soils on natural vegetation.
	Minimise damage to vegetation and habitats to allow flora re-growth and species to re-inhabit the area. Vehicle movements will be minimised and limited to designated construction roads.
	Habitat restoration activities should be undertaken using indigenous plant species only.
	Conserve topsoils and use for restoration to facilitate re-vegetation.
	Ensure proper waste disposal avoiding natural habitats (please refer to the waste chapter for all relevant measures).
<b>Loss of local flora &amp; site vegetation</b>	Avoid damage to vegetation for purposes other than planned Project activities.
	Soil conservation strategies should be adopted in the area to control top soil erosion. Soil erosion management measures will be included in the Construction Environmental Management Plan.
	Internal tracks will be constructed as soon as possible and the use of vehicles on site will be avoided without these roads, so that adjacent vegetation and soil is left undisturbed and uncompacted as far as possible.



Impact / Risk	Management Measure
<b>Introduction of Alien Species</b>	Clean construction vehicles before they access the site and eliminate all soil residue from other sites.
	Maintain all related equipment to avoid introduction of invasive species.
	Eliminate any invasive species identified in construction areas.
<b>Fauna Disturbance</b>	Undertake a pre-construction surveys and translocate fauna species, with specific focus on PBFs.
	Clear trees and shrubs within the direct project footprint (if any) before the nesting season if possible. Check for nests before construction starts in an area and avoid or relocate all identified nests.
	Ensure that there is no vegetation clearance within the canyons, as these are not within the Project footprint.
	Train on-site employees to be aware of nests, avoid any displacement without an expert opinion on the status of the nests.
	Monitor identified nests to verify whether they are active. Monitoring will only be done by trained E&S officers to avoid disturbance.
	The use of flood lights shall be avoided or limited especially in areas perceived to be used by the animals frequently.
	Control access to sites not required for construction to reduce disturbance from vehicles and workforce.
	Daily times for starting and ending of operation of machines and vehicle should be restricted to between 6 am to 6 pm daily.
	Conduct construction activity sequentially with access to other areas of the site controlled to reduce disturbance.
	Minimise noise in accordance with the Project standards, as per the noise chapter.
	Implement all necessary dust suppression measures, described in the air quality chapter, to avoid further impacts on biodiversity features.
	Use only designated roads for on-site traffic and respect speed limits, as described in the community H&S traffic.



Impact / Risk	Management Measure
<b>Fauna Mortality</b>	Ban hunting, poaching, or other activities involving biodiversity features.
	Raise awareness to conserve species on-site and in the area.
	Limit on-site vehicle speed to avoid potential road kill.
	Undertake driver awareness training on the species present in the area that may be run over by vehicles.
	Implement a logging system requiring construction workers and drivers to report any sightings or collisions of fauna species and near misses, to allow additional mitigation to be identified and implemented as necessary (e.g. use of speed bumps near areas identified as high risk, fencing, etc).
	Check construction areas each morning to check for reptiles which may have entered operation areas, trenches, etc. overnight.
<b>Avifauna</b>	Implement a BMP including a precautionary method of working in relation to avifauna species. The management measures described below will be included in the BMP in the ESMS.
	Upright Insulators on transmission poles should be covered with plastic insulating caps or tubing to prevent electrocution risks
	If a nesting protected species is identified at the Project site identified, it must not be disturbed until nesting has completed.
	Check surveys for nesting birds should be undertaken prior to clearance of any vegetation. If active nests are recorded, whenever possible, clearance of the vegetation should be delayed until nesting has completed (i.e. chicks have fledged).
	Install bird deflectors on the project OHTL (300m) to minimise collision risks during operations. Engage the grid operator to explore the possibility to retrofit bird deflectors on the existing OHTL to the existing substation.





**Table 41 Biodiversity - Management Measures- Operational Phase**

Impact / Risk	Management Measure
<b>Fauna Disturbance</b>	Implement an BMP including a precautionary method of working in relation to biodiversity. The management measures described below will be included in the BMP in the ESMS.
	During operations, the Project personnel will keep to official Project access roads and tracks within the Project site.
	Implement site speed restrictions which all vehicle drivers must adhere to.
	Raise awareness to conserve species on-site and in the area.
<b>Introduction of Alien Species</b>	Identify and remove any invasive species identified onsite.
	In case of invasion by invasive plant species during operation phase of the project, strategies for controlling the invasive should be devised, such as uprooting the plants, for controlling them.
<b>Avifauna Collision &amp; Electrocutation</b>	Maintain OHTL bird divertors in the 300m of Project OHTL.

The management measures listed for the construction phase will be applied during decommissioning, as relevant.

### 7.5.4. Residual Impacts

**Table 42 Biodiversity - Residual Impacts- Construction Phase**

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
<b>Habitat Destruction</b>	Moderate	Yes	Minor



Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
<b>Loss of local flora &amp; site vegetation</b>	Moderate	Yes	Minor
<b>Fauna Disturbance</b>	Minor	Yes	Minor
<b>Fauna Mortality</b>	Minor	Yes	Minor
<b>Introduction of Alien Species</b>	Minor	Yes	Negligible
<b>Nest destruction or disturbance</b>	Moderate	Yes	Negligible

**Table 43 Biodiversity - Residual Impacts- Operational Phase**

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
<b>Fauna Disturbance</b>	Minor	Yes	Negligible
<b>Introduction of Alien Species</b>	Minor	Yes	Negligible
<b>Avifauna Collision &amp; Electrocutation</b>	Moderate	Yes	Negligible

### 7.5.5. Monitoring Measures

Table 44 Biodiversity- Monitoring Measures- Construction Phase



Impact / Risk	Monitoring Measure
<b>Habitat Destruction</b>	Monitoring of direct loss of habitat and species. Pictures shall be taken during specific and marked vantage points during construction and operations to monitor impacts on vegetation and regrowth.
<b>Fauna Disturbance</b>	Visual inspection of construction activity and noise resulting in disturbance to fauna species.
	Monitoring of nests onsite and in the immediate vicinity of the Project.
	Visual inspection on a daily basis of wildlife's presence to the Project site.
	Visual inspection of dust emission from construction activities.
<b>Loss of local fauna</b>	Visual inspection on a daily basis of vehicle movements and construction activity resulting in direct mortality of species.
<b>Invasive Alien Species</b>	Visual inspection on a daily basis of construction vehicles, equipment and materials movement into the Project area that may introduce invasive species to the Project area and surrounds. Visual inspection of construction areas to identify and manage invasive species.
<b>Nest destruction or disturbance</b>	The Presence of birds and nests will be monitored as part of the BMP implementation.

Table 45 Biodiversity – Monitoring Measures– Operational Phase



Impact / Risk	Management Measure
<b>Loss of local fauna</b>	Monitoring of direct loss of habitat and species.
	Visual inspection on a daily basis of vehicle movements and operation activity resulting in direct mortality of species.
<b>Invasive Alien Species</b>	Visual inspection of the Project site to identify invasive species.
<b>Avifauna Collision &amp; Electrocutation</b>	Regular monitoring measures should be implemented which checks for carcasses close to OHTL. It is not expected that there will be a mortality rate as a result of collision and subsequent electrocution. Nevertheless, it is important that this monitoring measure is carried out to ensure effective mitigation strategies are utilised if needed.
	Regular checking of the holes in energized areas to avoid nesting by any birds.



## 8 Noise

Acoustic disturbance is defined as the occurrence of noise or vibrations in the environment that turns into discomfort, pain or risks for population and their activities or causes significant effects on the natural environment, regardless of the source of the disturbance.

PV Projects generate noise mainly during construction and decommissioning. The noise level generated during the operational phase is generally low and do not negatively impact off site receptors. Construction noises are typically intermittent and limited to daytime working hours.

### 8.1. Baseline

The Project site is located in a generally quiet rural setting with the nearest settlement 0.5km away from the Project site. Motor vehicles and railways can be a source of noise and vibrations in the presented area. Typical noises during the day in nearby communities include cars, radios, cattle, dogs, tractors, or other animals. During site walkovers, noise pollution was minimal with little to no noise recorded on site.



Industrial activities were not observed in any of the 4 communities during site visits, with the exclusion of a batching plant and other small PV Plants. There are some commercial establishments in the local communities consisting of a petrol station, cafés, car repair shop, hardware shop, supermarket. The baseline survey results indicated that noise will be relatively homogeneous throughout the Project area.

Given the area that the site is located on, it is not expected to cause a significant level of noise pollution for residents in the affected communities. In relation to noise standards the project will adopt for its duration, when national and international standards differ, the most stringent is applied. In this case, the Project will adopt the WB/IFC Noise standards as they are the most stringent.



## 8.2. Noise Standards

### 8.2.1. WB/IFC Noise Standards

The World Bank/IFC Guidelines establish that noise impacts should not exceed the levels presented in the table below, or if the thresholds are already exceeded by the existing baseline, the Project should not result in an increase in background levels of more than 3 dB at sensitive receptors.

**Table 46 IFC Noise Standards**

Type of Receptor	Noise Thresholds	
	$L_{eq}$	$L_{eq}$
Residential, institutional, educational	55	45
Industrial, commercial	70	70



Example of Inverter



Example of Transformer

### 8.2.2. Armenian Noise Standards – All Noise Sources

Armenian regulations establish the thresholds for receptors outlined in the table below.



**Table 47 Noise Limits Established by Armenian Regulations**

Type of receptor	Time (Hours)	Maximum Permissible Noise Level	
		dBa <sub>LEQ</sub>	dBa <sub>MAX</sub>
Close territories of apartment buildings, polyclinics, dispensaries, rest homes, boarding houses, home for senior or disabled citizens, preschools, schools, other educational institutions and libraries	06:00-22:00	55	70
	22:00-06:00	45	60

### 8.2.3. Sensitive Receptors

Sensitive receptors within a 2km radius from the Project site have been identified through desk studies, secondary information and feedback from the consulted stakeholders.

There have been three communities identified within a 2km radius of the Project site. Ashnak community is 0.5km away from the Project site, Dashtadem is 1.25km away from the Project Site and Talin is 1.4km away from the site. Despite its

distance from the Project site, The Monastery of St Kristapor (1.31km away) is considered to be the most sensitive receptor in the area due to its cultural and touristic importance at a national scale. Dashtadem Fortress which is over 2km away from the Project site is also another sensitive site of cultural importance and should be considered in the early stages of baseline investigations.

## 8.3. Sensitive Receptors

**Table 48 Noise- Sensitive Receptors**

Receptor	Sensitivity	Justification
Residential / touristic Receptors	High	Residential and cultural / touristic receptors are highly sensitive to noise impacts.
Commercial Receptors	Medium	Commercial receptors and public buildings are less sensitive to noise impacts, particularly as they are not used during nighttime.

## 8.4. Impact Identification

### 8.4.1. Construction

The construction phase of the Project will generate noise from construction activities, heavy machinery etc. The Project site is located in a rural area within 2km of three communities and areas of cultural heritage. The location and topography of the project site is expected to reduce the level of noise impacts.

Construction activities and traffic will create some intermittent noise. Construction activities will only be carried out during the day, to avoid disturbance to nearby houses during resting hours, and all equipment will be regularly inspected to minimise noise emissions. The potential for significant noise impact to arise from construction vehicles and access road construction activities have the potential to impact sensitive receptors but given the

preliminary locations of the access road and mitigation measures, this is not expected to impact nearby sensitive receptors, as all are located further than 500m from the site boundary.

The magnitude of the noise to be generated at source (work site) depends on the number and type of equipment and machinery used, which will be reduced by the distance as it propagates towards noise sensitive receptors. Ground attenuation, air absorption and barrier effects would be factors reducing noise propagation.

An estimate of the number and type of equipment and machines that will be used as part of the Project and their sound power levels are listed below.



**Table 49 List of Construction Machinery/ Equipment**

Machine	Estimate numbers	Lw (dB)
Bulldozers	2	85
Excavators	3	101
Road Graders	2	101
Road Roller	1	85
JCB	2	103
Trucks	8	104
Trailer	1	101
Pickup Trucks	5	75
Vans for Staff	2	55

### Cumulative Noise Level at the Source

The noise level at the source is calculated assuming that all machines/equipment will operate at the same time at one location with maximum sound levels; this is established in order to demonstrate the worst case situation, but it should be noted that it is an unrealistic and very conservative assumption. Total noise level generated by all noise sources, is calculated with the formula:

$$L_{WT} = 10 \text{Log} \left( \sum_{i=1}^n 10^{L_{wi}/10} \right)$$

where;

n: Number of noise source

L<sub>wi</sub>: Sound power level of each source (dBA)

L<sub>WT</sub>: Cumulative noise level at the source

By using the above formula, the cumulative noise level at source was calculated as 115.5 dBA. It should be noted that this is an unrealistically conservative estimate, as it is impossible for all machinery to operate at the same point at once.

### Cumulative Noise Level at the Receptor

Noise generated at source reduces as it propagates. Noise levels at the selected noise sensitive receptors were calculated by using the following formula:

$$L_{PT} = L_{WT} + 10 \times \log \left( \frac{Q}{4 \cdot \pi \cdot r^2} \right)$$

where;

L<sub>PT</sub>: Noise power level at the receptor (dB);

Q: Ground absorption coefficient;

r: Distance between the source and the receptor.

The noise levels at different distances are calculated using the above formula and the results are given in the table below. Propagation of noise by distance is represented in graphical format provided in the following table.



**Table 50 Noise Level with respect to Distance during Construction**

Distance (m)	L <sub>pt</sub> (dBA)
15	81.0
30	75.0
50	70.5
100	64.5
130	62.2
150	61.0
200	58.5
300	55.0
400	52.5
500	50.5



600	49.0
700	47.6
755	47.0
800	46.5
900	45.4
1,000	44.5
1,100	43.7
1,200	42.9

**Table 51 Noise- Impact Magnitude- Construction**

Impact	Impact Magnitude	Likelihood	Justification
Construction Noise	Minor	Certain	Noise emissions during construction will be intermittent and mainly noticeable within the site and immediate environment.

It should be considered that the above is a desk based calculation, not a noise assessment based on computer modelling, and no atmospheric, ground absorption or barrier effect (topographical conditions, vegetation) were taken into consideration in order to simulate the worst case conditions. In addition, the case in which all construction machinery and equipment operating at the same time, at one location, with maximum sound levels, is impossible to occur in practice.

### 8.4.2. Operational Phase

PV Plants are generally not associated with noise generation during the operational phase and this will be the case with this Project. The

transformers and inverters are expected to make a very low humming sound during the operational phase, but this is expected to be negligible and will not impact be noticeable at nearby communities.

### 8.4.3. Decommissioning Phase

Decommissioning activities will generate noise, similar to those of construction activities but for a shorter time period. The decommissioning process will generate noise as heavy machinery will be required and metal structures will be disassembled. However, this will be a temporary impact with lower magnitude than construction impacts.

**Table 52 Noise- Impact Magnitude- Operational**

Impact	Impact Magnitude	Likelihood	Justification
Operational noise	Negligible	Certain	Available information suggests that noise impacts at sensitive and residential receptors is unlikely given the distance and topography of the site.



## 8.5. Impact Assessment

Table 53 Noise Impacts- Impact Assessment- Construction Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
Construction Noise	Minor	Certain	Residential & Commercial Buildings	High	Moderate



Table 54 Noise Impacts- Impact Assessment- Operational Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
Operational Noise	Negligible	Certain	Residential & Commercial Buildings	High	Negligible

Decommissioning phase impacts are similar to construction impacts but with a lower magnitude and duration.

## 8.6. Management Measures

Table 55 Noise- Management Measures- Construction Phase

Impact / Risk	Management Measure
Construction Noise	<p>The electricity generators to be used during the construction phase of the Project will be fitted with silencers if noise emissions are high. Best practicable means will be followed to ensure that the quietest available plant and construction techniques will be used in order to limit noise output as far as practically possible.</p> <p>Where necessary to meet specified noise limits, the following measures will be implemented:</p> <ul style="list-style-type: none"> <li>• Installing acoustic enclosures for equipment causing radiating noise;</li> <li>• Improving the acoustic performance of constructed buildings, applying sound insulation;</li> </ul>



Impact / Risk	Management Measure
	<ul style="list-style-type: none"> <li>• Installing vibration isolation for mechanical equipment;</li> <li>• Relocating noise sources to less-sensitive areas to take advantage of distance and shielding:                             <ul style="list-style-type: none"> <li>– Sitting noise sources away from community areas, if possible;</li> <li>– Taking advantage of the natural topography as a noise buffer during facility design;</li> <li>– Reducing Project traffic routing through community areas wherever possible.</li> </ul> </li> </ul>
	<p>Strictly ensure the use of protective personal equipment (PPE) at all times while on site and noise reduction techniques such as silencers and ear muffers to employees.</p>
	<p>Regularly maintain all machinery and vehicles. Replace any broken parts immediately.</p>
	<p>Ensure efficient operation of all plant and vehicles to avoid unnecessary noise disturbance.</p>
	<p>Optimise the use of noisy construction equipment during daylight hours and turn off any equipment when not in use.</p>
	<p>Inform local communities of any major noise generating construction activities at least three days in advance.</p>
	<p>Ensure that the mobile vehicles use only designated access roads to reduce traffic routing through community areas.</p>
	<p>No noisy construction activities will be carried out at night under any circumstances.</p>
	<p>Implement the Stakeholder Engagement Plan to collect, investigate and resolve the complaints and suggestions through the grievance mechanism, to proactively investigate and address any complaints regarding noise.</p>
	<p>Project construction traffic routing through community areas outside the Project access road will be avoided to the extent possible.</p>

## 8.7. Residual Impact

Table 56 Noise- Residual Impacts- Construction Phase



Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
Construction Noise	Moderate	Yes	Minor

Table 57 Noise- Residual Impacts- Operational Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
Operational Noise	Negligible	Yes	Negligible

## 8.8. Monitoring Measures

Table 58 Noise- Monitoring Measures- Construction Phase

Impact / Risk	Monitoring Measure
Construction Noise	Conduct noise monitoring at sensitive receptors if there are any stakeholder complaints regarding noise.
	Monitor high noise activities within the site to define areas and activities where hearing protection PPE is required (e.g. ramming)

Table 59 Noise- Monitoring Measures- Operational Phase

Impact / Risk	Monitoring Measure
Operational Noise	Maintenance of equipment shall be conducted regularly to avoid unnecessary noise disturbances. Maintenance shall be recorded.
	Any maintenance activities which are expected to be noisy shall be carried out during the daytime and recorded..



The monitoring measures listed for the construction phase will be applied during decommissioning, as relevant.

## 9 Landscape & Visual Impacts

Given the characteristics of the solar power plants, there can be instances where PV Projects create significant visual impacts on the existing landscape.

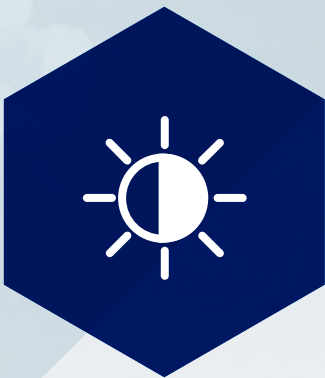
Impacts upon the landscape typically occur in situations where the visual horizon is disturbed by a development. Such impacts may include:

- The anthropogenic intrusion of the landscape by buildings or structures where no intrusion previously existed; or
- The change in the landscape character of an area, which could arise from new development or from changes in the land use.

Visual impacts may occur when the visual envelope or line of sight to and/or from a receptor (e.g. residential areas and area of natural beauty) is intersected or blocked by a development.

### 9.1. Baseline Conditions

The Project site consists of areas that are sparsely vegetated or have no vegetative cover. The Project site is also a significant distance from touristic areas, between 1.4km





and 2.7km away. Due to the topography and the low elevation of the panels, the Project will not be visible from a wide area, and will only be visible from specific points within the local communities (Ashnak, Talin, Katnaghbyur & Dashtadem). Hence, the visual effects of the construction will be of low significance within the Project area.

During site investigations, two smaller operational PV Projects were identified in the nearby communities, meaning that PV sites are already part of the landscape in the area and the Project will not cause an unprecedented impact or change the landscape dramatically. The PV Plant should have little effect on the overall characteristics of the landscape visible from nearby settlements.

## 9.2. Sensitive Receptors

Sensitive receptors for landscape impacts include main transportation routes, sites of cultural importance and settlements.

The Monastery of St Kristapor which is of cultural significance is 1.31km away from the Project site. Less than 20% of the site will be visible from the monastery and the small visible areas are not expected to have a significant landscape impact from this location. The PV Plant should have little effect on the overall characteristics of the landscape visible from nearby settlements, as it will only be visible from specific points and not the main streets / local roads. The distance from the closest highway is 1.5km away from the site. Dashtadem fortress is 1.5km away from the Project site, less than 7% of the site will be visible, given that there is a hill between the site and Dashtadem that

screens out most of the Project site. Therefore, the Project is not expected to have a significant landscape impact from this location.



Site walkovers have indicated that there is no direct line of sight to the highway. The closest protected area to the Project is Aragats Alpine State Sanctuary which is 15.5km away from the Project site. Mount Aragats is the highest peak in Armenia and is an isolated 4 peaked volcano massif. The Aragats slopes are scattered with numerous parasitic cones, which in the past regularly spotted volcanic materials. As a result of volcanic eruptions, the slopes of Aragats (up to the lower skirts), mostly are covered with lava flows where the Project site is located. Aragats is rich with non-metallic minerals of volcanic origin tuff, pumice, perlite, etc. Aragats peaks are covered with snow all year round, while at the foot of the mountain, all seasons of the year are differentiated by their nuances. The Aragats mountain is surrounded by the Kasagh river on the east and the Akhurian river to the west. The circumference of the mountain is around 200km and covers an area of 6,000km<sup>2</sup> or around one fifth of Armenias total area.

It is 28km away from the Project site in distance so no landscape impacts will occur. Mt. Aragats plays a significant role in Armenian history and culture, it holds spiritual value for many Armenians. Numerous historical monuments are located on its slopes and many legends and folk tales are associated with its name and origins. Prehistoric items of cultural significance have been preserved on the slopes of the mountain such as rock carvings and 'dragon stones' which are very symbolic to Armenias culture and heritage. The landscape on the site is expected be impacted by PV panel installation, therefore the landscape changes within the site will be significant.

Figure 15 Zone of Theoretical Visibility from St. Kristapor's Monestary

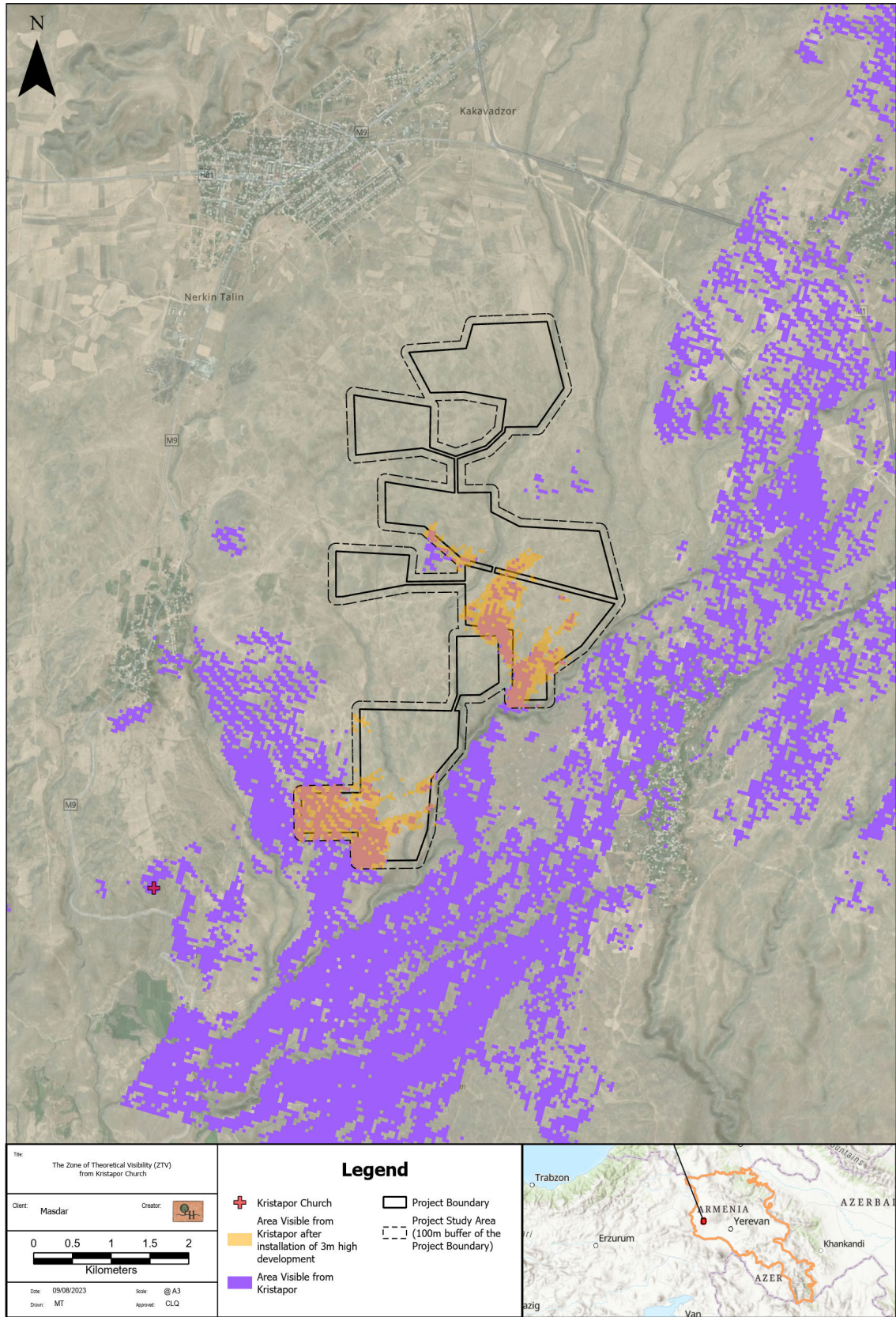
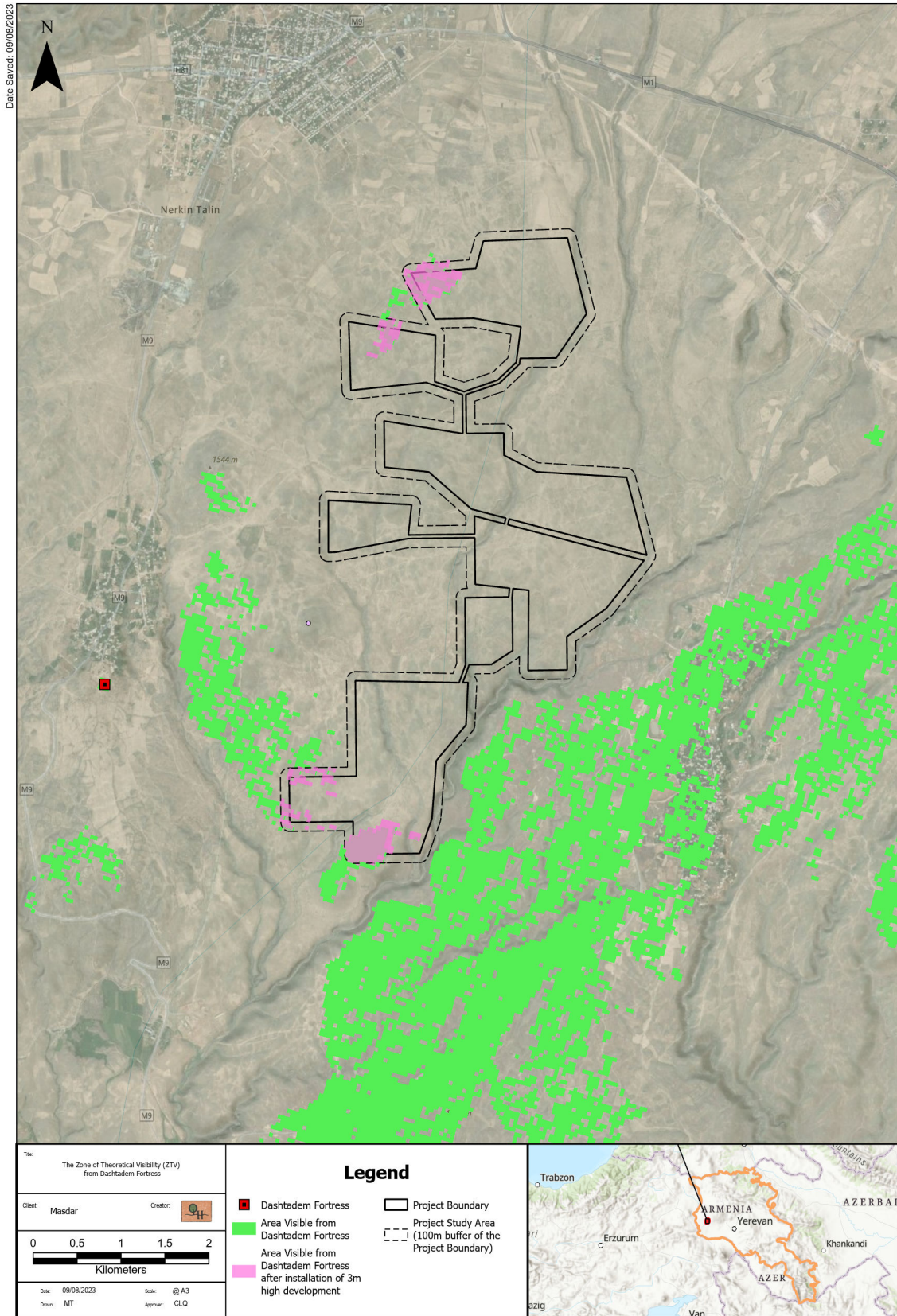




Figure 16 Zone of Theoretical Visibility from Dashtadem Fortress





### 9.3. Impacts

#### 9.3.1. Construction Phase

The potential landscape and visual impacts during the construction phase may include the visual disturbance from the presence of construction equipment and machines, and the visual impact associated with increased vehicles, materials and personnel movements in the area. Lighting impacts may also be associated with the construction phase of the Project when the sun sets and lighting equipment is deployed. Other elements of operation of the Project that will affect the landscape comprise on-site roads, access roads, and occasional vehicles that pass along the roads

from PV panels has sometimes been described for aircraft, but modern PV panels are opaque and have low reflectivity is known to cause visual impacts during the operational phase, but this is not expected to have a significant impact on nearby communities or sites of cultural heritage e.g., The Monastery of St Kristapor.

Once the Project reaches the operational phase, the PV panels are not expected to be visible from a wide area given the topography and the low elevation of the Project site. The Project site will only be visible from specific points within the local communities (Ashnak, Talin, Katnaghbyur & Dashtadem). Hence, the visual effects of the Project during the operational phase will be of low significance within the Project area.

#### 9.3.2. Operational Phase

Following the impacts of construction and establishment of Project features, the operational phase will result in changes to the landscape character or visual envelope of receptors overlooking the Projects site. Glare

**Table 60 Landscape and Visual Impacts- Sensitive Receptors**

Receptor	Sensitivity	Justification
<b>Dashtadem Fortress &amp; St Kristapors Monastery</b>	High	The site will be visible from Dashtadem Fortress and St. Kristapor's Monastery which have been categorised as areas of cultural significance. The Project is not expected to have a significant landscape impact from this location.

**Table 61 Landscape and Visual Impacts- Impact Magnitude- Construction Phase**

Impact	Impact Magnitude	Likelihood	Justification
<b>Change in Landscape Character</b>	Moderate	Certain	Impacts in regard to the local landscape and visual impacts during construction are expected to be moderate.

### 9.3.3. Decommissioning Phase

The decommissioning of the PV Plant will result in positive landscape and visual impacts during the decommissioning process and the re-mediation of all previous impacts once decommissioning and restoration is complete.



**Table 62 Landscape and Visual Impacts- Impact Magnitude- Operational Phase**

Impact	Impact Magnitude	Likelihood	Justification
<b>Change in Landscape Character</b>	Moderate	Certain	Impacts in regard to the local landscape and visual impacts during operations are expected to be moderate.



PV Project in the Local Community





## 9.4. Impact Assessment

Table 63 Landscape & Visual Impacts- Impact Assessment- Construction Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
Change in Landscape Character	Moderate	Certain	Rural Landscape	Low	Minor

Table 64 Landscape and Visual Impacts- Impact Magnitude- Operational Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
Change in Landscape Character	Moderate	Certain	Local Communities & Rural Landscape	Moderate	Minor

Decommissioning phase impacts will be positive, as described above.

## 9.5. Management Measures

Table 65 Landscape and Visual Impacts- Management Measures- Construction Phase

Impact / Risk	Management Measure
Visual Impacts	Keep lightning to a minimum consistent with maintaining activities and health and safety requirements.
	Use of materials that will not result in light reflection for all Project components.



Impact / Risk	Management Measure
<b>Change in Landscape Character</b>	Design and construct the site control building and facilities considering the landscape and the nature of area.
	If necessary, locate substations away from direct views from roads and residential dwellings.
	Reuse stored top soil for rehabilitation of sites.
	Minimise cut and fill for site tracks and re-vegetate disturbed soils as soon as possible after construction.

**Table 66 Landscape and Visual Impacts- Management Measures- Operational Phase**

Impact / Risk	Management Measure
<b>Visual impact due to earthworks, presence of construction machinery, temporary construction compounds.</b>	Implement topsoil management measures (please refer to the geology and soils chapter for all relevant measures).
	Keep lightning to a minimum consistent with maintaining activities and health and safety requirements.
	Use of materials that will not result in light reflection for all project components.
	The obstacle lighting will include shielding such that no light is visible below 10 degrees below horizontal.

During the decommissioning phase, the management measures will focus on habitat and landscape restoration.



## 9.6. Residual Impact

Table 67 Landscape and Visual Impacts- Residual Impacts- Construction Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
Change in Landscape Character	Minor	Yes	Minor

Table 68 Landscape and Visual Impacts- Residual Impacts- Operational Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
Change in Landscape Character	Minor	Yes	Minor



## 9.7. Monitoring Measures

Table 69 Landscape and Visual Impacts- Monitoring Measures- Construction Phase

Impact / Risk	Monitoring Measure
<b>Change in Landscape Character</b>	Monitor compliance with mitigation measures. No additional monitoring is required.

Table 70 Landscape and Visual Impacts- Residual Impacts- Operational Phase

Impact / Risk	Monitoring Measure
<b>Change in Landscape Character</b>	Monitor compliance with mitigation measures. No additional monitoring is required.

The monitoring measures listed for the construction phase will be applied during decommissioning, as relevant.

## 10 Soils, Water & Groundwater

This chapter covers surface water, drainage and storm water management. The construction and operational phases of the Project may potentially increase the risk of contamination of soils and groundwater through poor management practices. In general, contamination risks to soils and groundwater are associated with the transport, handling and storage of liquid waste and hazardous materials, as they pose the potential threat of spillage onto the ground.

The Project will also require water during the construction, operational and decommissioning phases.

### 10.1. Observations and Baseline Conditions

#### 10.1.1. Desktop Research

##### 10.1.1.1 Soil and Geology

In Armenia's territory, nearly all zonal soil types are available not only because of the diversity of biodynamic and lithological-geometric conditions but also due to its long and diverse economic activities.





Some of the most common soil types found in Armenia include Mountainous-Meadow (Leptosols), Mountainous Meadow-Prairie (Phaeozems), Mountainous Brown Forest, Mountainous Cinnamomic Forest, Mountainous Black Soils (Chernozems), and Mountainous Brown Semidesert Soils (Calcisols). Overall, the country has a total 228 different soils with 14 types and 27 subtypes, together with a lot of families, varieties and species of soils.

The Project area is the Mountainous-Meadow natural-soil zone, which occupies mountainous arrays located higher than 2,200m above sea level. This zone is represented by two genetic soil types: Mountainous-Meadow and Mountainous-Meadow-Prairie. Occupying the highland part of the Armenian Volcanic Plateau and the Lesser Caucasus within the range of 2,200m and 4,000m, mountainous-meadow soils are formed in conditions of cold and humid climate.

Mountainous-meadow-prairie soils are formed on an elevation of 2,200m and 2,700m. They are soils with a very shallow profile depth (indicating little influence of soil-forming processes), and they often contain large amounts of gravel. They typically remain under natural vegetation, being especially susceptible to erosion, desiccation, or water logging, depending on climate and topography.

The Project site is a dry steppe zone, with typical brown soil. Dry steppe brown soils have a loamy soil mechanical composition, with a humus content of 2-3,5%. Brown soil's, water extracts reaction is weak alkaline PH = 7.4-8.5, cation exchange capacity is 30-35 mg/equivalent, a mass of soil particles that are smaller than 0.1 mm is high it should be 10-75% mostly pulverized and weathered. The degree of flooding at the canyons (which will not be used by the Project) is high, a significant part of the area is very congested and rocky.

While half of Armenia's area (approximately 29,800km<sup>2</sup>) has an elevation of at least 2,000m, the lowest points are in the valleys of the Araks River and the Debet River with elevations of 380m and 430m, respectively. The Armenian Plateau, which slopes southwest toward the Araks River, consists of intermediate mountain ranges and extinct volcanoes. The plateau contains Mount Aragats, the highest point in Armenia with an elevation of 4,090m. In the west part of the area is Arteni mountain. With a common ground (diameter 10 km) Great Arteni (2047 m) and Small Arteni (1753 m), are the picks made of neogen liparite lavas and their varieties.

The Project site is located on the southern slope of Mount Aragats, occupying part of the Talin plateau in the Aragatsotn Marz province. The province has a mountainous landscape containing the Aragats mountain range.



**Plate 6 Soil in the Project Area**



Loose Mountainous Soil at the Project Site



Rocky Mountainous Soil at the Project Site



**10.1.1.2 Water**

Armenia has several sources of surface water. The rivers of Armenia are part of either the Caspian Sea or Lake Sevan watersheds. There are approximately 100 freshwater lakes and ponds in Armenia. Armenia has a large number of streams which are also present in most regions of the country. The total number of streams recorded is 200. Yerevan, which is 68km away from the Project site is crossed by the Hrazdan river. The surface water monitoring network of Armenia includes 131 observation points of water bodies (rivers, reservoirs, Arpa-Sevan aqueduct and Lake Sevan) of 6 water basin management areas of the Republic (North, Akhuryan, Hrazdan, Sevan, Ararat, South). Water quality is characterized physicochemically with up to 45 indicators (main anions and cations, nutrients, heavy metals, primary organic pollutants) with a frequency of 5-12 times per year. The AYG-1 PV plant is located in the water basin management area of Akhuryan.

The main water source of the Aragatsotn Marz region is derived from the Karkachum and Metsamor river and its tributaries, Mastara Selav and Katnaghbyur. The distance between the Project site and the nearest tributary (Mastara Selav) is around 10-15 km.

Metsamor river has a length of 40 kilometres, the river has the most consistent flow compared to other rivers of Armenia. It originates from Metsamor Lake and is fed from the water sources located at the foot of The Aragats Mountain Range, it flows very slowly, mostly through the swampy shores and then flows into Araks. Kasakh river also flows into Metsamor, thus making it one of the most high-water rivers in Armenia. Metsamor river water has an "average" quality (3rd class), due to chemical oxygen demand, ammonium, nitrite and phosphate ions, in a lower stream water is of "unsatisfactory" quality (4th class) due to ammonium and nitrate ions.

According to the "Meteorology and Monitoring Center" SNCO 2021 summary, the water quality of the Karkachun River in the estuary was

assessed as "poor" (class 5) due to five-day biological oxygen demand, chemical oxygen demand, phosphate ion, manganese and total phosphorus.

The total groundwater in Armenia is estimated at 4 billion m<sup>3</sup>. Most of the drinking water is groundwater, playing an important role in the overall water balance. However, the risk of water contamination is high because of the poor state of the water supply networks. Groundwater is also used for irrigation in 19 percent of the area and the remaining water is irrigated from surface water.

In the Resolution of the Government of Armenia No 75-N of January 27, 2011 "On Definition of Water Quality Norms for Each Water Basin Management Area, Taking Into Consideration the Peculiarities of the Territory" the system of quality assessment of surface waters, for each indicator of the chemical quality of the water distinguishes five classes: "excellent" (1st class), "good" (2nd class), "average" (3rd class), "unsatisfactory" (4th grade) and "bad" (5th class). One of the main problems infrastructure in the Aragatsotn Marz region is related to the quality of drinking water supply. Drinking water supply is a problem in the each of the local communities where it is rated as 'average' or 'poor'.

A hydrology survey of the Project site was conducted and did not identify groundwater sources at the Project site. The survey found that there are seasonal water streams crossing the site. The Project design takes into consideration the effects of hydrology and appropriate measures would be put in place to safeguard the Project from flooding risks, by avoiding any construction on the gorges. Similarly, construction activities will minimize any impact on the natural gorges so as to not disturb the flow of water / streams. The communities are interested in using the donation agreement with the Project company to improve local groundwater supply.

During site walkovers, an operational pipeline and water pump system was identified offsite in the north of the site. It is part of the water supply system for the nearby communities.

There were no springs, ponds, pools, streams, rivers, water surfaces, swamps and etc. recorded within the site. The only surface water in the requested area is caused by precipitation. The canyons are ephemeral and channel water southwards when the snow melts in the spring or during heavy rains.



Water Pipeline and Pump Building at the Project Site

## 10.2. Sensitive Receptors

Table 71 Soils, Water and Groundwater- Sensitive Receptors

Receptor	Sensitivity	Justification
Soil	Medium	Soils in the Project area have a low sensitivity to erosion due to their low fertility. There is no pre-existing soil contamination in the area.
Groundwater	High	Water is scarce in the Project area. The lack of vegetation present on site indicates that the groundwater table is deep. Groundwater is the main water source for the local communities.



## 10.3. Impacts

### 10.3.1. Construction Phase

The following potential impacts have been identified during the construction phase of the Project:

#### Water Use

A water system will provide domestic water to the on-site sanitary facilities during construction. Potable water will be provided by a water tank regularly filled by tanker truck and the quality of domestic water must meet the standards - provided by a licensed contractors.

A complete potable water system includes tank, pumps, piping, accessories, control, and instrumentation will be provided. The potable water system will be provided with 2 x 100% adjustable frequency domestic water pumps to meet 100% of the water consumption of the staff.

The tank will be made of carbon steel and will be painted with an appropriate sealant inside and outside. The tank will be an outdoor type, and provided completely with its injection system, control, valves, accessories and piping. Disinfection system will ensure complete removal of micro-organisms. Storage and distribution facilities will be designed to ensure no unacceptable contamination of

domestic water. The water will be treated to ensure quality requirements are met

Drinking water needs to range from approximately 6L to 10L per person/day. However, considering water use for sanitary purposes (showers, washing, cooking, etc.), an estimation of 60L per person/day is expected during the construction phase.

A Mobile Concrete Batching plant will be placed on site for the preparation of the concrete to be used for the foundation installations for the Trackers and potentially for the Substation building. The main water requirement during construction would be water for concrete production.

The Project will ensure that the source of water used for sanitary purposes and batching plant activities does not affect community access to water and water availability for other users. Water sourcing from local community boreholes would likely not be sustainable and hence will not be allowed. Potable water will be provided by a water tank regularly filled by tanker truck and the quality of domestic water must meet the drinking standard. The estimated breakdown of water use and sources will be finalised by the EPC and detailed in the Water Management Plan of the ESMS.

**Table 72 Water Consumption and Main Uses (Construction)**

Uses	Tasks	Water Consumption (Construction Period)
<b>Construction Purposes</b>	Preparation of Concrete	6,500 m <sup>3</sup>
	Fire Safety Requirements	
	Drinking + Sanitary purposes	



**Table 73 Water Consumption and Main Uses (Operational)**

Uses	Tasks	Water Consumption (Per Annum)
<b>Operation Purposes</b>	Fire Safety Requirements	2,200 m <sup>3</sup>
	Drinking + Sanitary purposes	

**Drainage Changes**

Targeted grading activities, access roads and/or the stockpiling of materials could potentially cause changes in the natural drainage system onsite and minor localized flooding. The area has several basins and sub-basins running through it that function as a natural drainage system through the area. The Project will not build on the canyons, so there is an expectation that only a minimal amount of drainage may be required to be built. The main natural drainage channels within the site will not be impacted by the Project. Any change in the drainage patterns associated to access road construction or tracker foundations are not expected to have an impact on surface water bodies, as none are located near the site.

**Leaks and Spillage**

Soil can be susceptible to contamination from various sources during the construction phase. The main sources of contamination are typically associated with the transport, handling and storage of hazardous liquids/materials, as they pose the potential threat of releases and spills onto the ground. The risk of accidental spillage and leakage of various chemical products are often attributable to storage areas of the construction site as well as the transportation of such materials around the site. Improper methods of storage, transferring, and handling of these products can result in spillage to the ground, causing soil contamination. It should be noted that only small quantities of hazardous materials will be required on site.



Sewage leaks and spills may also cause soil contamination which is a significant concern during construction. The sanitary sewage system function on site will collect and transfer

the sewage generated to septic tanks, which will be collected and evacuated to a licensed wastewater treatment plant.



**Table 74 Soils, Water and Groundwater- Impact Magnitude- Construction Phase**

Impact	Impact Magnitude	Likelihood	Justification
<b>Spill and Leaks (Construction)</b>	Low	Possible	Hazardous materials, fuels and chemicals will be used during the construction phase which leads to a risk of direct contamination, if not handled or stored correctly.
<b>Water Use</b>	Moderate	Possible	Water is a scarce resource. If water used for the Project is taken directly from the community water supply, it could have a negative impact on water availability for the area.
<b>Increased surface runoff and associated flooding</b>	Low	Unlikely	Localized flooding may occur during the construction and operational phase due to potential changes in the drainage system and natural drainage patterns.
<b>Ponding</b>	Low	Unlikely	The PV plant construction and other Project activities may lead to the creation of stagnant water bodies in depressions created during the construction works.

### 10.3.2. Operational Phase

PV panels and the associated internal roads could decrease localized percolation of rain water to the ground during periods of heavy rain. This could have the knock-on effect of increasing water loading and potential localized flooding or erosion. Soil and groundwater contamination risks are not expected during the operational phase as there will likely be no storage of any significant quantity of hazardous materials, liquids, or fuels. Potential risks of concern during the operational phase are expected to be limited to the management of small amounts of hazardous materials/ wastes/ wastewater/ chemicals and fuels. Overall, the Projects drinking and domestic water usage during the operational phase is

expected to be low. There will be between 15-25 employees on site during the construction phase that will require drinking and domestic water. Similar to the construction phase, water will not be sourced from local community boreholes. Potable water will be provided by a water tank and regularly filled by tanker truck and the quality of domestic water must meet the drinking standard.



In relation to PV Panel cleaning, no wet cleaning of PV Panels is envisaged. Currently, the Project Company is planning to apply dry cleaning for PV panel cleaning which ensures low water usage during the operational phase.

**Table 75 Soils, Water and Groundwater- Impact Magnitude- Operational Phase**

Impact	Impact Magnitude	Likelihood	Justification
<b>Spill and Leaks</b>	Minor	Unlikely	Hazardous materials, fuels and chemicals will be on-site during the operational phase and there is a risk of direct contamination, if not handled or stored correctly.
<b>Water Use</b>	Moderate	Possible	As mentioned above, water is a scarce resource and water taken directly from the community water supply, it could have a negative impact on water availability for the area.
<b>Increased surface runoff and associated flooding</b>	Minor	Unlikely	It is unlikely that localised flooding will occur during the operational phase due to the drainage system that will be built on site.

### 10.3.3. Decommissioning Phase

Potential impacts during decommissioning include leaks and spills from vehicles; and waste left onsite affecting the soil, groundwater, and soil erosion. If the site is not adequately restored after decommissioning, the soil and drainage patterns can become inadequate for natural vegetation.



## 10.4. Impact Assessment

Table 76 Soils, Water and Groundwater- Impact Magnitude- Construction Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>Spill and Leaks</b>	Low	Possible	Soil and Groundwater	Medium	Moderate
<b>Water Use</b>	Moderate	Possible	Water Sources	High	Moderate
<b>Increased surface runoff and associated flooding</b>	Low	Unlikely	Groundwater	Medium	Negligible
<b>Ponding</b>	Low	Unlikely	Groundwater	Medium	Negligible

Table 77 Soils, Water and Groundwater- Impact Magnitude- Operational Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>Spill and Leaks</b>	Minor	Unlikely	Soil and Groundwater	Medium	Negligible
<b>Water Use</b>	Moderate	Possible	Water Sources	High	Moderate
<b>Increased surface runoff and associated flooding</b>	Minor	Unlikely	Groundwater	Medium	Negligible

Decommissioning phase impacts are similar to construction impacts but with a lower magnitude and duration.

## 10.5. Management Measures

Table 78 Soils, Water and Groundwater- Management Measures- Construction Phase



Impact / Risk	Management Measure
<b>Increased surface runoff and associated flooding and erosion</b>	Implement an Management Plan as part of the ESMS including a precautionary method of working in relation to geology and soils, water and groundwater. The management measures described below will be included in the ESMS.
	Ensure that the design of the drainage system for both permanent and temporary facilities has the capacity to adequately manage all surface runoff.
	Soil should not be piled on slopes to reduce mobility of soil by runoffs and other disturbances.
	Provide drainage at the temporary top soil storage sites throughout the storage period.
	If significant soil erosion is expected in any area, design sedimentation ponds for drainage water and surface runoff collection.
<b>Spill and Leaks</b>	All measures associated with spill prevention are discussed in the hazardous materials and waste management chapter, below.
<b>Water Use</b>	The Project shall not interfere with community water sources. All water will be purchased from an authorized supplier, ensuring that the Project does not reduce the local communities access to water.
	Ensure that the water supplier is licensed and complies with the Water Code of Armenia (2002).
	Ensure that potable water is not used for landscaping , concrete making or dust suppression, and that watering methods for these uses minimise water use.



Impact / Risk	Management Measure
<b>Ponding</b>	Minimise unnecessary soil stripping during the construction phase activities.
	Fill in areas where construction activities have caused ponding after construction has finalised. These areas can be identified through regular inspections after major rain events.

**Table 79 Soils, Water and Groundwater- Management Measures- Operational Phase**

Impact / Risk	Management Measure
<b>Increased surface runoff and associated flooding</b>	Implement an Operational Environmental Management Plan (OEMP) including a precautionary method of working in relation to geology and soils, water and groundwater. The management measures described below will be included in the OEMP in the ESMS.
	Ensure that the design of the drainage system can accommodate peak rainwater and does not cause ponding within the site or erosion at discharge points.
	Implement temporary drainage grooves and sedimentation ponds for surface runoff collection in any area where significant soil erosion is expected.
<b>Water Use</b>	The Project shall not interfere with community water sources. All water will be purchased from an authorized supplier, ensuring that the Project does not reduce the local communities access to water.
	Ensure that the water supplier is licensed and complies with the Water Code of Armenia (2002).
<b>Spill and Leaks</b>	Measures to prevent spills and leaks are listed in the hazardous materials and waste management chapter.

The management measures listed for the construction phase will be applied during decommissioning, as relevant.





## 10.6. Residual Impacts

Table 80 Soils, Water and Groundwater- Residual Impacts- Construction Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
<b>Spill and Leaks</b>	Moderate	Yes	Minor
<b>Water Use</b>	Moderate	Yes	Minor
<b>Increased surface runoff and associated flooding</b>	Negligible	Yes	Negligible
<b>Ponding</b>	Negligible	Yes	Negligible

Table 81 Soils, Water and Groundwater- Residual Impacts-Operational Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
<b>Increased surface runoff and associated flooding.</b>	Negligible	Yes	Negligible
<b>Water Use</b>	Moderate	Yes	Minor
<b>Spill and Leaks</b>	Moderate	Yes	Moderate



## 10.7. Monitoring Measures

Table 82 Soils, Water and Groundwater-Monitoring Measures- Construction Phase

Impact / Risk	Monitoring Measure
<b>Spill and Leaks</b>	Monitoring measures for spills and leaks are detailed in the hazardous materials and waste chapter.
<b>Water Use</b>	Monitoring of water consumption and use.
<b>Increased surface runoff and associated flooding</b>	Visual inspection of the condition of drainage systems and conditions at the discharge points of the drainage system.
<b>Ponding</b>	Visual inspection of the condition of drainage systems, conditions at the discharge points of the drainage system and areas where excavation has taken place after rain events.

Table 83 Soils, Water and Groundwater-Monitoring Measures-Operational Phase

Impact / Risk	Monitoring Measure
<b>Spill and Leaks</b>	Monitoring measures for spills and leaks are detailed in the hazardous materials and waste chapter.
<b>Water Use</b>	Monitoring of water consumption and use.
<b>Increased surface runoff and associated flooding</b>	Visual inspection of condition of drainage systems.

The monitoring measures listed for the construction phase will be applied during decommissioning, as relevant.



## 11 Air Quality

Poor air quality can adversely affect human health, ecosystems and vegetation. Such impacts can include long-term chronic exposure and short-term acute exposure health related issues. The air quality impacts on the environment can have direct effects on vegetation, as well as indirect effects to the acid and nutrient status of soils and waters, which in turn impact upon species and habitats.

This section assesses the potential impacts to air quality that may result from the proposed Project.

### 11.1. Observations and Baseline Conditions

#### 11.1.1. Desktop Research

Outdoor air pollution is a mix of chemicals, particulate matter, and biological materials that react with each other to form tiny hazardous particles. It contributes to breathing problems, chronic diseases, increased hospitalization, and premature mortality.

In accordance with the World Health Organization's guidelines, the air quality in Armenia is considered moderately unsafe.

The most recent data indicates the country's annual mean concentration of PM<sub>2.5</sub> is 33 µg/m<sup>3</sup> which exceeds the recommended maximum of 10 µg/m<sup>3</sup>.

Contributors to poor air quality in Armenia include industrial emissions, mining, food processing, and vehicle emissions. Available data indicates that Yerevan has consistently high levels of air pollution.

In Armenia, background air pollution is controlled by the Environmental Impact Monitoring Center SNCO (Armecomonitoring) operating in subordination of the Ministry of Environment. Air quality in major cities and towns in Armenia is severely affected by motor vehicle traffic because of the age of vehicles and fuel quality. Vehicle emissions are a major source of PM, NO<sub>2</sub> and CO<sub>2</sub>. Some common practices in rural Armenia such as burning of solid waste and plastics also contribute to deteriorating air quality. In rural areas, loose soil from farming and dust can be blown by the wind. Other sources of air contamination are industries, small diesel generators and the use of biomass fuels such as charcoal and wood.

The Project is located in a rural area surrounded by Talin, Dashtadem, Katnaghbyur and Ashnak communities. Pollution sources at Talin include vehicles, livelihoods of the population and a small number of industrial enterprises. However, in Talin and Dashtadem settlements there are no ecomonitoring samplers and the background air pollution indicators are determined by calculation according to the population. According to the "Armecomonitoring" guidelines, the background pollution in the air basin of Tallin community and nearby settlements (up to 10

thousand population) for 4 visible substances was:

- Carbon monoxide: 0.4 mg/m<sup>3</sup>;
- Nitrogen dioxide: 0.008 mg/m<sup>3</sup>;
- Sulfur dioxide: 0.02 mg/m<sup>3</sup>;
- Dust: 0.2 mg/m<sup>3</sup>.



Air quality at the proposed Project area is expected to be average to good. Burning of wood and biomass by residents in nearby communities (which is limited as all communities have access to natural gas) together with dust blown by the wind are likely to be the most significant impacts on local air quality.

The distances from the project site to sensitive receptors are presented below:

- Distance from Ashnak settlement – 0.5km away
- Distance from Dashtadem settlement– 1.25km away
- Distance from Talin settlement – 1.4 km away
- Distance from Katnaghbyur settlement– 2.30km away
- Distance from Yerevan-Gyumri highway– 0.9km away
- Distance from Kristapore monastery– 1.31km away

Given the sensitive receptors distance from the Project site, the Projects impact on air quality is not expected to affect the sensitive receptors mentioned or their surrounding environment.

## 11.2. Sensitive Receptors

Table 84 Air Quality- Sensitive Receptors

Receptor	Receptor Sensitivity	Justification
<b>Residential receptors</b>	High	Populations are always very sensitive to changes in air quality. Ashnak community is the only residential receptor within 500m of the Project site.
<b>Farmers and crops</b>	Medium	Farmers and road users could potentially be exposed to pollution for limited periods of time (during their working hours) and crops can be affected by lower air quality.
<b>Workers on Site</b>	High	Humans are always sensitive to changes in air quality. Workers employed at the Project site are receptors for dust produced during construction and operational phases.



## 11.3. Impacts

### 11.3.1. Construction Phase

Earthworks may generate dust and subsequently impact local air quality. The use of vehicles and heavy machinery also produce increased air emissions from exhausts. The typical air emissions resulting from these activities include; Nitrogen Oxides, Sulphur Dioxides, Carbon Monoxide, Carbon Dioxide, VOCs, Particulates and BTEX. The impact will be localized and is not expected to reach the communities.

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

- Excavations and earthworks, such as ground-breaking, cutting, filling and levelling;
- Truck movements on unpaved, or compacted surfaces;
- Particulate dispersion from uncovered truckloads;
- Unregulated stockpiles;

- Vehicle and Construction equipment emissions (e.g., NO<sub>x</sub>, SO<sub>2</sub>, CO, CO<sub>2</sub> & VOCs, particulates and BTEX) and particulates from vehicles, generators and other mechanical equipment; and
- Stored VOCs and other volatile hazardous materials (e.g., paints); and
- Batching Plant dust & VOCs.

#### Dust generation:

Dust resulting from construction activities typically comprises large diameter particles, which settle rapidly and close to the generation source. Far field dust impacts from construction works (>500m) are therefore considered unlikely.

Depending on factors such as meteorology (i.e. wind speed, wind direction and humidity), particle mass and moisture content of the soil, this will influence the dispersion of dust from activities such as excavating, handling of soil and the transfer of soil to trucks.



Additional impacts relate to the movement of soil where trucks are not effectively covered, or where vehicles are moving on unpaved surfaces on site. Uncontained and/or uncovered truck loads may be subject to losses of material where the containment is not effective (i.e., spills), or where wind or other air turbulence may disturb the contents and result in dispersion of material. Such impacts have the potential to degrade local air quality in the immediate area of such movements, if particles become suspended.

Dust may also occur due to equipment use and movement of trucks and material transportation. Except for vehicle movements on unpaved surfaces (e.g., along a site access road – if unpaved), dust due to the movement of trucks and material transportation should only occur where mitigation measures are not effectively implemented at the site, or by contractors bringing materials to the site (i.e. the sheeting/containment of truck and barge loads, wheel washing).

**Gaseous Emissions:**

Vehicles and equipment that operate on liquid fuel may result in the emission of gases to air due to the combustion of fossil fuels. Such vehicles and equipment are likely to include, but not be limited to the following: excavators; graders; pavers; trucks; cranes; temporary generators; and hand-held equipment operating on liquid fuel

**. VOCs:**

A small volume of fuels, paints, solvents and other volatile substances are likely to be required during the construction phase, which will be stored in secure areas within the construction laydown areas. Emissions from the batching plant will come primarily from the transfer of cement and additive materials to the silos, the transfer of sand and aggregate, truck loading, mixer loading, and sand and aggregate blowing from the piles. If not adequately contained, such substances have the potential to result in the dispersion of volatile emissions to the immediate air shed.

**Odour:**

On-site sanitation and toilet facilities are required for site staff and at any accommodation areas (any accommodation would be located off-site). There is the potential for release of associated odour to the immediate surrounding areas associated with inappropriate containment and coverage associated with wastewater holding tanks.



Air Quality Monitoring (not Project related)

**Table 85 Air Quality- Impact Magnitude- Construction Phase**

Impact	Magnitude	Likelihood	Justification
<b>Dust Generation (within 500m distance of Project site)</b>	Low	Likely	Some activities that involve excavations and breaking loose rocks have the potential to generate air pollutants in the form of dust particles. Given the low moisture content of the soil onsite, such impacts could potentially spread beyond the immediate surrounding areas, particularly during the summer months, if not properly managed. However, these risks can be easily managed with appropriate preventative and mitigative measures
<b>Gaseous Emissions</b>	Very Low	Certain	Air quality impacts relating to the use of vehicles and machinery are generally minor in magnitude for the number of vehicles and plant that will be required for the construction phase.
<b>VOC's</b>	Very Low	Unlikely	Fuels, paints and other volatile substances can potentially cause significant adverse impacts on the air quality if not properly managed. However, these risks can be easily avoided appropriate preventive and mitigative measures.
<b>Odour</b>	Very Low	Unlikely	Odour will occur if sanitary wastewater is not managed properly. This release is likely to be temporary and limited to the Project site and immediate adjacent areas. However, the requirements and expectations for on-site sanitation will be identified as mitigation measures in the ESIA.



### 11.3.2. Operational Phase

The Project will not impact the air quality of the site and surrounding area during the operational phase. The number of vehicles on site will be minimal. The vehicular traffic during the operational phase will be negligible and speed limits will be implemented to mitigate dust on the internal and access roads. Only well-maintained vehicles will be used and measures to minimize excess dust will be undertaken.

Table 86 Air Quality- Impact Magnitude- Operational Phase

Impact	Magnitude	Likelihood	Justification
<b>Gaseous Emissions</b>	Negligible	Certain	Air quality impacts relating to the use of vehicles and machinery are generally negligible for the operation phase.
<b>VOC's</b>	Negligible	Very Unlikely	Fuels, paints and other volatile substances can potentially cause significant adverse impacts on the air quality if not properly managed. However, these risks can be easily avoided appropriate preventive and mitigative measures.
<b>Odour</b>	Negligible	Unlikely	Odour will occur if sanitary wastewater is not managed properly. This release is likely to be temporary and limited to the Project site and immediate adjacent areas. However, the requirements and expectations for on-site sanitation are identified as mitigation measures in the ESIA.



### 11.3.3. Decommissioning Phase

Decommissioning impacts on air quality will be similar to construction impacts due to the presence of heavy vehicles and earthworks, however the required earthworks will be significantly reduced when compared to the construction phase.



## 11.4. Impact Assessment

Table 87 Air Quality- Impact Assessment- Construction Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>Dust Generation (within 500m distance of Project)</b>	Low	Likely	Residential receptors	High	Moderate
<b>Gaseous Emissions</b>	Very Low	Certain	Road users and farmers.	Medium	Minor
<b>VOC's</b>	Very Low	Unlikely	Residential receptors	High	Negligible
<b>Odour</b>	Very Low	Unlikely	Residential receptors	High	Negligible

Table 88 Air Quality- Impact Assessment- Operational Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>Gaseous Emissions</b>	Negligible	Unlikely	Road users and farmers.	Medium	Negligible
<b>VOC's</b>	Negligible	Very Unlikely	Residential receptors	High	Negligible
<b>Odour</b>	Negligible	Unlikely	Residential receptors	High	Negligible

Decommissioning phase impacts are similar to construction impacts but with a lower magnitude and duration.



## 11.5. Management Measures

Table 89 Air Quality- Management Measures- Construction Phase

Impact / Risk	Management Measure
<b>Dust Generation</b>	Carry out loading and unloading of material without allowing the dispersion of dust.
	Apply dust suppression methods (e.g. watering with water trucks at access roads and internal roads) when dust generation is unavoidable and monitoring shows it is impacting workers or nearby receptors (in prolonged periods of dry weather). The impact of dust should be assessed against the need to conserve water.
	Vehicle speeds shall not exceed the speed limits described in the community health and safety chapter and the Traffic Management Plan (TMP) of the ESMS.
	Drop height of materials that have potential to generate dust will be kept as low as possible.
	Where possible, soil stockpiles shall be located in sheltered areas where they are not exposed to high winds. If not feasible, stockpiles of soil (or other erodible materials) shall be securely covered.
<b>Gaseous Emissions</b>	Construction vehicles will not be permitted to keep engines running while waiting to enter to the site or waiting on-site.
	Well and adequate maintained vehicles will be used, and regular maintenance of vehicles will be ensured.
	In order to minimise air emissions sourced from construction machinery and trucks, relevant provisions of the IFC general guidelines, EBRD PR3 and ADB Safeguards and the Armenian (Air Quality) Regulations will be complied with.
<b>VOC's</b>	The Project will restrict storage and handling of hazardous materials and fuels to bunded areas of sufficient capacity to contain a release (please refer to the hazardous materials and waste chapter for all relevant measures).
<b>Odour</b>	Impermeable septic tank(s)/mobile toilets will be built/provided within the Project Area for collection of wastewaters (please refer to the hazardous materials and waste chapter for all relevant measures).



**Table 90 Air Quality- Management Measures- Operational Phase**

Impact / Risk	Management Measure
<b>Dust Generation</b>	Visual inspection on a daily basis of dust and air emissions throughout operation activities.
<b>Gaseous Emissions</b>	Monthly inspection and review of vehicle and equipment maintenance records.



The management measures listed for the construction phase will be applied during decommissioning, as relevant.

## 11.6. Residual Impact

**Table 91 Air Quality- Residual Impacts- Construction Phase**

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
<b>Dust Generation</b>	Moderate	Yes	Minor
<b>Gaseous Emissions</b>	Minor	Yes	No Change
<b>VOC's</b>	Negligible	Yes	No Change
<b>Odour</b>	Negligible	Yes	No Change



Table 92 Air Quality- Residual Impacts- Operational Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
Dust Generation	Negligible	Yes	No Change
Gaseous Emissions	Negligible	Yes	No Change

## 11.7. Monitoring Measures

Table 93 Air Quality- Monitoring Measures- Construction Phase

Impact / Risk	Monitoring Measure
Dust Generation	Visual inspection on a daily basis of dust and air emissions throughout construction activities.
Gaseous Emissions	Monthly inspection and review of vehicle and equipment maintenance records.
VOC's	Visual inspection of the condition of storage areas, fuel tanks, availability of spill kits, secondary containment as well as spill control measures.
Odour	Weekly inspection of the condition of septic tanks.

Table 94 Air Quality- Monitoring Measures- Operational Phase



Impact / Risk	Monitoring Measure
<b>Dust Generation</b>	Visual inspection on a daily basis of dust and air emissions throughout operation activities.
<b>Gaseous Emissions</b>	Monthly inspection and review of vehicle and equipment maintenance records.
<b>VOC's</b>	Although there will be reduced amounts of VOC's on site once the PV Plant is operational, there will still be small amounts of fuel etc stored on site. The same monitoring measures outlined in the construction phase will still apply during the operational phases to avoid environmental contamination.

The monitoring measures listed for the construction phase will be applied during decommissioning, as relevant.

## 12 Hazardous Materials & Waste Management

The objective of this chapter is to assess the impacts associated with the generation, handling, storage and transportation of waste material and hazardous material during the Project lifetime.



Improper hazardous materials and waste management contributes to a number of environmental problems, such as soil contamination from hydrocarbon leaks and heavy metals. If not properly disposed and/or contained, direct contamination to the soil and indirect contamination to sensitive receptors is likely. With proper management, a large amount of discarded non-hazardous materials can be recovered, reused or re-utilized. With regard to the hazardous wastes, these should be appropriately contained, treated and disposed of in order to prevent direct and indirect contamination issues.

### 12.1. Baseline Conditions

#### 12.1.1. Waste

Responsible waste management, as a result of waste generation and resource consumption, is essential to minimized direct and indirect impacts upon the environment. In order

to allow sustainable and environmentally friendly development in Armenia, it is vital to consider the methods for the handling, storage, and management of waste generated during the life-cycle of the Project.

Recognizing the need for environmentally safe disposal of hazardous waste, Armenia ratified UN Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their disposal. Armenia have also elaborated and adopted the “Law on Waste” of November 2004, which defines the state policy in the area of waste use in order to prevent the harmful impact of waste on the environment and human health, while maximizing its use as a secondary raw material. To ensure the enforcement of this Law, 29 sub-legislative acts have been adopted and several other measures are being implemented. These include “State registration of waste” and “Registration of waste generation and processing, as well as the removal locations”, with the purpose of creating and running their register.

Currently, there are sixty landfills in Armenia. There are 3 engineered landfill sites in Armenia, the closest one is called Nubarashen landfill which is located in Yerevan approximately 45km away from the Project site. There is a not engineered landfill site in Talin community which is operated by the municipality. Community garbage is collected by the communal service of the municipality and taken to the landfill site. There is no waste sorting, recycling, or reusing which takes place among at the landfill site in Talin. Instead, garbage is dumped into a working area and then flattened by a bulldozer. In the nearby communities, waste is sometimes dumped on undesignated dumping sites including roads, open fields, the Project site or

similar sites. Household waste is not sorted out and recycling rates remain significantly below their potential.



There are several hazardous waste treatment facilities in the country, but these are not located close to the Project site. Ekologia, Ecoprotect, Metexim Terminal and Am-Eska are hazardous waste treatment facilities that are in Yerevan.

### 12.1.2. Wastewater

The Armenian water supply and wastewater treatment operation were the responsibility of the State Water Committee, Ministry of Agriculture, Republic of Armenia from 2001 to 2004. In 2004, the Armenian Government on behalf the State Water Committee, Ministry of Agriculture and Yerevan City Hall outsourced two foreign companies for operating the Armenian water supply management and wastewater disposal.

The two companies operating Armenia’s water supply were “SAUR Group” CJSC which reports to the State Water Committee, Ministry of Agriculture, Armenia and “Veolia” CJSC which reports to the Municipality of Yerevan City.

“SAUR Group” CJSC is responsible for the following utilities: “Armenian Water and Sewerage” CJSC, “Shirak Water and Sewerage” CJSC, “Lori Water and Sewerage” CJSC, “Nor Akunk” CJSC and “Veolia” is responsible for “Yerevan Water” CJSC. Armenia has had 18 wastewater treatment plants but nowadays these utilities together have 6 plants: 1 in Yerevan City and 5 in the regions of Gegharkunik, Tavush, Vayots Dzor. These wastewater treatment plants only conduct mechanical treatment where the suspended and solid particles are mostly



removed. Wastewater is transported by a sewerage network which is present in all communities, there is no wastewater treatment which takes place and as a result is discharged into rivers throughout Armenia. This is a common practice in Armenia overall, not just local communities.



## 12.2. Sensitive Receptors

Table 95 Waste- Sensitive Receptors

Receptor	Receptor Sensitivity	Justification
Soil & Groundwater	Moderate	<p>Accidental releases of fuels, oils, chemicals, hazardous materials, etc. to the ground can potentially cause significant adverse impacts if not properly managed.</p> <p>Groundwater contamination can potentially occur if wastewater, hazardous materials or wastes reach the groundwater table. However, there is no groundwater onsite.</p>

## 12.3. Impacts

### 12.3.1. Construction Phase

#### Hazardous Materials

Hazardous materials are substances that when used inadequately or when released to the environment can reasonably pose a threat to human health or to any environmental component. Hazardous materials onsite will include fuel, oils, lubricants, paints, solvents, batteries. The quantity of hazardous materials onsite will be small and only be ordered as required for construction use.

observed during the construction phase with an estimated number of 250 employees present on site. This could result in a peak generation of 15,000 litres of wastewater per day. The Project aims to maximize local employment by hiring unskilled and semi-skilled workers meaning wastewater generation may be significantly lower than initially expected. Given that local employees will be commuting to the site and not utilizing worker accommodation, wastewater generation will be lower.

#### Domestic Wastewater

Drinking water needs to range from approximately 6L to 10L per person/day. However, considering water use for sanitary purposes (showers, washing, cooking, etc.), an estimation of 60L per person/day is expected during the construction phase. The highest influx of workers is expected to be

Domestic wastewater can create negative impacts at the point of generation, if released to the soil or groundwater, during transportation if released to the environment or at the treatment point if it is not adequately suited to treat the wastewater.

### Construction Wastewater

Construction wastewater can be generated during concrete batching, vehicle maintenance and the mixing of oils/lubricants in the wastewater due to equipment washing. The main water requirement during construction would be water for concrete production at the batching plant. The cement production process does not generate significant quantities of wastewater but concrete washing, vehicle washings and site run off occur that contain suspended solids and associated metals. Construction wastewater can create negative impacts if it is not adequately contained and treated. If adequate measures are in place, it is usually possible to treat construction wastewater onsite (settlement ponds for concrete washing, water-oil separators for vehicle washing areas) for reuse and avoid impacts.

### Waste and Waste Characterisation

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

- Hazardous wastes – materials which pose a potential hazard to the environment or health of employees or the general public;

- Non-hazardous wastes – solid materials which are not hazardous and degrade, chemically or biologically in the environment; and
- Inert wastes – materials that do not breakdown in the environment and are otherwise inert.



The main types of waste generated during construction include sand, gravel, concrete, scrap steel, glass, plastic, wood, packaging materials and waste from construction workers. Production of solid waste through packaging materials is expected to be high. Construction materials are predominantly inert and do not pose a threat to human health or the environment. However, correct management is required in order to reduce associated secondary waste impacts such as reducing resource use and avoiding impacts to natural habitats. The hazardous fraction of construction waste (oils, solvents, paints) is expected to represent less than 5% of the total amount of construction waste likely to be generated. All waste will be adequately contained and transported by licensed contractors to licensed treatment and disposal facilities. Reuse and recycling on-site will be maximized.



Oil Drums Stored Directly on Soil  
(illustrative only, not related to AYG-1)

Non-hazardous wastes will be stored in a designated area on the Project site and will be collected and transported to the community landfill in Talin once an agreement with communities is approved and signed.

Hazardous wastes will be stored in a designated area on the Project site and will be transported by a licensed contractor to a suitable hazardous materials facility where it will be disposed of.



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

**Table 96 Potential Waste Streams Associated with the Construction Phase**

Waste Type	Construction
<b>Inert</b>	Subsoil and Rock
<b>Non-Hazardous</b>	Concrete and cement
	Asphalt
	Scrap metal
	Wood
	Plastic
	Packaging
	Sewage and grey water from construction workers
	Water from washing surfaces that have not been in contact with.
	Municipal waste from construction workers
	Broken PV Panels
<b>Hazardous</b>	Resins and paints
	Waste oils
	Waste solvents and thinners
	Waste fuel and chemicals.
	Batteries
	Used spill kits and clean up materials.

Proper management is required in order to reduce associated impacts such as uncontrolled dispersion or inert and non-hazardous waste, or the release of hazardous waste, which can lead to land contamination and water pollution.

**Table 97 Hazardous Materials & Waste – Impact Magnitude – Construction Phase**

Impact	Magnitude	Likelihood	Justification
<b>Uncontrolled Dispersion / Release of Hazardous Materials, Construction Waste or Wastewater</b>	High	Possible	Hazardous waste and wastewater can potentially cause significant adverse impacts not only on the environment but also on human health, if not properly managed, However, these risks can be easily managed with appropriate preventive and mitigative measures

### 12.3.2. Operational Phase

#### Hazardous Materials & Solid Waste

Hazardous materials onsite will include small amounts of fuel, oils, lubricants, paints, solvents, batteries required for O&M activities. The quantity of hazardous materials onsite will be very small during the operational phase and will likely only be taken to the site if needed.

The Project operation phase will require maintenance throughout the operation phase to ensure extended system lifetime, as well as compliance with manufacturer warranty and

ensure efficiency in energy production. Routine maintenance activities include regular cleaning of panels and maintenance of electrical components, control equipment and access roads.



The nature of the proposed PV plant means that minimal waste will be generated from everyday operations, other than those involved in office/ domestic waste. The equipment used in the operational processes does not generate waste.

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

**Table 98 Anticipated Waste Streams- Operational Phase**

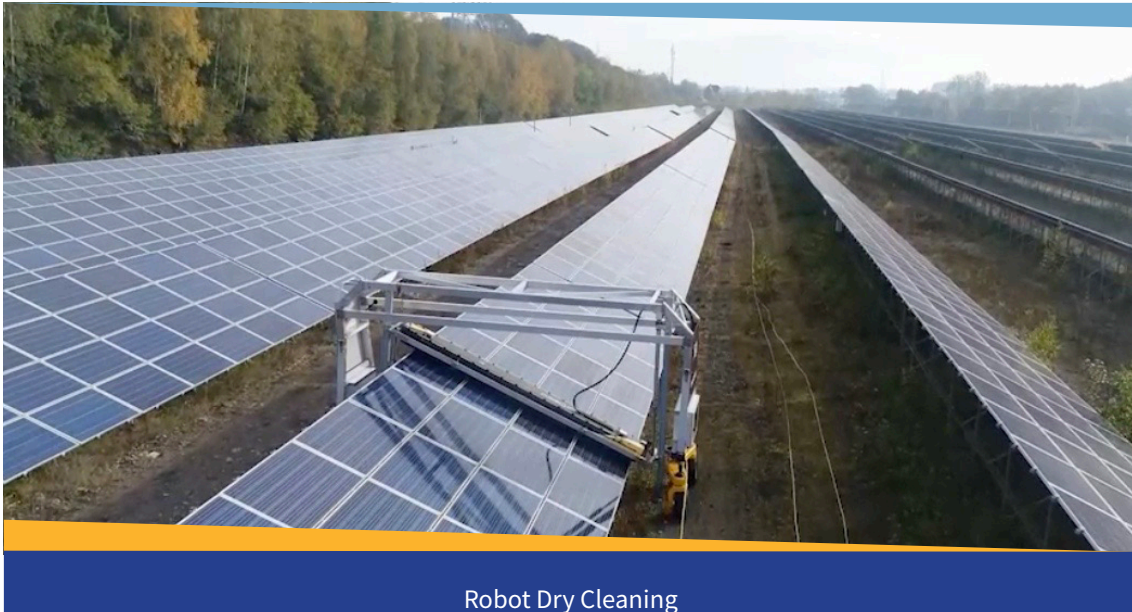
Waste Type	Operation
Non-Hazardous	Municipal waste from construction workers
	General domestic waste from offices and staff canteens
	Broken or under-performing PV Panels
Hazardous	Resins and paints
	Domestic scale Batteries
	Used spill kits and clean up materials.

#### Wastewater

The operational processes of the PV plant will not require the use of significant quantities of water, so no process wastewater will be generated. Wastewater during operation will be from sanitary / domestic sources and general cleaning.

**Table 99 Hazardous Materials and Waste- Impact Magnitude- Operational Phase**

Impact	Magnitude	Likelihood	Justification
Uncontrolled Dispersion / Release of Operational Waste or Wastewater	Low	Unlikely	Due to the small amounts of hazardous waste, non hazardous waste and wastewater generated during operations, the impact magnitude is considered to be low.



Robot Dry Cleaning

### 12.3.3. Decommissioning Phase

The Project is expected to have an economically useful lifespan of approximately 25 years and following this, the power plant infrastructure would either be decommissioned or upgraded (if a new license is granted) once it has reached the end of its economic life.

Upgrading the PV power plant will consist of replacing old PV modules for new ones, increasing the total peak power of the plant (a process called “Repowering”) or increasing the power of the plant by adding new elements such as trackers, PV modules or transformers.

If the plant is to be decommissioned, then the site should be returned to close to its original state. A Decommissioning and Site Restoration Plan will be developed prior to the decommissioning phase.

The facility will generate wastestreams similar to those observed during the construction phase, the following hazardous and non-hazardous waste streams during decommissioning.

During decommissioning, all above ground infrastructure will be removed. The components of a PV plant have an intrinsic value either for re-use or recycling. This value will cover the cost of decommissioning the plant and rehabilitating the site. Hazardous wastes will be disposed of in accordance with environmental guidelines required by the country; while the non-hazardous, like waste metals or plastics, will be delivered to respective recycling plants. It is anticipated that the redundant solar PV panels will be either recycled or sold for reuse, depending on performance and market conditions at the time.

Currently, there are no licensed solar module waste recycling organizations in Armenia. The policy in the field of hazardous waste in Armenia is currently being developed by the Ministry of Environment and the fact that solar plants have been widely installed in the territory of Armenia, it implies that opportunities for their utilization will be created in the near future.

Inert materials which cannot be recycled will be taken to a suitable disposal site.





## 12.4. Impact Assessment

Table 100 Hazardous Materials & Waste- Impact Assessment- Construction Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
Uncontrolled Dispersion / Release of Hazardous Materials, Waste or Wastewater	High	Possible	Soil / Groundwater	High	Major

Table 101 Hazardous Materials & Waste- Impact Assessment- Operational Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
Uncontrolled Dispersion / Release of Hazardous Materials, Waste or Wastewater	Low	Unlikely	Soil / Groundwater	High	Moderate

Decommissioning phase impacts are similar to construction impacts but with a lower magnitude and duration, except for the waste generated by the main Project components.

## 12.5. Management Measures

Table 102 Hazardous Materials & Waste- Mgt. Measures- Construction Phase

Impact / Risk	Management Measure
Waste Management Hierarchy	The waste management hierarchy establishes best practice for ensuring appropriate and sustainable use of resources and waste by preventing, reducing, re-using, recycling, recovering and disposing of waste. The hierarchy, which aims to achieve maximum reductions on waste quantities combined with the limited use of resources and landfill space, will be the cornerstone of the Project’s waste



Impact / Risk	Management Measure
	<p>management strategy. The waste management hierarchy also aims to reduce costs associated with material procurement, handling, transportation and the disposal of waste.</p> <p>The first step in the application of the waste management hierarchy is to consider options to prevent or reduce waste. Onsite composting facilities of organic waste will be installed and other options for recycling will be explored when they become available.</p> <p>Where waste generation cannot be avoided or further reduced at source, opportunities for reuse or recycling of materials will be explored, either for use for the same or a different purpose. Disposal to landfill is the least favored option in the waste hierarchy and will be the last resort after all other options have been considered.</p> <p>The waste management hierarchy will be communicated to and adhered to by all contractors.</p> <div> <p style="text-align: center;"><b>The Waste Hierarchy</b></p> </div>
<p><b>Solid Waste Management</b></p>	<p>Provide training to workers on the use of hazardous materials and on waste management.</p>
	<p>Provide training to workers on the use of hazardous materials and on waste management.</p>



Impact / Risk	Management Measure
	Provide adequate and appropriate storage areas.
	Ensure container types, labelling, classifying, etc. in the storage areas are in in line with Project standards.
	Segregate hazardous and non-hazardous wastes at source. Separate recyclable and non-recyclable solid waste and store separately until the related Municipality/ licensed firm collects it.
	Broken PV panels will be collected and stored until suitable recycling facilities became available. Broken or under-performing PV panels shall not be disposed of at landfills.
	Ensure the firms that will conduct transport/ recovery/ disposal of non-hazardous waste are licensed.
	Ensure that all excavation activities are implemented in line with the cut and fill program to minimise excavation waste.
	Under no circumstances will waste be burned, disposed of or buried on site.
	Ensure that the waste storage area does not allow waste to be blown away and dispersed by strong winds.
	Waste will be evacuated regularly and not be allowed to overflow.
	Food waste will be kept in lidded containers. Food waste will either be evacuated daily and food waste containers cleaned daily, or biodegradable waste bags will be used to store waste within the lidded waste containers.
	Chain of Custody forms will be used to ensure all waste is disposed of by the licensed contractor at the selected and licensed facility / landfill.



Impact / Risk	Management Measure
	Plastic bags are banned onsite, only biodegradable bags will be used.
<b>Hazardous Waste / Materials Management</b>	Ensure related waste disposal agreements with the Municipality and licensed recovery/disposal firms are in place.
	Hazardous material management will be included as a subject in EHS and OHS trainings to be provided to personnel.
	Hazardous material storage will be on hard standing and impermeable surface and the bulk storage facility will be bunded and secured. The Project will restrict storage and handling of hazardous materials and fuels to bunded areas of sufficient capacity to contain a potential accidental release.
	Oil will be stored at designated areas with secondary containment. The impermeable bund will have a capacity of at least 110% of the capacity of the tank and will be roofed.
	Hazardous materials will not be stored on-site until the hazardous materials and hazardous wastes storage area has been built by the EPC/contractors and inspected and approved by both the EPC and the Project Company.
	The MSDS will always be kept next to the hazardous materials storage and employees will be trained to understand the information described in MSDSs and its implications for emergency response.
	Routine control of hazardous materials and waste containers will be carried out and it will be ensured that they are not damaged, and no spill exists.
	All maintenance activities will be performed on suitable impermeable ground with a dedicated drainage and water/oil separator that prevents potential transport of contaminants to surface waters and groundwater.
	A designated area for refuelling of the mobile vehicles and machinery will be constructed (if required), with an impermeable surface and dedicated drainage.
Collection systems will be installed in these areas to manage any spills, fuels will be collected and either reused or removed by a licensed local contractor. Drip trays must be used when refuelling and servicing vehicles or equipment, where it is not on a hard standing surface.	



Impact / Risk	Management Measure
	Construction machinery and vehicles will be maintained and checked regularly in order to prevent spills and leakages of fuel and other hazardous materials.
	Spill kits, including absorbent pads and absorbent sands, PPE, a shovel and a container for used absorbent will be available near refuelling areas, hazardous material storage areas and hazardous waste storage areas at all times.
	Vehicle parking will be restricted to designated areas to minimise the potential for any oil or fuel leaks.
	Chain of Custody forms will be used to ensure all hazardous waste is disposed of by the licensed contractor at the selected and licensed hazardous waste disposal facility.
	A spill response procedure will be incorporated into the Emergency Preparedness and Response Plan (EPRP) which includes community sensitisation/ notifications when required. The Project will maintain spill clean up and response capability adequate for addressing spills for all phases of the Project. All spills will be immediately contained and cleaned up. Contaminated areas will be remediated, and post remediation verification will be carried out.
	<p>The spill response procedure should contain the following:</p> <ul style="list-style-type: none"> <li>• Response strategies for coordinated response to a spill;</li> <li>• Internal organization and responsibilities;</li> <li>• Reporting requirement;</li> <li>• Spill response resources, specifically spill kits, that must include as a minimum absorbent pads and absorbent sands, PPE, a shovel and a container for used absorbent will be available near refuelling areas, hazardous material storage areas and hazardous waste storage areas at all times;</li> <li>• Commitment to train personnel to conduct fuel and chemical handling according to formal procedures to reduce risk of accidental releases and fire and explosion hazards;</li> <li>• Conduct regular drills for practicing spill response actions;</li> </ul>





Impact / Risk	Management Measure
	<ul style="list-style-type: none"> <li>• Maintenance of any storage containers, treatment plants, pipes and components to be carried out regularly;</li> <li>• Provide firefighting equipment around the fuel tanks and any other hazardous flammable materials / waste storage areas;</li> <li>• All spills to be immediately contained and cleared up and proper wash down of the area and wastewater to be conveyed to an appropriate waste management site for treatment; and</li> <li>• If necessary, contaminated areas will be remediated and post remediation verification (e.g. soil sampling and laboratory analysis) will be carried out.</li> </ul>
<b>Wastewater Management</b>	Sanitary waste will not be discharged to the ground.
	Impermeable septic tank(s)/mobile toilets will be built/provided within the Project Area for collection of wastewater.
	Routine control and maintenance of domestic waste storage area(s) (i.e. septic tank(s)) will be carried out.
	Septic tanks will be emptied regularly by a license contractor for discharge to municipal sewage systems during the construction phase.
	All septic tanks will have secondary containment.
	If underground septic tanks are used, secondary containment is required and the space between the septic tank and the secondary containment will not be covered with soil or sand, to allow for the visual inspection of the bund and detection of leaks.
	Chain of Custody forms will be used to ensure all wastewater is disposed of by the licensed contractor at the selected and licensed wastewater treatment plant.

Table 103 Hazardous Materials & Waste- Mgt. Measures- Operational Phase



Impact / Risk	Management Measure
<b>Waste Management</b>	Implement the waste management hierarchy during all project phases. The management measures described below will be included in the operational HMWMP.
<b>Solid Waste Management</b>	Provide training to workers on the use of hazardous materials and on waste management.
	Provide adequate and appropriate storage areas.
	Ensure container types, labelling, classifying, etc. in the storage areas are in in line with Project standards.
	Segregate hazardous and non-hazardous wastes at source.
	Separate recyclable and non-recyclable solid waste and store separately until the related Municipality/ licensed firm collects it.
	Ensure the firms that will conduct transport/ recovery/ disposal of non-hazardous waste are licensed.
	Under no circumstances will waste be burned, disposed of or buried on site.
	Ensure that the waste storage area does not allow waste to be blown away and dispersed by strong winds.
	Broken PV panels will be collected and stored until suitable recycling facilities became available. Broken or under-performing PV panels shall not be disposed of at landfills.



Impact / Risk	Management Measure
	<p>Food waste will be kept in lidded containers. Food waste will either be evacuated daily and food waste containers cleaned daily, or biodegradable waste bags will be used to store waste within the lidded waste containers.</p> <p>Chain of Custody forms will be used to ensure all waste is disposed of by the licensed contractor at the selected and licensed facility / landfill.</p> <p>Plastic bags are banned onsite, only biodegradable bags will be used.</p>
<b>Hazardous Waste / Materials Management</b>	<p>Ensure related waste disposal agreements with the licensed recovery/disposal firms are in place.</p> <p>Hazardous material management will be included as a subject in EHS and OHS trainings to be provided to personnel.</p> <p>Hazardous material storage will be on hard standing and impermeable surface and the bulk storage facility will be bunded and secured. The Project will restrict storage and handling of hazardous materials and fuels to bunded areas of sufficient capacity to contain a potential accidental release.</p> <p>Oil will be stored at designated areas with secondary containment. The impermeable bund will have a capacity of at least 110% of the capacity of the tank and will be roofed.</p> <p>The MSDS will always be kept next to the hazardous materials storage and employees will be trained to understand the information described in MSDSs and its implications for emergency response.</p> <p>Routine control of hazardous materials and waste containers will be carried out and it will be ensured that they are not damaged, and no spill exists.</p> <p>All maintenance activities will be performed on suitable impermeable ground with a dedicated drainage and water/oil separator that prevents potential transport of contaminants to surface waters and groundwater.</p> <p>There will be no onsite refuelling or vehicle cleaning during operations, unless major unscheduled maintenance is required. Should this be the case, the measures listed in the construction phase section for onsite refuelling will be applied</p>



Impact / Risk	Management Measure
	<p>Construction machinery and vehicles will be maintained and checked regularly in order to prevent spills and leakages of fuel and other hazardous materials.</p> <p>Spill kits, including absorbent pads and absorbent sands, PPE, a shovel and a container for used absorbent will be available near refuelling areas, hazardous material storage areas and hazardous waste storage areas at all times.</p> <p>Vehicle parking will be restricted to designated areas to minimise the potential for any oil or fuel leaks.</p> <p>Chain of Custody forms will be used to ensure all hazardous waste is disposed of by the licensed contractor at the selected and licensed hazardous waste disposal facility.</p> <p>A spill response procedure will be incorporated into the Emergency Preparedness and Response Plan (EPRP) which includes community sensitisation/ notifications when required. The Project will maintain spill clean up and response capability adequate for addressing spills for all phases of the Project. All spills will be immediately contained and cleaned up. Contaminated areas will be remediated, and post remediation verification will be carried out.</p>
	<p>The spill response procedure should contain the following:</p> <ul style="list-style-type: none"> <li>• Response strategies for coordinated response to a spill;</li> <li>• Internal organization and responsibilities;</li> <li>• Reporting requirement;</li> <li>• Spill response resources, specifically spill kits, that must include as a minimum absorbent pads and absorbent sands, PPE, a shovel and a container for used absorbent will be available near refuelling areas, hazardous material storage areas and hazardous waste storage areas at all times;</li> <li>• Commitment to train personnel to conduct fuel and chemical handling according to formal procedures to reduce risk of accidental releases and fire and explosion hazards;</li> <li>• Conduct regular drills for practicing spill response actions;</li> </ul>



Impact / Risk	Management Measure
	<ul style="list-style-type: none"> <li>• Maintenance of any storage containers, treatment plants, pipes and components to be carried out regularly;</li> <li>• Provide fire-fighting equipment around the fuel tanks and any other hazardous flammable materials / waste storage areas;</li> <li>• All spills to be immediately contained and cleared up and proper wash down of the area and wastewater to be conveyed to an appropriate waste management site for treatment; and</li> <li>• If necessary, contaminated areas will be remediated and post remediation verification (e.g. soil sampling and laboratory analysis) will be carried out.</li> </ul>
<b>Wastewater Management</b>	Sanitary waste will not be discharged to the ground.
	Impermeable septic tank(s)/mobile toilets will be built/provided within the Project Area for collection of wastewater.
	Routine control and maintenance of domestic waste storage area(s) (i.e. septic tank(s)) will be carried out.
	Septic tanks will be emptied regularly by a license contractor for discharge to municipal sewage systems during the construction phase.
	All septic tanks will have secondary containment.
	If underground septic tanks are used, secondary containment is required and the space between the septic tank and the secondary containment will not be covered with soil or sand, to allow for the visual inspection of the bund and detection of leaks.
	Chain of Custody forms will be used to ensure all wastewater is disposed of by the licensed contractor at the selected and licensed wastewater treatment plant.



Table 104 Hazardous Materials & Waste- Mgt. Measures- Decommissioning Phase



Impact / Risk	Management Measure
<b>PV Panel Recycling</b>	A decommissioning and site restoration plan will be prepared identifying appropriate measures for PV Panel recycling.
	PV Panels will be segregated in the waste storage area and separated based on if they can be recycled or sold
	PV Panels will be transported for recycling by a licensed third party contractor
<b>Hazardous Waste</b>	Hazardous wastes will be disposed of in accordance with environmental guidelines required by the country.
	Chain of Custody forms will be used to ensure all hazardous waste is disposed of by the licensed contractor at the selected and licensed hazardous waste disposal facility.
	Ensure related waste disposal agreements with the licensed recovery/disposal firms are in place.
<b>Non-Hazardous Waste</b>	Segregate hazardous and non-hazardous wastes at source.
	Separate recyclable and non-recyclable solid waste and store separately until the related Municipality/ licensed firm collects it.
	Ensure the firms that will conduct transport/ recovery/ disposal of non-hazardous waste are licensed.
	Under no circumstances will waste be burned, disposed of or buried on site.



## 12.6. Residual Impact

Table 105 Hazardous Materials & Waste- Residual Impacts- Construction Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
Uncontrolled Dispersion / Release of Hazardous Materials, Waste or Wastewater	Major	Yes	Negligible

Table 106 Hazardous Materials and Waste- Residual Impacts- Operational Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
Uncontrolled Dispersion / Release of Hazardous Materials, Waste or Wastewater	Moderate	Yes	Negligible

## 12.7. Monitoring Measures

Table 107 Hazardous Materials & Waste- Monitoring Measures- Construction Phase

Impact / Risk	Monitoring Measure
Improper Waste Management	Visual inspection of the condition of solid non-hazardous waste segregation and storage areas.
	Waste log monitoring.
	Monitoring of chain of custody documents.



Impact / Risk	Monitoring Measure
<b>Uncontrolled Dispersion / Release of Wastewater</b>	Monitoring of waste contractor register.
	Monitoring of training records.
	Visual inspection of the condition of sanitary facilities and septic tanks.
	Monitoring of records of Liquid Waste Consignment Notes.
	Monitoring of chain of custody documents.
	Monitoring of training records.
<b>Uncontrolled Dispersion / Release of Hazardous Waste and Material</b>	Visual inspection of the condition of hazardous waste segregation and storage areas.
	Waste log monitoring.
	Monitoring of hazardous materials register.
	Monitoring of training records.
	Monitoring of emergency drill records.



Impact / Risk	Monitoring Measure
	Verification of availability of spill kits.
	Verification of availability of MSDSs.

**Table 108 Hazardous Materials and Waste- Monitoring Measures- Operational Phase**

Impact / Risk	Monitoring Measure
<b>Improper Waste Management</b>	Visual inspection of the condition of solid non-hazardous waste segregation and storage areas.
	Waste log monitoring.
	Monitoring of chain of custody documents.
	Monitoring of waste contractor register.
	Monitoring of training records.
<b>Uncontrolled Dispersion / Release of Wastewater</b>	Visual inspection of the condition of sanitary facilities and septic tanks.
	Monitoring of records of Liquid Waste Consignment Notes.



Impact / Risk	Monitoring Measure
	Monitoring of chain of custody documents.
	Monitoring of training records.
<b>Uncontrolled Dispersion / Release of Hazardous Waste and Material</b>	Visual inspection of the condition of hazardous waste segregation and storage areas.
	Waste log monitoring.
	Monitoring of hazardous materials register.
	Monitoring of training records.
	Monitoring of emergency drill records.
	Verification of availability of spill kits.
Verification of availability of MSDSs.	

The monitoring measures listed for the construction phase will be applied during decommissioning, as relevant.



# 13 Social Risks & Impacts - Overview

## 13.1. Chapter Structure

Social risks and impacts related to PV power Projects include a number of distinct but interrelated aspects. The discussion of social aspects in this ESIA report follows the following structure:

- **Demography:** This chapter focuses on understanding the demography of local communities in the Project area. It describes the population characteristics, dynamics and addresses impacts like the potential influx of job seekers into the Project area as a result of the Project.
- **Local Governance:** This chapter describes the governance structures and dynamics within the local communities. It also addresses potential risks (e.g., corruption) and benefits that the Project can potentially have on local governance.
- **Economic Conditions:** This chapter describes the local economy, livelihoods and employment in the Project area and the potential direct and indirect impacts of the Project on these aspects, including risks like the frustration of local expectations in relation to the Project and local inflation, and positive impacts like employment, skills development and purchases of Project



supplies locally.

- **Social Welfare:** This chapter describes the systems that are in place to maintain the well-being of society, including healthcare and education, and other organizations and structures operating in the Project area to support the communities or specific social groups. Potential Project impacts discussed in this chapter include negative impacts on social infrastructure (e.g., adding pressure on the local healthcare system), the spread of communicable diseases, potential impacts on social support networks, and potential positive impacts such as support from the Project to the education and healthcare system or capacity building.
- **Community Safety and Security:** This chapter describes the security conditions in the Project area and addresses the risks that the Project can pose to local communities in relation to security and community safety, including potential conflicts between Project employees and locals, risks associated to the Project's security contractors and direct safety risks from the Project activities (e.g., construction safety risks, road safety).
- **Cultural Heritage:** This chapter focuses on the potential archaeology and cultural heritage related impacts, including both tangible and intangible cultural heritage.
- **Labour and Working Conditions:** This chapter addresses the risks related to the labour and working conditions of the Project workforce, including employment rights, non-discrimination and equal opportunities, child and forced labour, worker organizations and worker accommodation. The chapter

specifically discusses risks associated with subcontractors and suppliers.

- **Occupational Health and Safety:** This chapter addresses the OHS risks relevant to the Project.



## 13.2. Social Survey

The social survey gathered primary data for the baseline sections of chapters within this ESIA report. The methodology of the social survey is described here to avoid repetition in all social chapters.

The communities living within the Project area were interviewed during a social survey with focus on significant social and related environmental issues. The survey tools that were used include questionnaires, structured interview guides, check-lists, etc. Overall, the study was undertaken through the stages described below. The social survey report is available in full in the annexes provided.

### Initial Site Reconnaissance and Scoping

The initial scoping site visit was designed to provide a preliminary view of the communities in the area. It involved establishment of the diversity on physical environment, demographic and socio economic conditions in the area. The study team has a strong track record on the study of issues and socioeconomic surveys in that part of the county.

The methodology used involved preliminary activities and meetings done by the team during the scoping stage before the actual assessment, they included reconnaissance visits to the Project area and also meetings with

keystakeholders as described in the stakeholder engagement chapter. The information obtained was used to plan the subsequent fieldwork and logistics. The consultant met the heads of communities from Talin and Dashtadem communities. These communities are near the Project site and are affected by the Project. The table below shows the schedule of the meetings. The questionnaires for the social

survey were tested and adjusted as relevant for successful implementation in the Project area.



**Table 109 Social Survey Preparatory Meetings**

Community	Date	Venue
Talin	26 <sup>th</sup> August 2021	Talin Administration Office
Dashtadem	18 <sup>th</sup> August 2021	Dashtadem Administration Office
Dashtadem	9 <sup>th</sup> January 2021	Community Hall and Regional Administration Office
Talin	9 <sup>th</sup> January 2021	Community Hall and Regional Administration Office
Talin	1 <sup>st</sup> July 2022	Talin Administration Office

**Initial Engagement for Survey Design:**

This section describes the stakeholder engagement process used to plan and design the social survey, which feeds baseline information into the subsequent chapters and has also informed the impact assessment and mitigation sections of this ESIA.

There were two meetings held during August of 2021 with the Heads of Communities from Dashtadem and Talin communities. The team from Energy Advisory met with the head of Dashtadem and Talin community and gathered information related to the Project site, social dynamics in the Project area and previous land uses at the Project site.

On the 9th of December 2021, the first public consultations were conducted. The consultants informed community members about the ESIA studies, baseline surveys and potential project impacts. On the 1st of July 2022 the second public consultations took place and focussed on the preliminary assessment (scoping phase) of the environmental impact of the construction and operation of the Project. The consultants presented the outcome and findings of the Scoping Stage to local communities. Useful information from community members was gathered during the first and second consultation meetings which informed certain elements of the social survey.



## Field Survey

The socioeconomic survey is aimed to understand the social characteristics of the Project area, hence allowing for the identification, assessment and management of potential Project impacts. The study aimed to establish a baseline on social and economic trends (population trends, settlement trends, economic patterns, cultural setting and linkages, land ownership issues, informal land uses, use of natural resources, etc.).

Specific objectives of the field assessment included:

- Obtain any available information and data from the local public offices;
- Evaluation of the environmental setting around the Project site. General observations were focused on land use trends, public amenities, settlements, economic activities, social interactions, etc.;
- Evaluation of social, economic and cultural settings in the Project area; and

- Undertake an additional consultative public participation exercise so as to reach a large section of the communities and PAPs, including those who did not attend public consultations, to ensure that they concern on the perceived environmental and social impacts of the Project and the associated opportunities were adequately captured in the ESIA package.

The field survey consisted of the following elements:

- Household survey;
- Obtain any available information and data from the local public offices;
- Observations.

Following the testing of the household survey questionnaire, the field work for the household survey was conducted during August 2022. The sample size was 80 households of the Affected Communities: 10 households in Ashnak, 10 in Katnaghbyur, 25 households in Dashtadem and 35 in Talin. Each household was chosen by a random selection of streets with every second household on each street being surveyed. The number of households surveyed from each



Main Square Talin Community



community was due to Talin and Dashtadem owning the area of land at the Project site prior to land acquisition by for the Government. It was confirmed during the survey preparation that the land was used primarily by these two communities. In addition the higher population size of Talin was also considered to determine sample sizes.

Questionnaires were used to collect socio economic data. The data provided information about but not limited to the following:

- Household demographics, main occupation and composition;
- Household vulnerability (people with disabilities, household head gender, etc.);
- Education level;
- Project acceptability and issues of community members;
- Land use in the project area;
- Health status
- Community safety; and
- Infrastructure and utilities.

### Observations

Observation was used during the data collection exercise and also as a means of ascertaining some of the issues raised during the stakeholder engagement process and household survey. Economic conditions, livelihoods and production systems, land use, settlement patterns and facilities as well as natural resources were identified, noted and photographed for documentation purposes.

The findings of the socioeconomic survey are described on each socioeconomic chapter, as relevant.



Dashtadem Community



### 13.3. Definition of Affected Communities



As defined in the glossary, the affected communities for the proposed Ayg-1 PV Plant are the Talin, Dashtadem, Ashnak and Katnaghbyur communities. These communities are considered to be potentially impacted by the Project, and even after mitigation it is expected that residual positive and negative environmental and social impacts will be noticeable at these communities.

Talin community is the largest of the affected communities with a population of 4,072 as per the 2020 census. Most of the gross output in Talin is provided by agriculture. Animal husbandry is mainly developed, they are engaged in large and small cattle breeding, poultry breeding and use the communal lands at the Project site for livestock grazing. Talin city is 1.4km from the Project site, the Project will also use former communal land of the Talin community, provided for the Project by the Government of Armenia.

Dashtadem Community is located 1.25km from the Project site with a population of 627 persons according to the 2020 Census. In regards to population, this is the smallest affected community, but most of the Project land was formerly communal land of this community. The population is mostly engaged in animal husbandry and farming and use communal lands for livestock grazing.

Ashnak community is located 0.5km to the south east of the Project site, the community and the Project site are separated by a gorge. According to the 2020 Census, Ashnak has a population of 1,379.

Katnaghbyur community is located 2.3 km north east of the Project site with a population of 1,336 according to the 2020 Census. There has been no communal land has been acquired for construction of the Project site.

At the beginning of Project development, Talin, Dashtadem, Ashnak and Katnaghbyur communities were considered separate communities, from an administrative standpoint. However, since 2022, a process of consolidation of local authorities has been carried out, and over 20 communities including Dashtadem, Ashnak and Katnaghbyur have merged into Talin community.

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## 14 Demography

This chapter describes the demographic baseline conditions in the Project area, including population characteristics (size, sex ratio, age), religion and ethnic composition, average household size and gender roles, and identifies potential Project impacts.

### 14.1. Observations and Baseline Conditions

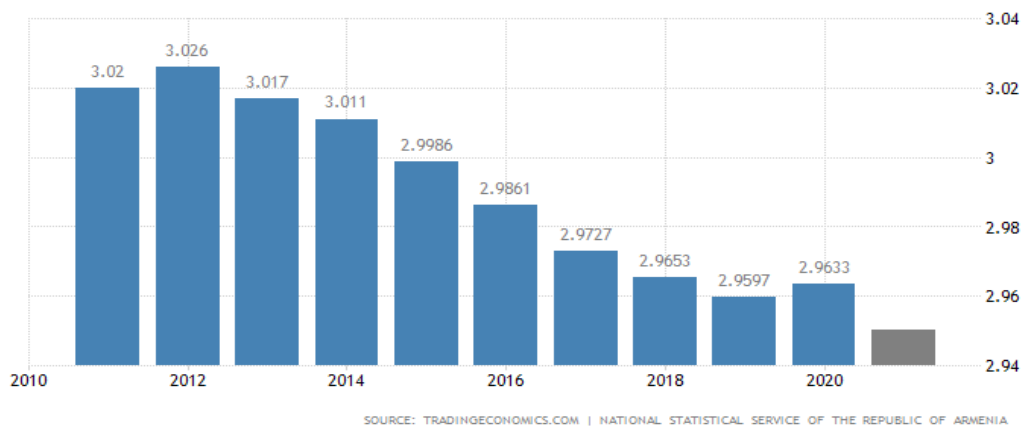
#### Population Characteristics

Armenia has experienced a population decline since the dissolution of the USSR in 1991, but the decline levelled out again during the years 2008-2010. Based on the UN population Projections, the population of Armenia was close to 3 million as of 2020. The annual growth rate of the population in Armenia has been wavering on both sides of zero since the turn of the century, gaining numbers just notice a decline in population a few years later leading to little overall change. As of 2019, the population was close to a standstill growing at just 0.09% per year. According to 2020 statistics, the population of the Aragatsotn Marz region comprises of 124,700 Armenian's.

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Figure 17 Armenia- Historical Population Growth From 2010-2020



As of 2020 the population of the Aragatsotn Marz region is predominantly made up of rural communities with urban populations making up just 21.5% of the regions’s total. The four local communities surrounding the proposed project area (Talin, Dashtadem, Katnaghbyur and Ashnak) contain just 5.86% of the total population of the Aragatsotn Marz region. Of these four communities, Talin has the largest and most urbanised population at 4,072. While making up only 3.27% of the total population of

the region, Talin holds 15.19% of the total urban population in Aragatsotn Marz, highlighting the regions rural dominance. The remaining three rural communities, however, have small populations and combined make up just 3.31% of the rural population of Aragatsotn Marz.

Table 110 Population Data (2020)

Population Data	N/%
Total population of Aragatsotn Marz Region	124,700
Urban population of Aragatsotn Marz Region	26,800
Rural population of Aragatsotn Marz Region	97,900
Population - local communities	7,314
Share of the population of local communities in the total population of Aragatsotn Marz	5.86%
Share of the population of Talin in the urban population of Aragatsotn Marz	15.19%
The share of the population of local rural communities in the rural population of Aragatsotn Marz	3.31 %

Recent years have seen changes in the composition of the population of local communities surrounding the Project site. According to the 2011 census, the total population of the local communities surrounding the project site made up just 8,163 persons. Further investigation has shown that the declining trend in the population of Armenia, since 2011, has also been reflected in the local communities in this project area (Table

107) The total population of these communities has declined by 10.4% between 2011 and 2020 with the most significant decline observed in the Talin region which saw a population decline of 23.3% during the same time period. Katnaghbyur has also seen a small population decline from 2011 to 2020. However, in contrast, the Dashtadem and Ashnak communities have recorded moderate population growth.



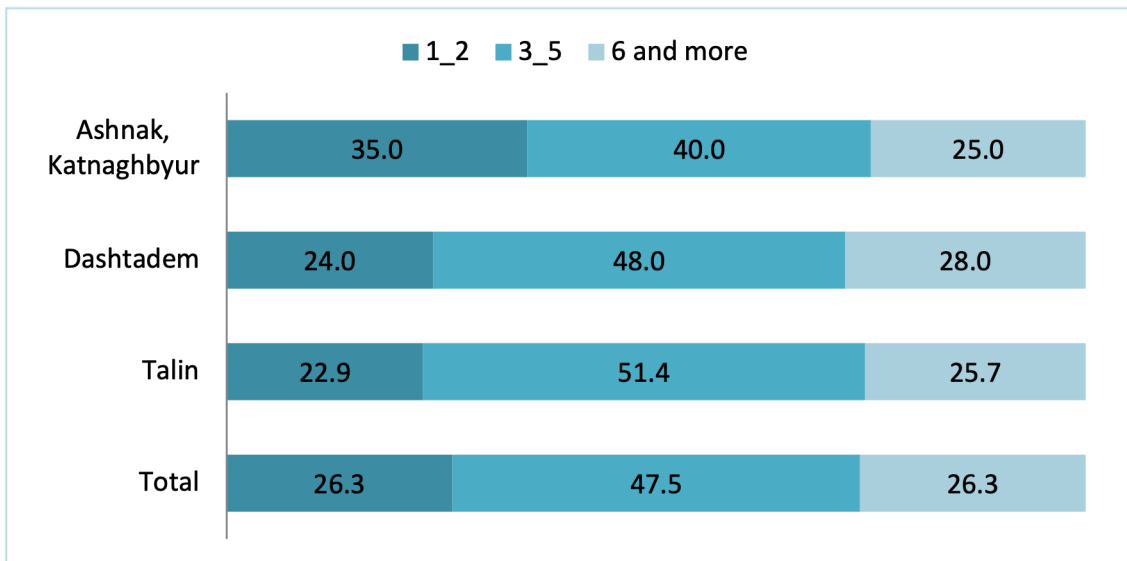
**Table 111 Local Communities Population 2011 vs 2020**

Community	2011 Census	As of the beginning of 2020
Talin	5,310	4,072
Dashtadem	548	627
Katnaghbyur	1,274	1,236
Ashnak	1,031	1,379
<b>Total</b>	<b>8,163</b>	<b>7,314</b>

Overall, 51.4% of households in the four communities surrounding the project site consist of 3-5 people. Following this, families with 1-2 and 6 or more members make up an even mass of 26.3% each. The table below represents this. In the city of Talin, there is a 51.4% of households that have between 3-5 family members. The highest percentage of household members is between 3-5 family members across all four communities surveyed. Although the highest percentage of household members in Ashnak and Katnaghbyur is between 3-5, families of 1-2 people are increasing sharply and families of 3-5 people are decreasing (respectively, 35.0%, 40.0%).

Most of the families of 1-2 members surveyed (81%) consist of elderly people who live without children. There is one instance of unmarried sisters with no children), and 19% of families consist of a parent and one child.

Figure 18 The Number of Household Members by Settlement (%)



During the household survey, participants of the following ages live in the households that participated in the survey: Children under 6 make up 4.7% of the total number surveyed. School-age children aged 7-17 make up 18.6%. Three age groups: 18-35, 36-50, 63 and older, have an equal percentage (19.9%) of the adult population. People aged 51-62 make up 17.1%. Data derived from the household

survey indicates that households are mainly managed by older generations. In almost half of the families surveyed, 48.8% have a household head over the age of 63. There were 40% of the households surveyed have stated the household head is between 51-62 years old. Only 11.3% of the households have HH heads below 50 years old, indicating the overall importance of age in household roles.

Table 112 Age Composition (%)

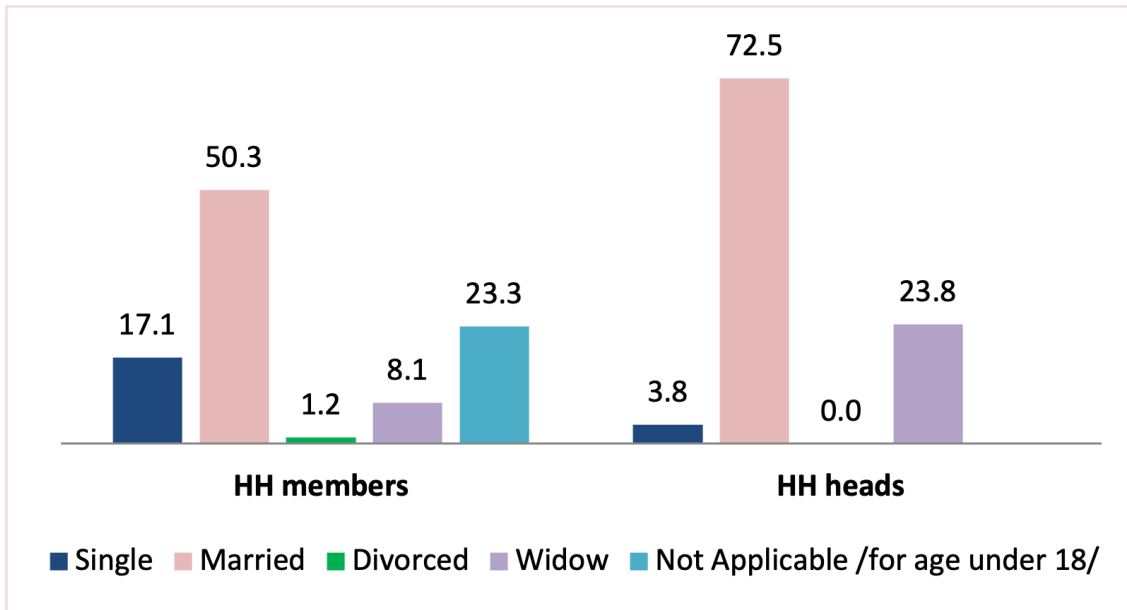
Age Groups	HH Members	HH Heads
0-6	4.7	-
7-17	18.6	-
18-35	19.9	1.3
36-50	19.9	10.0
51-62	17.1	40.0
63+	19.9	48.8
<b>Total</b>	100%	100%

Half of the household members and 72.5% of the household heads are married. As mentioned, HH heads are mainly comprised of elderly people. As a result of this, 23.8% of married household members have already become widows. Unmarried people also make up 3.8% of house heads. Among the total members

of households, those who are married make up the largest number of people surveyed, unmarried participants make up 17.1% of the total surveyed while widows comprise of 8.1%. Divorced people make up only 1.2% of the total households surveyed.



Figure 19 Marital Status (%)



Emigration

The local communities are ethnic Armenians who have migrated from Western Armenia at different times. For example, part of the population of Talin migrated mainly from Mush, Sasun and Alashkert regions since 1829. The ancestors of the inhabitants in Dashtadem and Katnaghbyur villages were Armenians deported from Mush, Sasun, Alashkert, and Khnus in 1915. The population of Ashnak village was also formed mainly with settlers from the villages of Sasun in 1914-1920.

After the collapse of the Soviet system in 1992- 1994, the biggest wave of emigration began in both Armenia and Aragatsotn Marz, the main causes of which was the Artsakh war and its consequences, as well as the country's energy and economic crisis. Following this, there is still a large number of the population emigrating from Armenia to Russia and to a number of countries within the EU.

The data in the table 109 below indicates that the population of the Aragatsotn Marz region has also decreased due to emigration. If we compare 2012-2016 and 2016-2020 Statistical data, we will see that in the last 5 years emigration rates have increased, especially from urban areas. The results of our study indicate that the rate of emigration is higher than the rate of immigration in the affected settlements. Figure 13 demonstrates that 16.3% (13 families) of the studied households, people emigrated, and in 5.0% there was immigration (4 families).

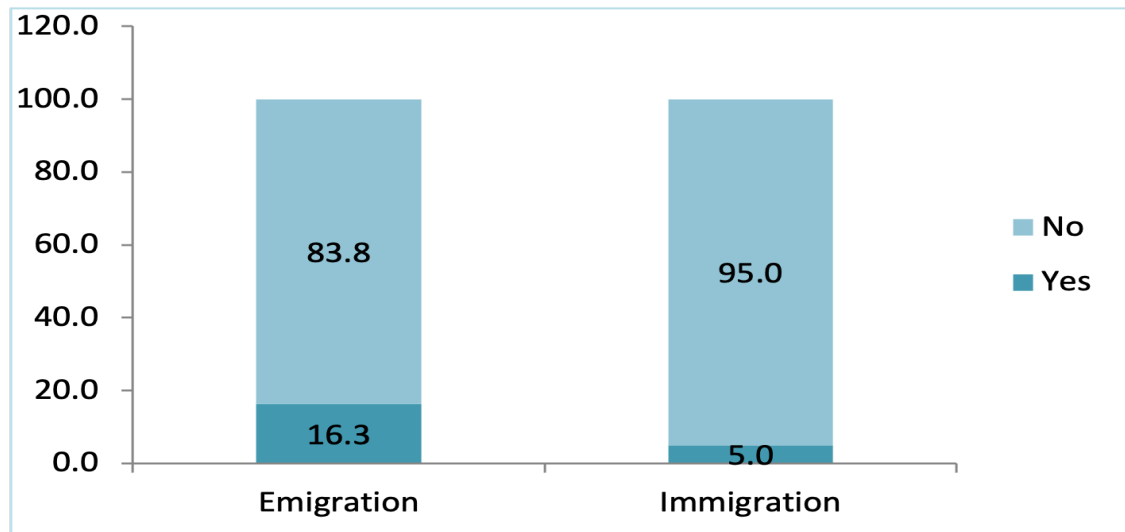
According to the results of the socio-economic survey, there are migrant members from 13 HHs. In the case of 85% of them, migration took place with complete families consisting of both women and men. Only sons emigrated from 2 HHs (15%). Based on these data, we can say that the percentage of emigration is slightly higher for males.

Table 113 The Population of Aragatsotn Marz by Years

Aragatsotn	2012	2016	2020	2012-2016, %	2016-2020, %
Urban	30,600	29,100	26,800	-4.90	-7.90
Rural	102,400	100,700	97,900	-1.66	-2.78
Total	133,000	129,800	124,700	-2.41	-3.92



Figure 20 The Population of Aragatsotn Marz by Years



In general, the reasons for emigration are socio-economic in nature: unemployment, low incomes, poor farming conditions, etc. There is also internal migration from these communities, they go to Yerevan for education and work purposes. Overall, the population of the Aragatsotn Marz region has decreased by 6.2% over the past 9 years. In the previous 10 years, more emigration took place from Dashtadem village and Talin city than in Ashnak or Katnaghbyur. 46.2% of surveyed Dashtadem residents have emigrated while 38.5% of Talin residents have emigrated in the past 10 years. Ashnak and Katnaghbyur have relatively smaller emigration rates with 15.3% of surveyed community members migrating. This decrease in population is caused not only by the growth of emigration but also by the reduction of natural growth rates.

The reasons for emigration in this region are mainly due to socio-economic conditions: unemployment, low incomes, unfavourable conditions for agriculture, etc. The household survey has revealed residents of the four local communities mainly emigrate to Russia. A total of 9 families who previously lived in the Project area have emigrated to Russia in recent years. The respondents to the survey outlined the opportunity of working abroad as the main reason for the emigration of their family members. Four other households have emigrated to other European countries such as Germany, Italy, USA and Ukraine. In addition to finding attractive job prospects abroad, respondents also mentioned treatment and poor socio-economic conditions in Armenia as reasons for emigration.

There is also internal emigration from local communities, residents are known to move to Yerevan permanently for education and work. According to unofficial data, community leaders in rural local communities have conveyed that the rates of emigration abroad have been quite low in recent years. Only 15 farm households have emigrated from the county, mostly from the village of Ashnak.

In terms of immigration, the main country that HH members have travelled from is also Russia. Three household members out of four families returned from Russia to Armenia. Their return was due to various factors, both psychological (due to homesickness) and personal motives (due to family circumstances, age).

According to the results of the socio-economic study, only 4 families returned to Armenia in the last 10 years. In 3 out of 4 families, household members returned from Russia, and their return is due to both psychological (due to homesickness) and personal reasons (due to family circumstances, due to age). 1 family returned from Ukraine, the reason for which is again missing their country.

**Ethnic Composition and Religion**

Armenia is the most ethnically homogeneous country of the former Soviet Union with 98% of its population identified as Armenian. The Yazidis form the largest non-native population living in Armenia, the majority of the Yazidis came to the country in 19th and early 20th centuries following the religious persecutions they were experiencing by the Ottoman Turks and the Sunni Kurds. According to the 2011 census around 35,000 Yazidis live in Armenia.

Russians make up the second largest minority. In the 2011 census there were 11,911 Russians counted, making up nearly 0.4% of the whole population.

Results of the household survey indicates that 99.7% of the respondents were Armenian while 0.3% Russian.

Most Armenians are Christian, primarily of the Apostolic Church rite. Over 90% of Armenians belong to the Armenian Apostolic Church. Armenia also has a population of Catholics and evangelical Protestants. According to the Census of 2011, the religion in Armenia is the following:

- Christianity 2,862,366 (94.8%) of whom 2,797,187 Armenian Apostolic (92.5%);
- 29,280 Evangelical;
- 13,996 Armenian and Roman Catholic;
- 8,695 Jehovah's Witness;
- 8,587 Eastern Orthodox;
- 2,874 Molokan;
- 1,733 Assyrian Church of the East;
- 733 Protestant;
- 241 Mormon, Yazidism;
- Paganism;
- 812 Islam;
- 5,299 Other Religion.

**Persons with Disabilities**

People with disabilities are considered members of a vulnerable group. According to the community register, there are 685 people with disabilities in the four local communities, which makes up about 9.4% of the population.



## Gender

There are 2.6% more women than men in the Aragatsotn Marz, as is outlined in the table below. The gender ratio of the population in the local communities does not differ much from the data of the Marz region. The share of women and men is almost equal in the total population (50.2% and 49.8%, respectively). According to the World Bank, as of 2016, 33.2% of the households in Armenia are recorded as female headed households. The number of female headed houses has declined since 2010. The world bank reported that 37.1% of the total households in Armenia were headed by women in 2010 which is a decrease of 4% in the 6-year time period.

Households led by women are poorer than men-led households. These are mainly families where the husbands are absent/dead, and the wives are involved in low-paid jobs. The number of such families in the local communities is 262, the share in the total number of households is 9.73%. According to the Statistical Committee, the risk of poverty increases with the growth of family members. In contrast to urban households, rural households are larger in the region. The average number of members per household is 3.15 for the villages of the Aragatsotn Marz region and 3.00 for larger and more central cities on average. Families with large numbers of children and fewer breadwinners are poorer and more vulnerable when compared with smaller families. In the local communities, the share of households with 3 or more children and large families in the total number of households is quite high. This figure is 22.73% and 9.92%, respectively.

In general, household heads in the affected settlements of the project are mostly men. There are 4 households out of 80 surveyed that are women headed households. According to the results of the survey, male and female members are almost equally represented in these households.



Although the heads of Armenian families are mostly men which is evidenced by our quantitative indicators, women play various role in the family and participate in the management of family issues together with men. More than half of women (61.3-78.8%) fully participate in the decision-making process in one or more issues. In the surveyed families, women's participation is relatively high in decision-making processes related to household matters. In contrast, women's participation in decision making related to financial investments is low.

Survey results indicate that only 11.3% of women take part in decision-making at all in matters related to the purchase or sale of important assets such as land, cars, etc. Results have indicated that all women participate in household matters or daily shopping, and a very small number (1.3%) do not participate in matters related to children's education. Not applicable options refer to cases where the studied families consisted of either only women or only men, or when the respondents indicated that such issues were not discussed in their families.

**Table 114 Gender Composition of the Local Communities (%)**

Gender	Settlements	
	Aragatsotn marz	Local communities
Male	48.7	49.8
Female	51.3	50.2
Total	100.0	100.0



**Table 115 Women's Participation in Decision Making (%)**

Question	No Participation	Some Participation	Fully Participate	Not Applicable	Total
Issues related to financial investment	7.5	21.3	61.3	10	100
Issues related to education/health of children	1.3	7.5	62.5	28.8	100
Asset purchase/sales	11.3	15	62.5	11.3	100
Selection of place of residence	6.3	12.5	63.8	17.5	100
Household issues e.g., everyday shopping	0	11.3	78.8	10	100

**Refugees & Undocumented Immigrants**

There are roughly 4400 refugees and internally displaced people in the Aragatsotn Marz region. Their number has decreased periodically due to naturalization and emigration factors. According to desk study results, refugee families currently make up a small part of the affected communities, 0.59% of the total local communities are comprised of refugees and internally displaced people.

Along with regular emigration within Armenia, in 2014 an influx of refugees was observed due to the war in Syria. About 22,000 Syrian-Armenians have immigrated to Armenia since

the Syrian war, only 1/3 of whom have settled in Armenia, mainly in the city of Yerevan. In the Aragatsotn Marz region, they have settled in the regional centre Ashtarak, and in villages close to the capital. There was no immigration of Syrian-Armenians to the four affected local communities. Since 2020 there has been an influx of refugees from the Republic of Artsakh to different provinces of Armenia, due to the war. In the local communities, the number of displaced people is low - only 15 households have been recorded as displaced families, most of which live in Talin (12 households - 44 people) and 3 households in the Dashtadem community. Typically, refugees experience greater vulnerability due to the increased risk of poverty posed by fleeing their native country or region. This in turn often hinders



refugees efforts to improve their quality of life and gain access to suitable employment.

Refugees who are living in the local community can access benefits from the Project through potential employment and avail of measures which will be included in the CDP plan as part of the ESMS.



## 14.2. Sensitive Receptors

**Table 117 Demographic Conditions- Sensitive Receptors**

Receptor	Receptor Sensitivity	Justification
<b>Local Households</b>	Medium	The available information about the Project area indicates a medium sensitivity to the type of demographic impacts potentially caused by the Project.
<b>Female Headed Households</b>	High	Female Headed Households show a higher level of vulnerability and a lower capacity to adapt to external impacts given that their level of poverty is usually higher.
<b>Refugees</b>	High	Refugees tend to be highly vulnerable due to their high level of poverty as a result of fleeing their native country. In some cases, refugees are not presented with opportunities to improve their quality of life or gain employment as a result of their lower capacity to adapt as a result of their poverty level.

## 14.3. Impacts

### 14.3.1. Construction Phase

The proximity of a Project may result in encroachment by people looking for job opportunities. Encroachment and informal settlements can potentially result in secondary impacts, such as destruction of habitat, encroachment on nearby land uses, degradation of sanitary conditions, conflicts and security risks.

### 14.3.2. Operational Phase

Encroachment caused by labour force migration is less likely during the operational phase, compared to the construction phase, due to the small

number of operational employees required.

### 14.3.3. Decommissioning Phase

Encroachment caused by labour force migration is less likely during the decommissioning phase, compared to the construction phase, due to the smaller number of workers required for decommissioning and its shorter duration

Table 118 Demographics Impacts- Impact Magnitude

Impact	Impact Magnitude	Likelihood	Justification
<b>Influx / Encroachment caused by jobseekers</b>	Medium	Unlikely	The location of the Project and rate of employment and education in Armenia makes the likelihood of the immigration of jobseekers into the area low.





## 14.4. Impact Assessment

Table 119 Demographics Impacts- Impact Assessment- Construction Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>Influx / Encroachment caused by jobseekers</b>	Medium	Unlikely	Local Households / Women Headed Households	High	Moderate

Table 120 Demographics Impacts- Impact Assessment- Operational Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>Influx / Encroachment caused by jobseekers</b>	Low	Unlikely	Local Households / Women Headed Households	High	Minor Negative

Decommissioning phase impacts are similar to construction impacts but with a lower magnitude and duration.

## 14.5. Management Measures

Table 121 Demographics Impacts- Management Measures- Construction Phase

Impact / Risk	Management Measure
<b>Influx / Encroachment caused by jobseekers</b>	The Developer, EPC and subcontractors recruitment system will be centralized and fully transparent, giving priority to unskilled local workers from the affected communities.
	Recruitment at the gate is prohibited.



Impact / Risk	Management Measure
	The Community Liaison Officer (CLO) shall be appointed and will oversee the recruitment process and ensure that unskilled workers are recruited, whenever possible, for the local communities.
	Daily wagers will not be allowed except when the nature of the work requires it, subject to a specific application by the EPC to Ayg-1's E&S Manager justifying the need for daily wagers for a specific day and activity.

**Table 122 Demographics Impacts- Management Measures- Operational Phase**

Impact / Risk	Management Measure
<b>Influx / Encroachment caused by jobseekers</b>	The Developer, O&M and subcontractors recruitment system will be centralized and will give priority to unskilled local workers from the affected communities and the local area. There will never be recruitment at the gate.
	Daily wagers will not be allowed except when the nature of the work demands it, subject to pre-approval by the Project Company.
	Community Liaison Committee shall be used in establishing whether the workers are from within the project area of influence.

## 14.6. Residual Impact

**Table 123 Demographics Impacts- Residual Impacts- Construction Phase**

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
<b>Influx / Encroachment caused by jobseekers</b>	Moderate	Yes	Negligible Negative



Table 124 Demographics Impacts- Residual Impacts- Operational Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
Influx / Encroachment caused by jobseekers	Minor Negative	Yes	Negligible Negative

## 14.7. Monitoring Measures

Table 125 Demographics Impacts- Monitoring Measures- Construction Phase

Impact / Risk	Monitoring Measure
Influx / Encroachment caused by jobseekers	Monitoring of worker register maintained by the EPC HR Manager.
	Review of stakeholder grievance register.
	CLO to oversee and monitor the recruitment process.

Table 126 Demographics Impacts- Monitoring Measures- Operational Phase

Impact / Risk	Monitoring Measure
Influx / Encroachment caused by jobseekers	Monitoring of worker register maintained by HR Manager.
	Review of stakeholder grievance register.
	CLO to oversee and monitor the recruitment process.



## 15 Local Governance

This chapter describes the governance structures and dynamics within the local communities and Government Authorities. It also addresses potential risks and benefits that the Project can create.

### 15.1. Observations and Baseline Conditions

Armenia is a Democratic semi-presidential republic. The President is the head of state and enjoys wide powers. The Government exercises executive power and is composed of Ministers led by a Prime Minister.

The President of Armenia performs their functions through the powers prescribed by the Constitution. The President of Armenia is elected if they receive three fourths of votes based on the total number of Deputies in the National Assembly.

The National Assembly is referred to as the Parliament of Armenia, it is the legislative branch of the government of Armenia. The Single-Chamber National Assembly is the supreme legislative authority of Armenia.





The National Assembly is a unicameral body. It consists of at least 101 seats, but with additional seats allocated, it may grow and reach to about 200 seats in extremely rare cases. As of 2021, there are 107 seats, any top segment of a party list cannot include over 70% of representatives of the same sex. The parliamentary majority nominates the Prime Minister, subject to approval by the President and after consultations with parliamentary factions. The President appoints and dismisses members of the Government (Ministers) based on the Prime Minister's recommendations.

A state representative is appointed for each province. The Provincial Administrations operate as intermediaries between local citizens and community-level authorities and the Central Government. Governors of Provinces are nominated by the Prime Minister, subject to approval by the Parliament (National Assembly).

The community level Authority is the only Self-Government level in Armenia. Armenia is divided into 915 communities, including 866 villages, 48 towns and the capital Yerevan. Each community, with the exception of Yerevan, elects its Major (via a direct system) and a legislative body (Municipal Council) called a 'Council of Elders' (Avaganu Khorurd). Every community in Armenia elects its own Municipal Council (Legislative Body).

Local Authorities include the Municipal Council and the head of the community (Mayor) who heads the community Administration.

Other Government Authorities relevant to the Project include the Ministry of Environment, Ministry of Culture, The Agency for the Protection of Monuments of History and Culture, Ministry of Nature Protection, Ministry of Energy and Natural Resources. These have been described in section 4.4 Institutional Framework.

### Transparency and Accountability

The International Development Association (World Bank Group) has developed a number of indicators describing development related aspects through the Country Policy and Institutional Assessment (CPIA) process.

The CPIA transparency, accountability, and corruption in the public sector rating assesses the extent to which the executive can be held accountable for its use of funds and for the results of its actions by the electorate and by the legislature and judiciary, and the extent to which public employees within the executive are required to account for administrative decisions, use of resources, and results obtained.

The three main dimensions assessed here are the accountability of the executive to oversight institutions and of public employees for their performance, access of civil society to information on public affairs, and state capture by narrow vested interests.

The Index has a value from 1 to 6. As of 2013, Armenia has a score of 4.1 which is quite a high score but indicates that there are still Governance gaps in the Country.

**Gender Aspects**

Women comprise 52.2% of population in Armenia and 56% of those with higher education, but their representation in decision-making domains remains low.

The current representation of women in governing roles is detailed below:

- Less than 2 percent as community heads;
- 10 percent as local council members (data of 2019);
- 24 percent as National Assembly members; 8 percent of Government Ministers and 26 percent as Deputy Ministers;

- 0 percent as female governors, 18 percent as vice-governors.



The data indicates that gender equality remains a significant issue in Armenia.

The UNDP in partnership with the Ministry of Territorial Administration and Development is currently implementing the “Women in Politics” Project which is aimed at contributing to enhanced political participation of women and youth in local development processes. The Project has implemented strategies and recommendations in order to measures and improve women’s political participation.

**Table 127 Governance- Sensitive Receptors**

Receptor	Receptor Sensitivity	Justification
<b>Governance Structures</b>	Low	Local Governance structures have legally established procedures are expected to have a low sensitivity to potential governance impacts caused by the Project.

**15.2. Impacts**

The potential Project impacts on local governance are not phase dependent. Projects can weaken local governance when they do not comply with the relevant legal requirements and when there are cases of corruption (e.g., Project employees or agents offering bribes to public officials, or the Project paying bribes following a request from a corrupt official).

On the other hand, Projects can have a positive impact on local governance when the Project does not only comply with all applicable laws and regulations and avoid any corrupt undertakings but goes beyond legal requirements in terms of stakeholder engagement, transparency and accountability, implementing international best practice. This would be expected to contribute to building capacity within local authorities and generate higher expectations for quality Project governance in the area.

**Table 128 Potential Governance Impacts- Impact Magnitude**

Impact	Impact Magnitude	Likelihood	Justification
<b>Non compliances / corruption</b>	Major Negative	Very unlikely	The Project has mechanisms in place to ensure compliance with the relevant requirements. Ayg-1’s parent company Masdar and ANIF have mechanisms in place to control Projects and prevent corruption.
<b>Governance Capacity Building</b>	Minor Positive	Likely	National Legislation already includes provisions for ESIA consultations and disclosure. The Project is implementing a Stakeholder Engagement Plan and will implement an ESMS in line with International Best Practice. This will be applied to the ESIA, the management of Project impacts as part of the ESMS and the Community Development Plan.





### 15.3. Impact Assessment

Table 129 Local Governance- Impact Assessment- All Phases

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>Non compliances / corruption</b>	Major Negative	Very Unlikely	Governance Structures	Low	Minor Negative
<b>Governance Capacity Building</b>	Minor Positive	Likely	Governance Structures	Low	Minor Positive

### 15.4. Management Measures

Table 130 Local Governance- Management Measures- All Phases

Impact / Risk	Management Measure
<b>Non compliances / corruption</b>	Avoid any kind of non-compliance. A comprehensive Environmental and Social Management System (ESMS) will be developed that will track compliance with all the legal and regulatory obligations. The ESMS for the construction phase will rely on the ESIA as a legal register. The ESMS for the operational and decommissioning phases will have specific legal registers that will be updated at least annually. The ESMS will have a permits register to ensure that the Project Company, the main contractors (EPC / O&M), subcontractors and suppliers have all relevant permits and licenses.
	The ESMS will include an anti-corruption policy and all managerial personnel will be trained on anti-corruption practices.
	During the recruitment process there will be a clear and transparent process to avoid any actual or perceived corruption or unfairness in the recruitment process.
	The Community Liaison Officer will oversee that the recruitment process is aligned with the documented procedure.





Impact / Risk	Management Measure
<b>Governance Capacity Building</b>	The implementation of the ESMS which includes the stakeholder engagement plan, the grievance mechanism, the creation of a Community Liaison Officer and other participatory tools will ensure that governance capacity building is maximised as a result of the Project.

## 15.5. Residual Impact

Table 131 Local Governance- Residual Impacts- All Phases

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
<b>Non compliances / corruption</b>	Minor Negative	Yes	Negligible Negative
<b>Governance Capacity Building</b>	Minor Positive	Yes	Minor Positive

## 15.6. Monitoring Measures

Table 132 Local Governance- Monitoring Measures- All Phases

Impact / Risk	Monitoring Measure
<b>Non compliances / corruption</b>	Monitoring of the grievance mechanism for workers and external stakeholder. Investigation of any corruption allegation.
	Monitoring of training sessions on anticorruption practices.
	Regular update of the legal register (operations and decommissioning) and monitoring of the permits register (all phases) as per the frequency established in the ESMS Manual.

Impact / Risk	Monitoring Measure
<b>Governance Capacity Building</b>	Monitoring of the grievance mechanism for workers and external stakeholder.



## 16 Economic Conditions

The Project may result in economic opportunities for local residents and potential risks to local economic activities. In addition, the Project may raise expectations about economic benefits that could be unrealistic, and if not adequately handled can lead to frustration and mistrust towards the Project.

This chapter describes the economic baseline conditions of the Project area, including key economic sectors, income, and sources of water and energy. Detailed baseline information is provided in this section following the data analysis of the household survey. This chapter also identifies potential economic risks and opportunities.

### 16.1. Observations and Baseline Conditions

The economy in the Aragatsotn Marz region is mostly comprised of agriculture and industry. Industries in this region tend to specialize in the production of food, beverages, valuables and mining of construction materials. According to the latest statistical data (2019), the specific weights in the main sectors of the region's economy are as follows:



- Agriculture - 9.9%,
- Construction - 3.3%,
- Industry - 2.1%,
- Retail trade - 1.7%,
- Services - 0.7%.

**Occupation:** According to the household survey, the primary occupation of the respondents from Talin and Dashtadem was agricultural based activities, indicating that the Project area is heavily dependent on this economic sector. A summary consisting of the main employment of the members of the 80 households that participated in the survey is outlined below. A large percentage (37.5%) of household heads are pensioners. This is due to the fact that a large majority of household heads are over 62 years of age. A large proportion of surveyed community

members are self-employed in the field of agriculture, and employment in the public and private sectors.



In the case of the private sector, they mainly work in the fields of construction, trade, food production, service, and agriculture. During the survey, young respondents also detailed their employment in the technology sector. 10.6% of household members are unemployed but only half of them are looking for work, the other half are busy with family household matters. There are no entrepreneurs in the households surveyed who have their own business outside of agriculture. There is a small percentage of household members who are unable to work due to a disability. A relatively large number of household heads are also self-employed in the agriculture sector (23.8%), public (11.3%) and private sectors (8.8%). In 5% of these families, the head of the household travels to Russia for seasonal work.

**Table 133 Primary Employment Status (%)**

Employment Status	HH Members	HH Heads
Public Sector Employment	13.4	11.3
Private Sector Employment	10.6	8.8
Self-Employment in Agriculture	14.9	23.8
Self-Employment in Other Sector	5.0	6.3
Entrepreneur outside of Agriculture	0	-
Migrant Worker	1.9	5.0
Pensioner	15.2	37.5
Unemployed Looking for Job	5.3	2.5
Unemployed Not Looking for Job	5.3	3.8
Student	4.3	-
Pupil	1.6	-
Member of Military	0.3	-
Disabled	0.9	1.3
Under 16	21.4	-
Total	100	100

For household members as well as the heads of households, the work and jobs respondents have are typically permanent positions, 68% of household members and 61.4% of household heads have a permanent employment status.

In relation to seasonal work, household heads are more involved with seasonal work in comparison to household members (Figure 14).

Regarding intermittent employment, 5.4% of household members work from time to time when suitable employment is available. In contrast, household heads are typically less involved with intermittent work with only 2.27% of respondents outlining this.

There is a high percentage of both household heads and household members that hold a secondary form of employment. In total, 14.6% of household members and 35% of household heads have a secondary source of employment, the indicators of which are summarized in the figure below. It is clear from the data displayed below that most secondary employment is related to self-employment in agriculture involving farming and animal husbandry, 59.6% of household members and 57.1% of household heads are involved in agriculture as a form of secondary employment.



**Figure 21 Primary Nature of Work (%)**

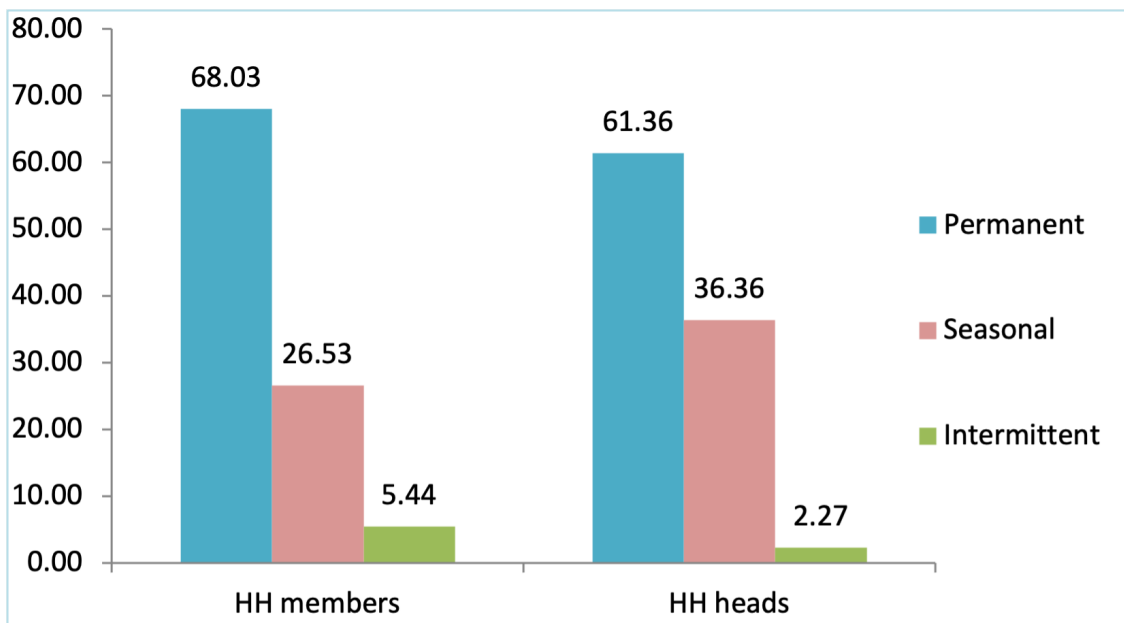
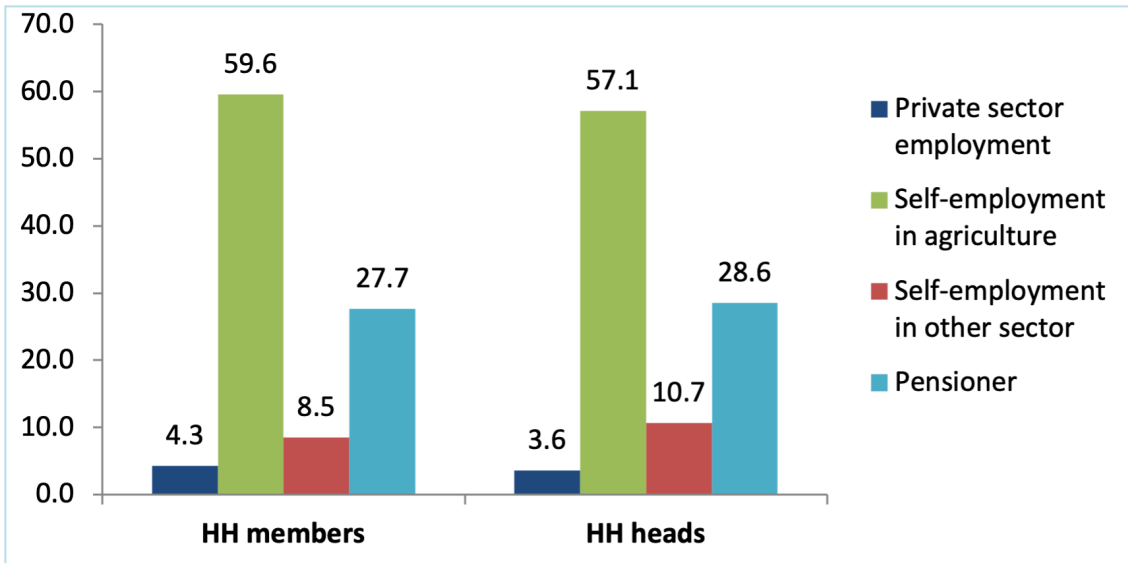




Figure 22 Secondary Employment Status (%)



### Agriculture

The rural population of the province is 3 times larger than the urban population. The majority of the rural population is involved in agriculture, including farming and cattle-breeding. Most of the agricultural lands are used as arable lands and perennial plantations, agriculture accounts for most of the gross output in the area. Being a major agricultural region, Aragatsotn contributes 9.7% of the annual total agricultural product of Armenia. Around 79% of the total area of the province are classified as arable lands, out of which 25% are ploughed. With an approximate area of 240 km of farmlands are occupied by grains and dry seeds with cereals. However, due to poor irrigation, the yields can be very low and are not guaranteed. Around 40% of orchards in Aragatsotn are occupied by grapes. Potato farms occupy around 16 km<sup>2</sup> while vegetables are spread over 10 km<sup>2</sup> of farms.

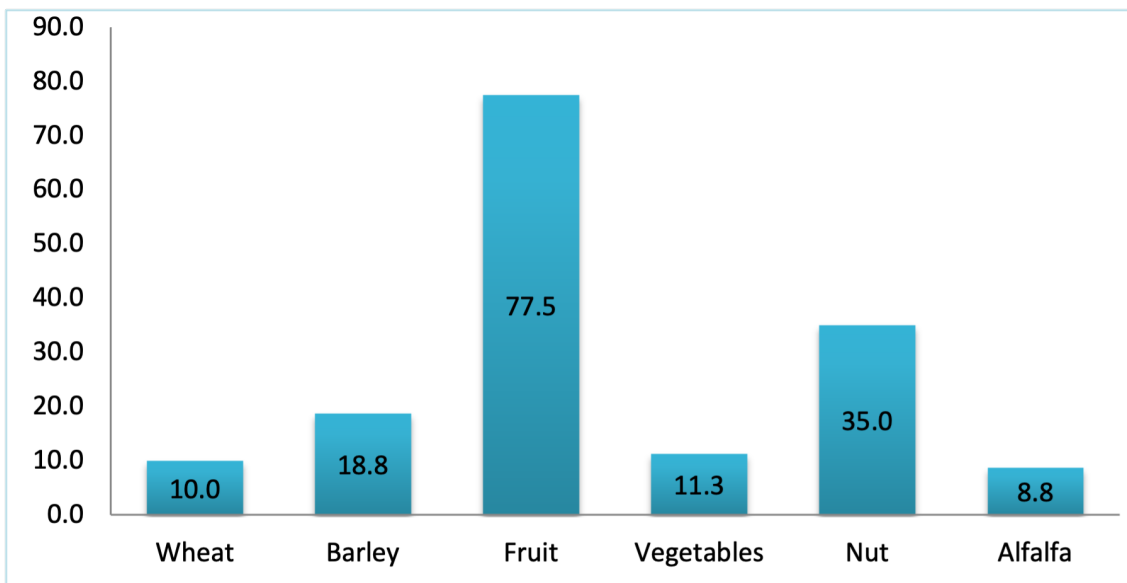
The land used in the Project area by affected communities is not utilized to its full potential, only small areas of land are planted which is due to the low degree of capitalization of the sector, the lack of processing technologies and irrigation water. For example, in Talin, 10% of the community is irrigated by canals, and 90% is not irrigated due to the lack of effective irrigation networks. The Arzni-Shamiram-Talin canals pass through the territory of the Aragatsotn marz, there are also 29 artificial reservoirs in the Aragatsotn Marz region with the largest being the Aparan reservoir (7.9 m<sup>2</sup>). The total volume of the Aparan reservoir is 91 million cubic meters, the useful volume is 81 million cubic meters. The annual volume of irrigation water in the region is about 520 million cubic meters. Along with the Aparan reservoir, there is also the Halavar, Tsilkar, Nerkin Sasnashen, Davtashen, Talin, Verin Bazmaberd, Kakavadzor, Shenik, Ashnak reservoirs in the Aragatsotn Marz region. There are also large reserves of ground and artesian water. The Talin canal, Talin and Ashnak reservoirs are located in the territory of the local communities.

The results of the social survey conducted in the four communities surrounding the Project show that despite the problems in this area, the population utilizes their land in some way. It is only in 10% of households that people do not plant any kind of crops. Figure 16 Indicates that 77.5% of the surveyed households have fruit trees. These trees are mainly apricot and apple trees. There is also some households that have different types of cherry, plum, pear, peach and quince trees, as well as vines.

Following this, the next most common crop in the affected communities is walnut, 35.0% of households have a walnut tree with this is the most traded agricultural product. Among the grain crops, respondents have detailed that barley is grown the most. There are 15 households (18.8% of the total households surveyed) that sow barley. Community members who cultivate wheat make up 10% of the total households surveyed while vegetables are grown by 11.3% of farmers and alfalfa by 8.8%.



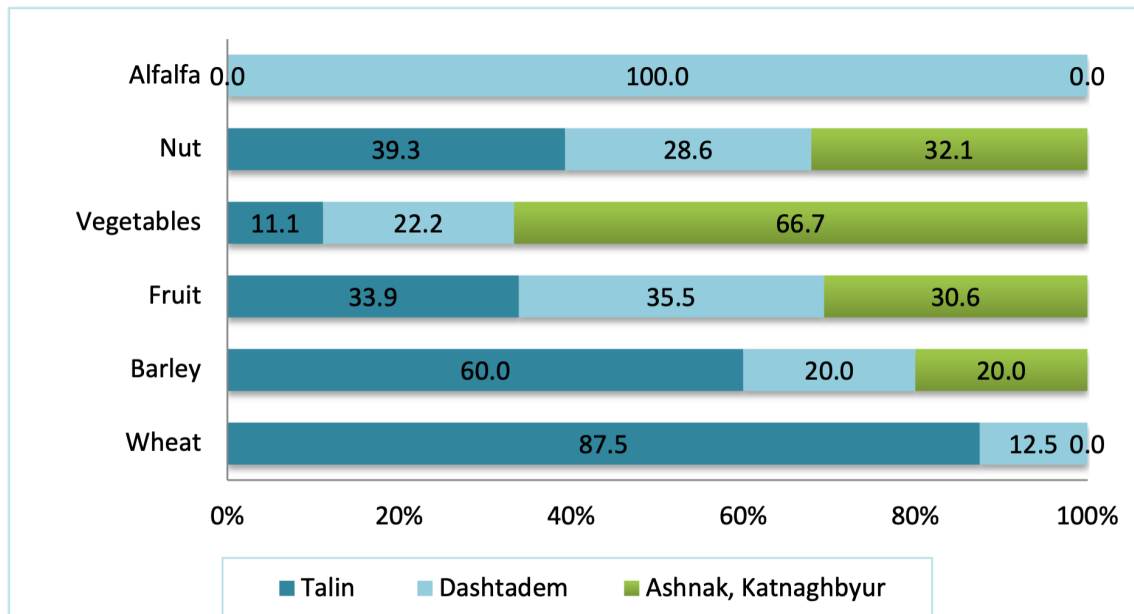
**Figure 23 Households planting different types of Crops (%)**



The results of the social survey coupled with on site investigations indicate that wheat and barley are cultivated more in Talin. Wheat cultivation comprises of 87.5% of the total farmers, making it the most popular crop planted by farmers in Talin. Barley cultivation is the second most popular crop planted in Talin with 60% of farmers cultivating barley (Figure 17).

According to the results of the social survey, alfalfa is sown only in Dashtadem. Vegetables are cultivated more in Ashnak and Katnaghbyur villages than in other settlements. Fruit and nut cultivation is almost equally present in all settlements.

Figure 24 Planted Crops by Settlement (%)



The results of the social survey found that fruits and nuts are harvested by the villagers every year, they also sell a fraction of their yield to generate income. The data in the table below indicates that households generally sell 39.3% of their yearly nut yield. Every third family (33.9%) sells a portion of the fruit from their yearly yield which mainly consists of apricots and apples as mentioned above. The survey results show that the annual income received by households from walnuts was between 8,000 - 200,000 AMD.

The highest income from selling fruits recorded during the social survey was 505,000 AMD which was received by one household. Five households receive between 200,000 - 400,000 AMD from selling fruit and nuts. It should be noted that these households sell all their agricultural products locally. Only one of the households who participated in the survey stated that they go to a market located 5km away once a month by private car.

Table 134 Cultivation of Crops (%)

Crop	Grown Yearly	Grown Last Year	Crop Rotation	Sold
Wheat	62.5	75	37.5	25
Barley	46.7	86.7	46.7	6.7
Fruit	100	100	-	33.9
Vegetables	88.9	100	33.3	0
Nuts	100	100	-	39.3
Alfalfa	100	71.4	28.6	0

**Plate 7 Agriculture Activity in the Project Area**



The results of the social survey found that 62.5% of respondents grow wheat every year with only 37.5% utilizing crop rotation. Most households that cultivate wheat keep their yields for personal use while 25.0% of households also sell a portion of their crop yield. Barley is grown annually by 46.7% of survey respondents, most households that cultivate barley keep their yields for household use while only 6.7% sell a portion of their annual barley yield.

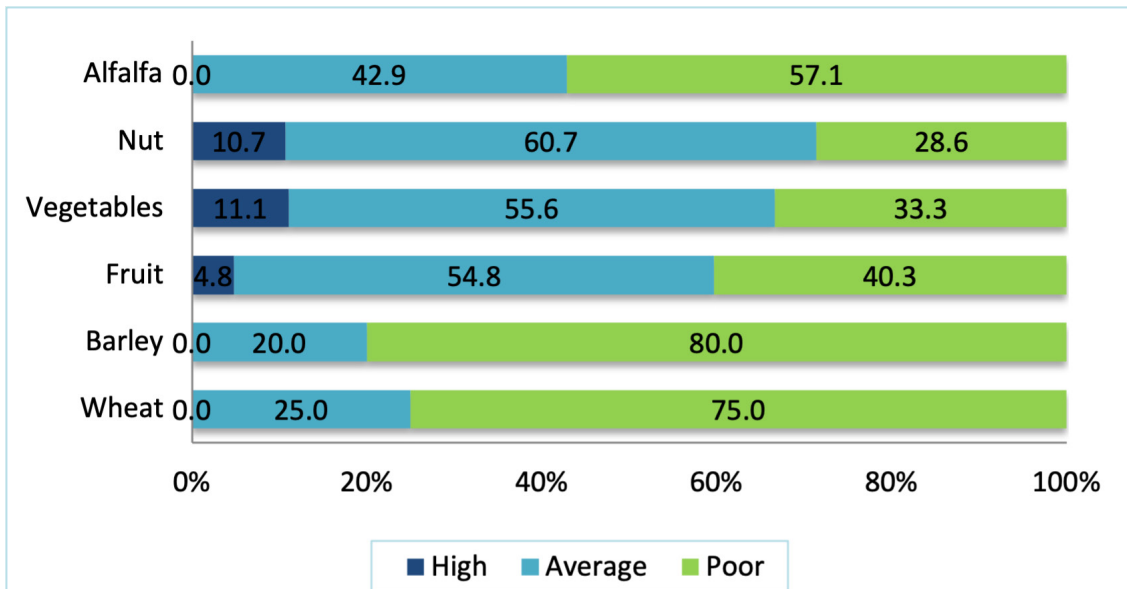
Out of the 15 farms cultivating barley, 86.7% planted this crop in the last year. The highest income received from both barley and wheat was 300,000 AMD per year.

As mentioned above, vegetables and alfalfa are cultivated by a small number of people and are not sold. They are for personal use only.

The survey participants also evaluated the yield of their crops which is depicted in Figure 18. It is clear that the yields of vegetables and nuts were relatively high based on the respondents evaluation of their crop yields. Barley, wheat and alfalfa were rated as low yielding crops by most respondents. Barley was rated as a low yielding crop by 80% of respondents, 75% of participants outlined that wheat produced low yields while 57.1% highlighted that alfalfa was another low yielding crop. More than half of the respondents, 54.8% rated the fruit yield as average.

The socioeconomic survey identified that most of the barley and alfalfa growers are also engaged in cattle breeding.

Figure 25 Yield of Crops (%)



**Livestock**

Around the highlands of Mount Aragats, particularly in the regions of Aparan and Talin people are engaged in cattle-breeding and poultry farming. Bee-keeping farms are also found at higher woodlands.

According to published data, there are few farms with 8 or more livestock in the local communities. The total number of farms with more than 8 livestock in the local communities is 36, which is about 7% of the total number of farms, 21 in Dashtadem community, 11 in Talin, 4 in Ashnak and none in Katnaghbyur . The number of cattle recorded by years from the Talin and Dashtadem communities has increased since 2018.

The number of cattle recorded in Talin community has gradually increased each year with a total number 1048 recorded in 2021 versus 697 in 2018, this is an increase of

351 cattle in the area, Dashtadem have also recorded a relatively gradual increase in the number of cattle between the years 2018-2021. Apart from a slight decrease in 2019, the number of cattle recorded in 2018 was 1015 and in 2021 was 1366, which demonstrates an increase of 351 cattle in the area, similar to Talin. Table 132 describes farming information from all affected communities indicates that the number of cattle recorded in both Katnaghbyur and Ashnak has decreased during the time period of 2018-2021. The data presented in table 131 demonstrates that both Talin and Dashtadem appear to rely more on cattle farming as opposed to sheep and goat farming that is also demonstrated in table 132. This is of importance as the Project site was formally land owned communally by Talin and Dashtadem, the acquisition of the land and subsequent compensation measures will be discussed in detail as part of the assessment of land acquisition.

Small farms (8 heads or less) in the local communities appear to be a more common and



viable option for members of the community. Talin is host to the largest number of small farms with 178 farms in the area while Katnaghbyur has 142 small farms. Ashnak and Dashtadem have 130 and 55 small farms respectively. The desk study found that both large and small farms keep the cattle stabled during the winter

months. The large and small farms tend to use the summer months for grazing activities and let their livestock roam free. Desk studies have also indicated that both small farms and farms with 8 heads or more are not commercially orientated.



**Table 135 Farming Information from Talin and Dashtadem Communities**

Type of Information	Talin	Dashtadem
Total pasture area (ha)	2444.68	2102.49
Farms with 8 heads and more	11	21
Small farms (up to 8 heads)	178	55
<b>The total number of livestock in the settlement</b>		
Large cattle	1048	467
Sheep	614	899
Goats	109	0
<b>The total number of livestock (by years)</b>		
2021	1048	1366
2020	841	1118
2019	694	983
2018	697	1015

**Table 136 Farming Information from Affected Communities**

Farms	Talin	Dashtadem	Katnaghbyur	Ashnak	Total	
Large (with 8 or more livestock)	11	21	0	4	36	6.7%
Small (up to 8 livestock)	178	55	142	130	505	93.3%
Total	189	76	142	134	541	100.0%
<b>Number of Cattle By Years</b>						
2021	1048	1366	695	1219	4328	
2020	841	1118	849	1405	4213	
2019	694	983	850	1032	3559	
2018	697	1015	843	1642	4197	

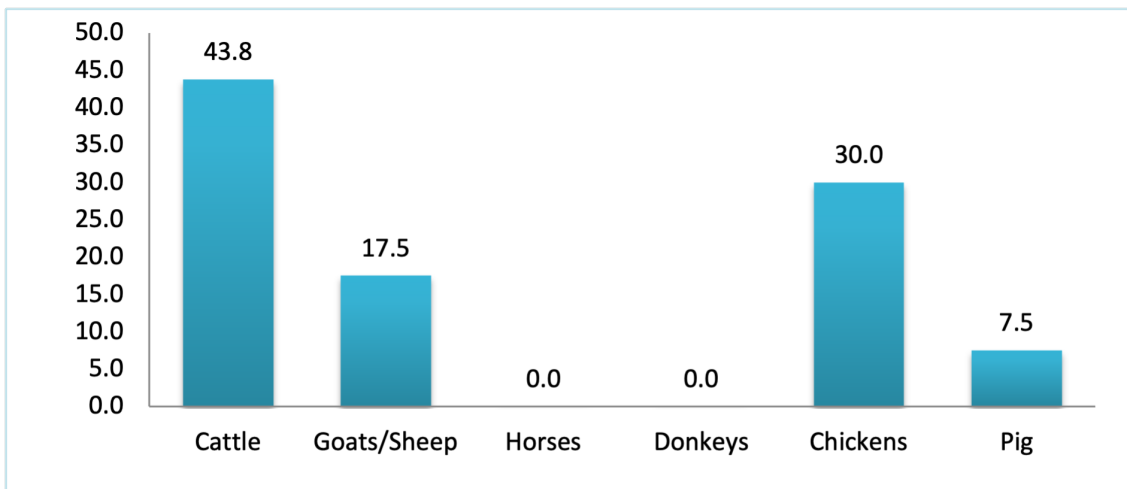
Following the desk study which was conducted in 2021, the social survey was administered to 80 households in the four communities that surround the Project site. The social survey results indicate that 37 households participate in livestock farming. The results of the social survey also highlight that 46.3% of the total households breed either large or small cattle. There are 14 farms which can be considered

as large seeing as they have 8 or more animals. From the data summarized below in Figure 16, there are 43.8% of households which have large cattle, 17.5% have goats/sheep, 30.0% have chickens and 7.5% have a pig.



There are no households surveyed that own horses and donkeys.

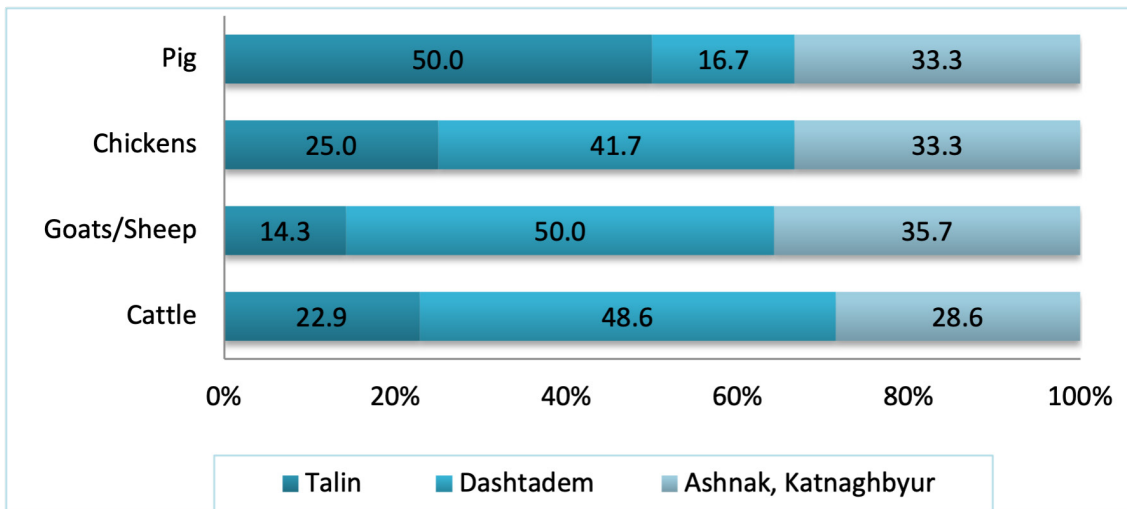
**Figure 26 Availability of Farm Animals (%)**



The results of the social survey indicate that livestock breeding is practiced more in Dashtadem when compared to Talin, Ashnak and Katnaghbyur. As a result of this, around half of cattle, sheep/ goat farmers are from Dashtadem. Figure 20 highlights that 48.6% of respondents from Dashtadem breed cattle while 50% farm goats/sheep. The other half of respondents that are livestock farmers are distributed between Ashnak, Talin and Katnaghbyur. In Talin, pig farming is more common when compared to the other three communities with 50% of Talin respondents practicing this type of livestock farming.

Similar to livestock breeding, the results of the social survey indicate that Dashtadem has the highest percentage of poultry farmers (41.7%) when compared to the other three settlements. Poultry farming is less popular in Ashnak and Katnaghbyur with only 33.3% practicing this type of livestock farming.

Figure 27 Livestock Breeding by Settlements (%)

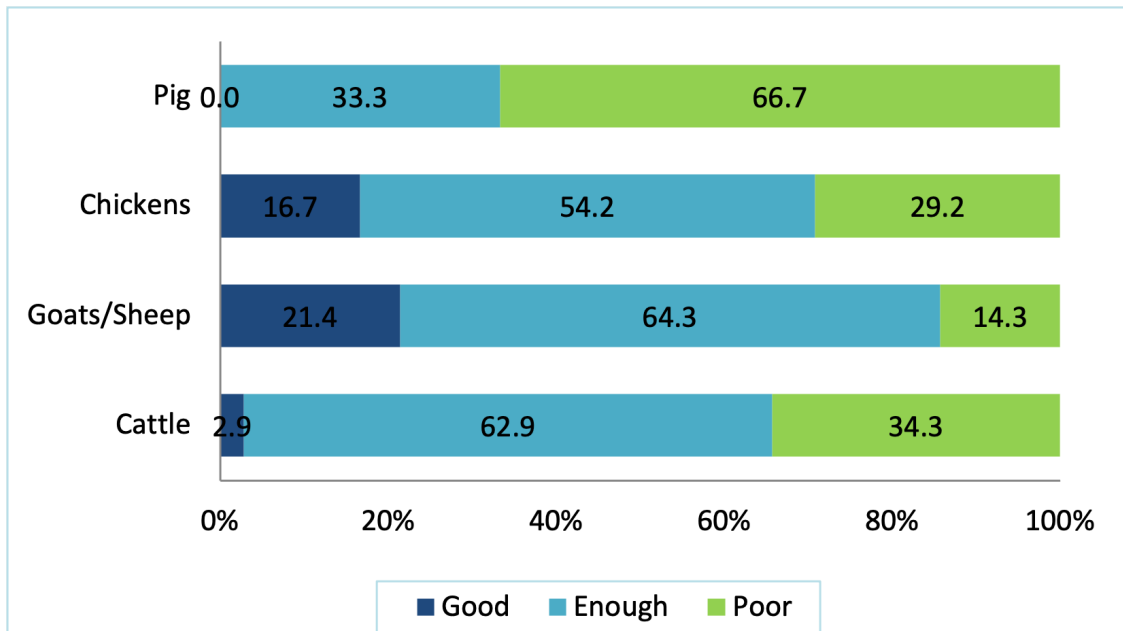


Similar to crop yields, the survey participants also evaluated the productivity of their livestock. Goats/sheep and chickens were evaluated as relatively high by respondents which is highlighted below in Figure 21. In relation to other livestock farming, 66.7% of pig farming households and 34.3% of cattle farming households assessed their profitability as poor.

Only 4 of the livestock farmers use slaughterhouse services with a frequency of once a year. About 86% of livestock farmers employ a veterinarian to perform mandatory vaccinations for animals. A third of farmers indicated that they do not pay for veterinary services.

The poor profitability of cattle highlighted by respondents may be due to cattle being stabled for long periods of time, cattle are usually stabled for a maximum of 7 months. As a result this, feed costs can increase due to lack of pasture. During the social survey, a farmer with 20 large cattle highlighted that he spends about 1.5 million AMD annually on fodder. A farmer with 50 sheep estimated the cost of fodder at 2 million AMD because the animals are kept in the stable for 5 months.

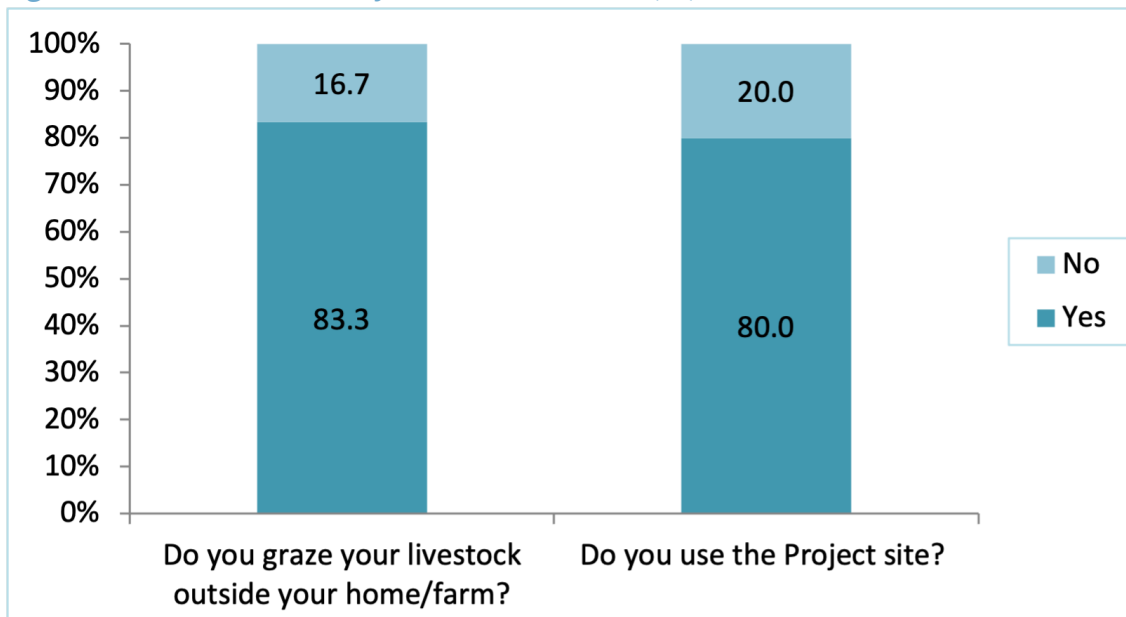
Figure 28 Livestock Income Estimation (%)



Land Use Issues

During the social survey, farmers were asked about their land use patterns in order to gauge if the Project causes economic displacement. The results of the social survey found that 83.3% of livestock farmers use land outside of their home/farm to graze livestock, the lands that farmers use for grazing are exclusively communal lands. The social survey highlighted the location of communal lands in which farmers use to graze their cattle, the results of the survey indicate that 80.0% of the farmers use the land on the Project site for grazing (Figure 22). The Project will use 525 hectares in total leaving 6431.34 hectares of communal lands available to community members that are equally viable.

Figure 29 Use of Pastures by Livestock Farmers (%)



The data in Figure 23 highlights that 17 out of 25 HHs (68%) from Dashtadem use the Project site for livestock grazing. This is closely followed by livestock farmers from Talin, out of the 35 households surveyed in Talin, 6 HHs (17%) have stated they use the Project site for livestock grazing.

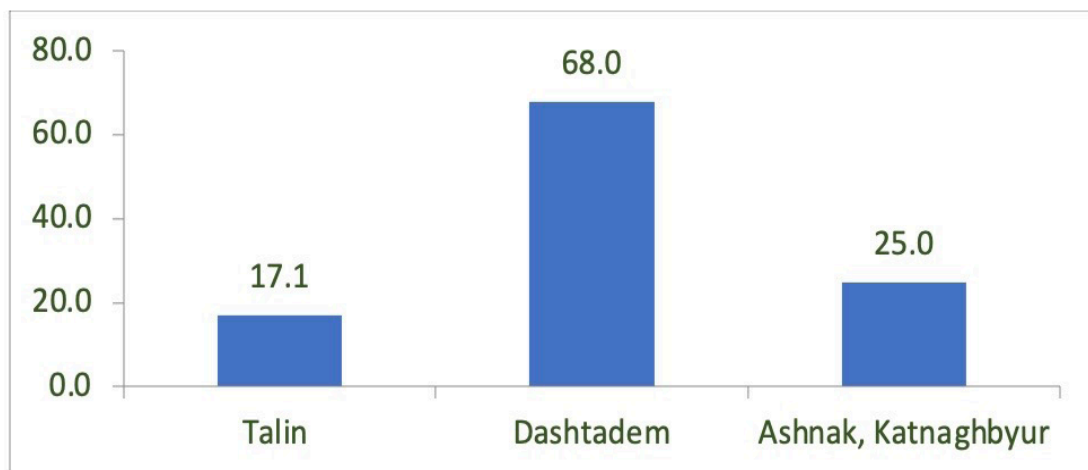
According to the social survey, 6 households out of 8 who own livestock in Talin use the project site for grazing activities. In Dashtadem, all 17 households who own livestock use the project site for grazing. 2 out of 7 households who own livestock in Ashnak use the project

site for grazing activities. In Katnaghbyur, all 3 households who own livestock have reported to use the project site for grazing activities.



Interviews with Talin and Dashtadem community heads have outlined that farmers do not use the Project site for the majority of the year, and only use it during the Summer months. However, the heads of communities have highlighted that the productivity at the Project site during these Summer months remains low.

**Figure 30 Respondents Use of the Project Site for Pasture by Settlement (%)**



The lands owned by the community are also used by households for other purposes. The results of the social survey indicate that communal land is used as a burial ground by all villagers. Based on the results of the social survey, an analysis was conducted to ensure the Project site is not used as a burial ground by villagers, results of the analysis indicate that the burial grounds are not located at the Project site. Communal land is also used for other purposes, 12.5% of respondents use communal lands for collecting medicinal

plants, 5% collect field edible plants and 3.8% use communal land for collecting wild fruits. For example, 5 households in Dashtadem and Talin communities are herb collectors, they detailed during the social survey that they sometimes use the Project area for this purpose.

During the survey, one participant from Talin stated that they use communal land for hunting purposes. Only 2.5% of households collect firewood from lands owned by the community



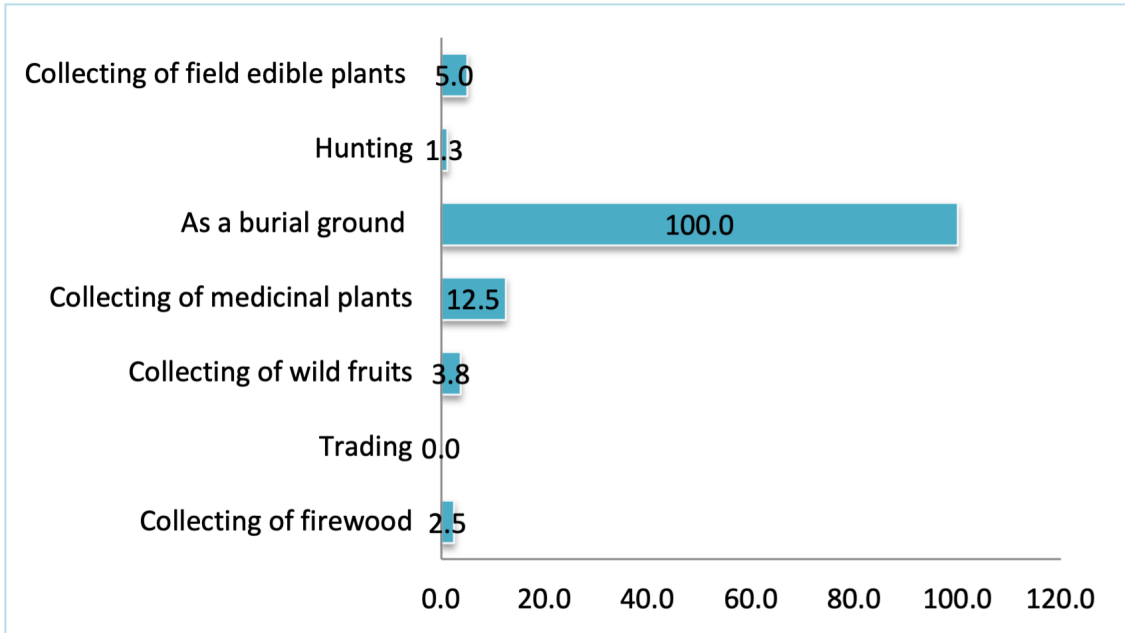
but this is not in the Project site since the project site has predominantly herbaceous vegetation.

Communal lands for hunting/gathering activities will still be widely available to community members to continue these practices. The site will use 525 hectares in

total leaving 6,431.34 hectares of communal lands available to community members that are equally viable to continue these activities. The socioeconomic survey shows that the above activities do not have an impact on the economy of the household considering they are not constrained by land availability.



**Figure 31 Other Uses of Community Land Apart from Grazing (%)**



**Plate 8 Project Area- Livestock Grazing**



Cow at the Project Site

## Women's Employment

The majority women in the local communities work in agriculture and animal husbandry, but they face many difficulties in this area. For example, the lack of agricultural insurance is a major problem both in affected communities and in general: recurrent frosts, hails and droughts dramatically reduce the expected income from agriculture. Besides, the low market value of agricultural products, the market volatility, and the sale of agricultural products without contracts make women vulnerable in relation to their income. In the agricultural sector, women also do hard physical work in the absence of men.

Some women, mainly in Talin, are self-employed in small and medium-sized businesses and services. In our study, we found that women can accompany their husbands when going abroad for seasonal work but working abroad is not seen as a source of employment or personal income for them.

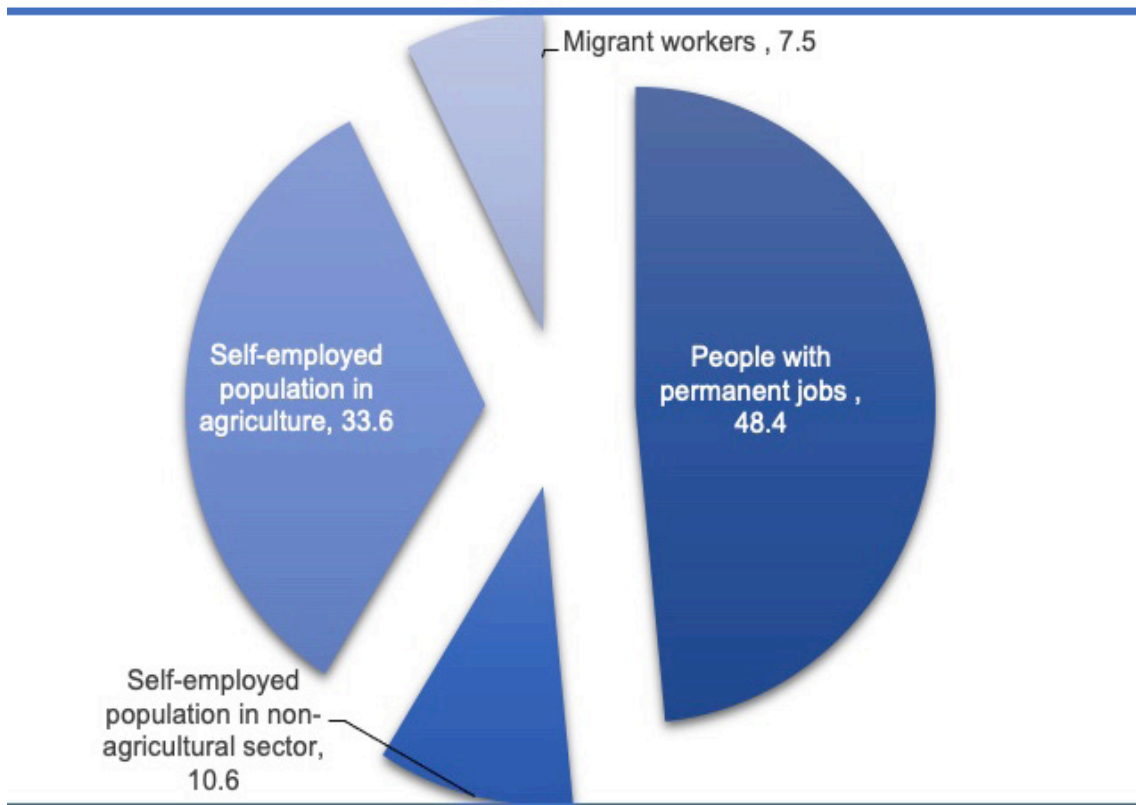
Women's labour market participation rate is lower than men. They make up 40.8% of those who have a permanent job outside of agriculture. In the affected local communities, women work mainly in jobs which pay minimum or below average wage. Women usually work in the fields of education (school, kindergarten) and healthcare (hospital, medical centre), they make up the majority of the workforce in these fields at the national level. In the local communities, women are engaged in trade, services, production (milk processing plant), and to a lesser extent, in local government. The low employment rate indicates that women take the main responsibility for childcare and running the household (this is typically also the case for women with formal employment).



**Table 137 Women's Share in Employment**

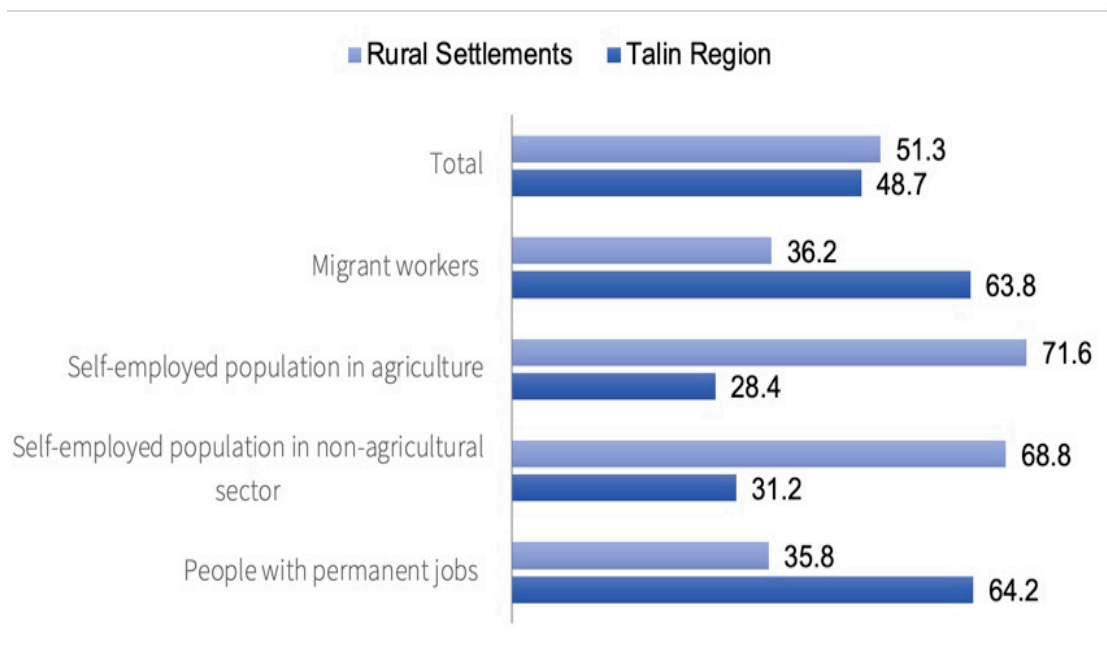
Type	Average
Women with permanent jobs	40.8%
Self-employed women in agriculture	56.5%
Self-employed women in non-agricultural sector	42.0%

Figure 32 Employment Percentage in the Local Communities



Source: Community Register Data

Figure 33 Percentage of Employment in Local Communities



Source: Community Register Data

**Income**

In addition to income from primary and secondary employment outlined above, the population of the affected communities also has other sources of income. The data in table 134 Indicates that 15.0% of surveyed households receive financial support from family members or relatives living abroad.

The same percentage (15%) receive a family allowance which is a maximum of 36,000 AMD. There are 12.5% of households that receive other benefits/pensions, these benefits mainly refer to disability benefits.7.5% of households support their needs by using lines of credit and borrowed funds.



**Table 138 Additional Sources of Household Income (%)**

Other Income Sources	Percentage (%)
Non-land informal employment	6.3%
Income from renting property (house, land, car)	1.3%
Family allowance	15%
Other allowance / pensions	12.5%
Child- birth allowance	2.5%
One-time benefit, help	-
Migrant remittances	-
Cash assistance from Armenia	1.3%
Cash assistance from abroad	15%
Pensions/social/welfare grants	1.3%
Loan/credit facility	7.5%
Withdrawn savings/savings scheme	-
Other	-

In order to further analyse the total household incomes received by households from various sources, numerical data was obtained which is presented below. In general, 17.5% of the 80 households that participated in the survey receive up to 100,000 AMD per month. The other 82.5% receive a monthly income of between 100,000 -300,000 AMD. Those with higher incomes of between 300,000 -500,000 AMD account for 18.8% of the households

surveyed while respondents who earn more than 500,000 AMD account for 10.0%, of households respectively. It should be noted that 47.5% of households participating in the survey consisted of 3-5 people.

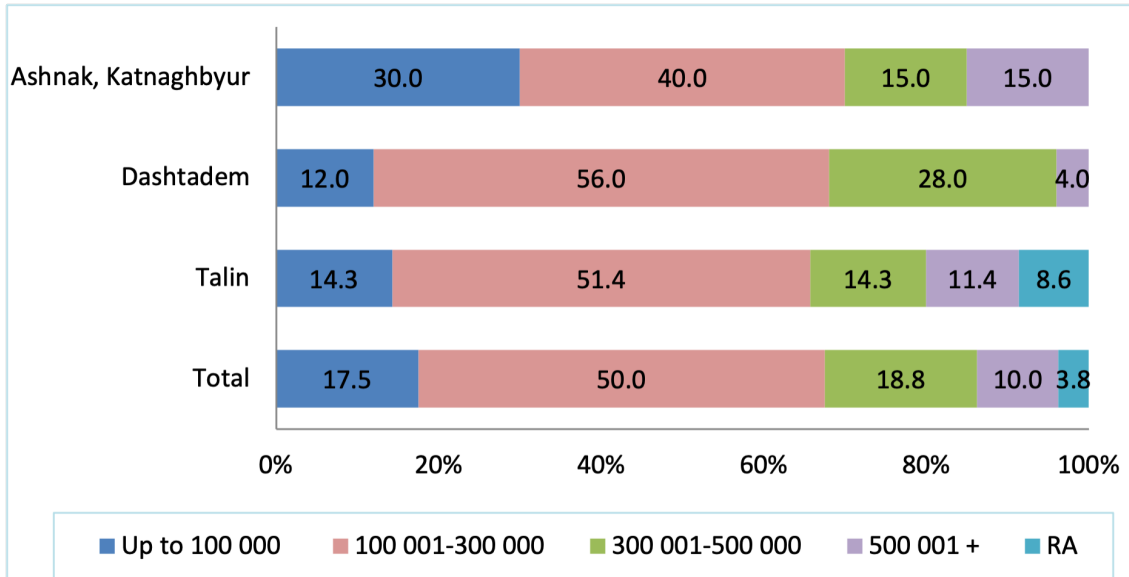
These families make up 32.0% in Dashtadem, and 30.0% in Ashnak and Katnaghbyur, whereas Talin has the lowest percentage of high income

families with 25.7% earning 300,000-500,000 or 500,000+ AMD. Many families in Ashnak and Katnaghbyur receive up to 100 thousand AMD, while there are relatively few families

who receive 100-300 thousand AMD which is detailed in Figure 27. 3.8% of the interviewed households did not provide information on monthly income.



**Figure 34 Monthly Average Income of HH in AMD (%)**



**Assets**

In addition to the analysis of the income received by households, the analysis of savings and debts was conducted in order to summarize the households socio-economic status. Figure 28 indicates that there are households in each of the four affected communities are not in a good financial position. Many of the surveyed households are only able to meet monthly expenses, most have to repay loans and debts. The survey results indicate that only 8.8% of respondents stated that they have savings. However, these savings are expected to be small amounts, are not kept in the form of deposits and do not provide income for families.

Results from the social survey show that 53.8% of households have loans and 33.8% have debts. When considering this issue according to settlements, it becomes clear

that more families have loans and debts in Talin city in comparison to Dashtadem, Ashnak and Katnaghbyur villages. In Talin, 65.7% of families surveyed have loans while 45.7%, are in some form of debt. In Dashtadem 44.0% of households surveyed have loans while 28.0% have other debts. Survey results indicate that in Ashnak and Katnaghbyur settlements, 45.0% of surveyed families have loans and 20.0% are in other forms of debt.

In relation to means of transport, the use of automobiles is widespread among each community. 62.5% of the households who participated in the social survey own a family car. A bicycle as a means of transport serves only 2.5% of families.



Figure 35 Availability of Savings, Loans and Debts by Settlement (%)

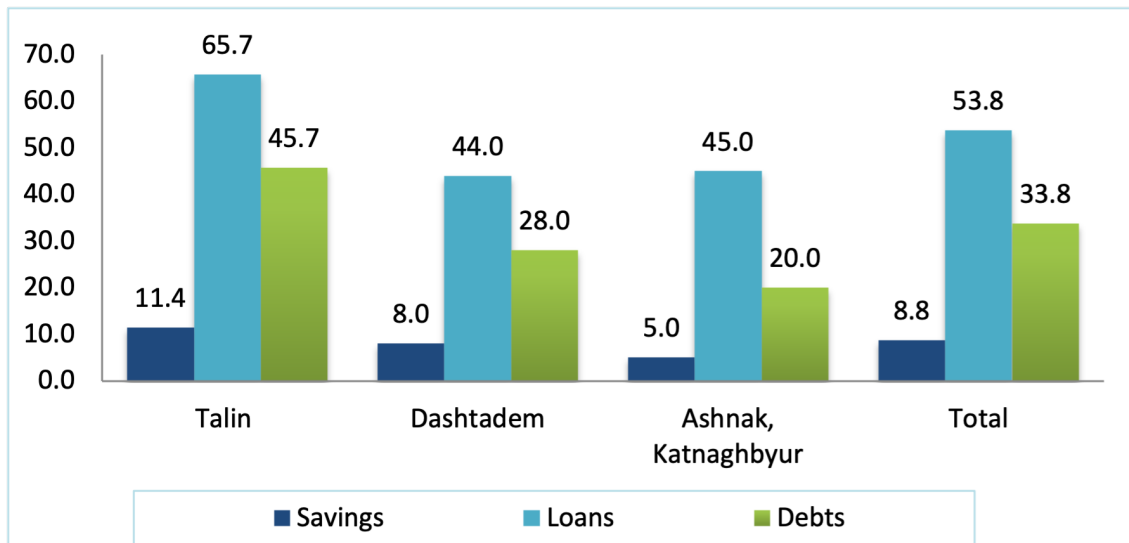


Table 139 Modes of Transportation in Local Communities (%)

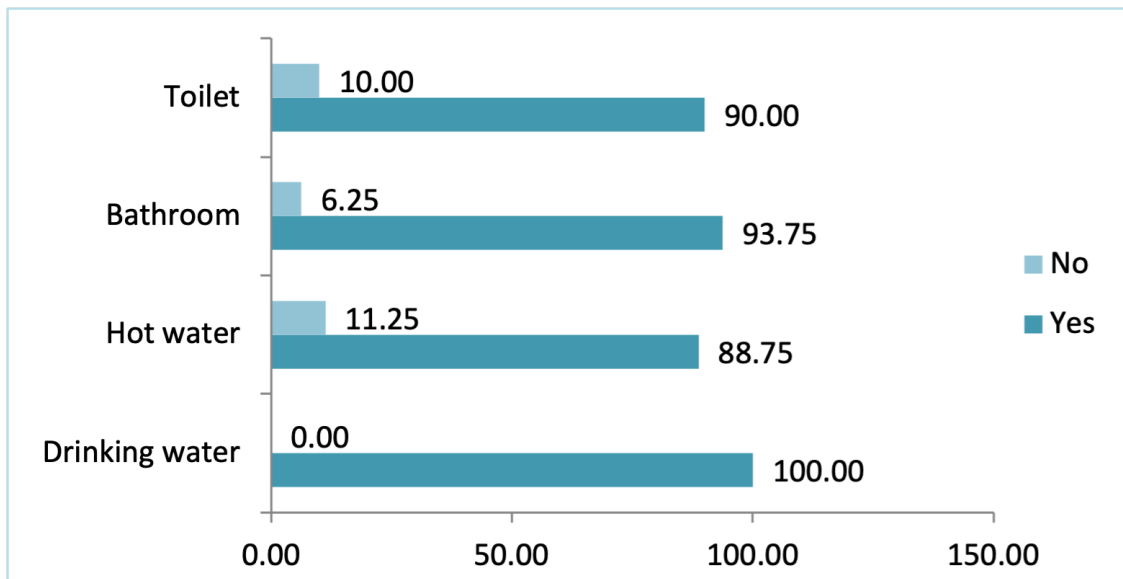
Means of Transport	Yes	No
Car/Truck	62.5%	37.5%
Bicycle	2.5%	97.5%
Motorcycle/Scooter	0%	100%

### Housing and Living Conditions

The household survey also gained insight on the conditions of the participants houses. The results of the survey indicate that not all households participating in the survey have access to utilities. There is drinking water available in all survey participants' homes. In relation to bathrooms, 6.3% of surveyed HHs do not have a bathroom. The bathroom is replaced by one of the rooms in the house or another building in the yard, which is also used for bathing. 11.3% do not have hot water, they heat water on stoves or electric heaters for bathing or other purposes. 10% do not have a toilet inside the house, they are outside toilets and are not

connected to any system. The availability of utilities in respondents homes is displayed below in Figure 29. The households without hot water are equally present in all beneficiary settlements. Respondents to the survey who reported that they do not have toilets are mostly in the villages Ashnak, Katnaghbyur and Dashtadem. The lack of bathrooms is common in rural areas.

Figure 36 Availability of Utilities (%)



The analysis of living conditions also provides an insight into the financial capacity of households residing in the beneficiary communities. The data in Table 136 indicates that the majority of surveyed households have issues related to poor living conditions and struggle to participate in recreational activities due to their poor financial situations.

The results of the survey indicate that 90% of respondents are unable to pay for at least one week of vacation per year. 85% of respondents households are unable to replace worn furniture, 80% are unable to repair the interior and exterior of the house. Providing sufficient heating in winter is also unaffordable for 60.0% of surveyed families living in the beneficiary areas.

A relatively large number of households (76.3%) stated that they can host relatives and friends once a month. This is most likely related to the Armenian culture and hospitality rather than respondents financial capabilities. This is also evidenced by the fact that only 33.8% of participants stated that they can buy meat every other day. The households have rated this ability relatively high, also considering they own farm animals, which they can slaughter and use for household needs if they necessary.

**Table 140 Ability to Meet Living Conditions (%)**

Is your household able to do the following?	Yes	No
Provide adequate heating in your house?	40%	60%
Change worn furniture?	15%	85%
Implement interior/exterior finishing of the house?	20%	80%
Pay for a one-week vacation annually?	10%	90%
Buy chicken / meat / fish at least every two days?	33.8%	66.3%
Host your relatives/ friends at least once a month?	76.3%	23.8%



**Sources of Water and Energy**

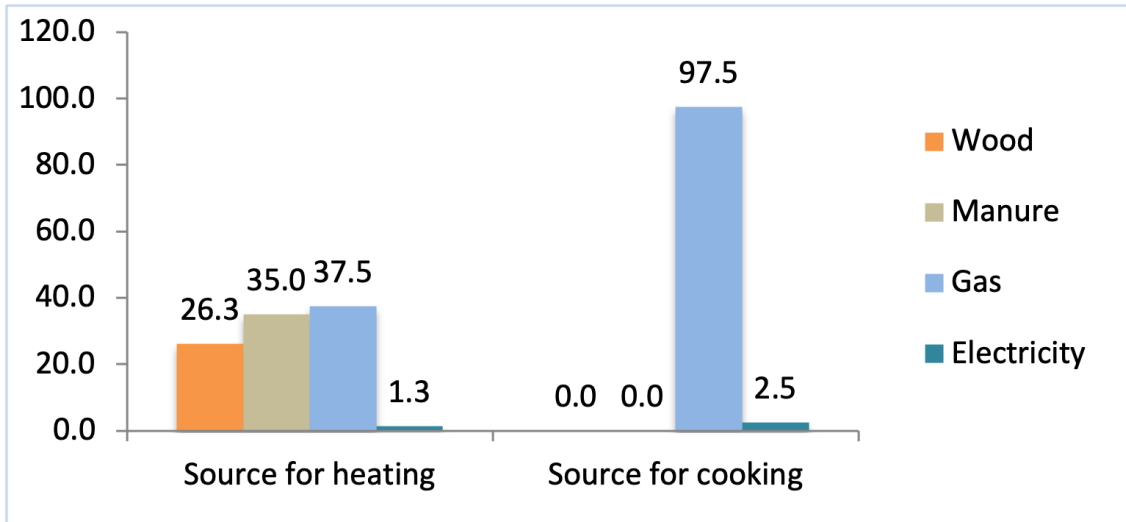
The social survey gained insight on sources of energy available to the affected communities. Electricity as a source of home lighting is used in all cities and villages of the Republic of Armenia, including the affected communities of the Project. However, an issue related to energy for community members is the energy available for heating and cooking. The data Figure 30 indicates that 97.5% of households use gas for cooking. However, during the survey, 2.5% of respondents claimed that they could not pay the required amount for the gasification of their house, so they use electricity for cooking.

The results of the social survey indicate the surveyed households use several sources of heating for their homes. There are 37.5% of respondents that heat their house using gas during winter months. Similarly, 35% of respondents use dried dung to heat their houses. Those who use dried dung are mainly participants that are engaged in animal husbandry and use manure for heating. Wood is also a common source of heating with 26.3%

of respondents reporting to use wood as a heating source. Table 136 showed that 60% of respondents are not able to provide sufficient heating of the house in the winter months. Wood and dung stoves usually provide the ability to heat 1-2 rooms in the house while individual gas heating systems heat the entire house.

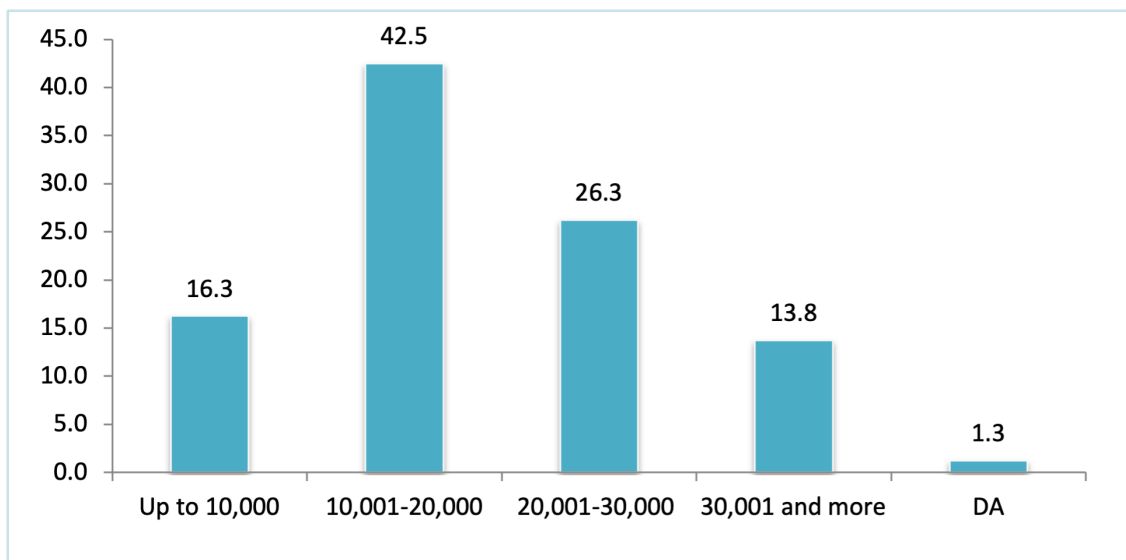
There is only 5% of households that use alternative energy sources such as solar panels and solar water heaters. According to the survey, solar panels are used in Talin while solar water heaters are also used in Ashnak and Katnaghbyur.

Figure 37 The Source for Heating and Cooking (%)



The average monthly amount of utility bills for 42.5% of households is 10,000 -20,000 AMD. There is 26.3% of surveyed households who pay a higher utility bill amount of 20,000- 30,000 AMD. For 13.8% of households surveyed, the fees for gas, electricity, and wood are higher again at 30,000 + AMD which is displayed in Figure 31. The results of the survey found that the high price of utility services troubles 18.8% of respondents which is displayed in Table 137. A small number of households also mentioned other problems related to electricity and gasification. 25.9% of the respondents did not express any concerns regarding the provision of utilities.

Figure 38 Average Monthly Utility Bills in AMD for Surveyed Households (%)



As mentioned, all households are provided with a water supply system but 15.0% of surveyed households do not pay for water. These are 7 households from Katnaghbyur village. In addition to this, another 5 households from Talin and Dashtadem communities also stated that they do not pay for drinking water. As well as the main water supply system of the house, 25.0% of households also have an auxiliary source of drinking water outdoors that is suitable for consumption.

Once again, referring to the problems related to water supply, most of the respondents, 68.8%, stated that water is scarce and is provided by the hour. Drinking water is scarce especially in the summer months and water is provided by the hour which is usually 2-3 hours a day at most. Only 30.0% stated that they do not see a problem with the water supply. 1.2% of respondents found it difficult to answer the question. The data in Table 137 demonstrates that the majority of problems with utilities are related to drinking water. This has been reported as a problem by 48.2% of the households surveyed.



**Table 141 Problems With Utility Services**

Main Problems with Utilities	%
Drinking water is scarce, it is provided by the hour	48.2%
Utility prices are high	18.8%
Power outages	1.2%
Gasification is expensive	3.5%
DA	2.4%
I have no worries	25.9%

### Sewage

It has been reported that sewage disposal is a serious problem for rural settlements in the Project area. The social survey and investigative studies have revealed that Dashtadem, Katnaghbyur and Ashnak villages do not have a sewage system in place. However, in Talin community, 36.3% of surveyed households are connected to the sewerage system. There are also 1-2 newly built districts in the city of Talin where there is no sewerage system resulting in 10% of households surveyed pumping sewage into a nearby steep. In rural settlements, 42.5% of the households dig sewer pits which need

to be cleaned and emptied from time to time. For this purpose, people use appropriate machinery for which they allocate money from their family's limited funds. The results of the survey indicate that 10.0% of households surveyed use outdoor latrines. These are most common in Katnaghbyur, as well as in Dashtadem.

48.8% of the respondents express concern about the sewage disposal system, pointing to its absence while 51.2% do not see any problem in this regard.



**Table 142 Sewage Disposal Methods**

Sewage Disposal Method	%
Toilet connected to a sewerage system	36.3%
Toilet connected to a septic tank	1.3%
Sewage pit	42.5%
Outdoor toilet	10%
It flows on its own and fills a nearby steep	10%



### 16.1.1. Poverty

By law, the Minimum Wage in Armenia is equal to 68,000 AMD per month. 82.5% of the households surveyed declared a total household income of between 100,000 - 300,000 AMD per month. 47.5% of these households consist of families of 3-5 people. Those families earning a total household income of 300,000 AMD per month with 5 people in their family are believed to be living below the poverty line. When considering a dual income (2 persons), those households earning 100,000 per month are also estimated to be under the poverty line.

Many of the members of these households have secondary forms of employment in order to generate additional income. It is estimated that if these household members did not obtain secondary employment, they would also be under the poverty line. Many of the surveyed households struggle to meet monthly expenses, depend on money from family members abroad and are in financial debt. Therefore, based on the self declared household income data gathered during the social survey, a large number of the households in the affected communities are believed to be living under poverty line.

## 16.2. Sensitive Receptors

**Table 143 Economic Conditions- Sensitive Receptors**

Receptor	Receptor Sensitivity	Justification
<b>Local Economy</b>	Medium	The local economy is vulnerable to economic shocks since it is not diversified and relies significantly on low productivity agricultural activities.
<b>Local Communities</b>	Medium	Households in the local communities combine a number of income streams and agriculture activities, but are sensitive to external shocks due to limited savings, limited access to financial tools and relatively low productivity agriculture.

## 16.3. Impacts

### 16.3.1. Construction Phase

#### Frustrated Community Expectations

While the communities have had previous experience with PV plant developments in the area, the Ayg-1 PV Project will be the largest PV Plant in Armenia once completed. Community members may not have had prior experience with a Project of this magnitude.

Project developers, consultants and authorities sometimes highlight the potential economic benefits of Projects to the local communities without providing specifics (number of workers, duration, employment conditions, procurement opportunities, etc.). This can lead to the creation of unrealistically high expectations among community members in terms of employment creation, local supply chain opportunities and the CDP / CSR activities. For energy projects communities often expect that the Project will provide free or discounted electricity to local households, this is not possible since the electricity will be provided to the grid and clear stakeholder engagement needs to be carried out to ensure discounted electricity is not expected by the community. Unrealistic or incorrect expectations may lead to frustration, mistrust and potential conflicts between the Project and the communities.

#### Local Employment

During the construction phase of the PV Plant, manpower is required to effectively and efficiently construct the PV Plant. Some engineers and specialists are likely to be hired abroad or in other areas, but labourers and semi-skilled construction workers can be hired locally. During the construction phase of the PV Plant a minimum of 250 workers are expected to be employed. Based on availability and requirements, during the construction phase between 25-75% will be local hires. The Project aims to maximize the benefits to local communities and will require the contractor leading the construction to recruit men and women from local communities in the Project area when and where possible. A transparent recruitment procedure will be set up and disclosed to the communities.



#### Dissemination of Skills

Construction workers will be trained on construction techniques, E&S and H&S aspects. These aspects will improve the employees future employability.

#### Local Purchases

PV panels and key electrical components will be imported, but the Project will support local businesses to provide services for the Project (e.g., provision of construction inputs, food for workers, etc.). When local supplies are available, meet the required quality standards and are within prevailing market prices, the Project (including the EPC and its subcontractors) will favour local suppliers.

**Local Inflation**

Projects can generate inflation locally when there is a significant Project demand for local products, limited supply, limited access to other markets and limited supply elasticity. This can cause inflation locally and make products unavailable for local consumers.

The Project area is well connected to national roads and relatively close to Yerevan, so the number of Project workers and associated demand for local products is not expected to be significant compared to the size of the local population and the characteristics of the regional market.



**Table 144 Economic Impacts- Impact Magnitude- Construction Phase**

Impact	Impact Magnitude	Likelihood	Justification
<b>Frustrated Community Expectations</b>	Moderate Negative	Possible	Community expectations usually raise beyond the Project’s capacity to deliver if not adequately managed. The impact on the relationship between the community and the Project can be significant.
<b>Local Employment</b>	Moderate Positive (Construction) Minor Positive (Operations)	Likely	A significant number of jobs will be offered to local people during the construction phase. The number of jobs will be lower during operations.
<b>Dissemination of Skills</b>	Minor Positive (Construction)	Possible	The skills provided would be useful for construction works but they are not necessarily applicable to the economic activities of local communities.
<b>Purchases from the local economy</b>	Minor Positive (Construction)	Possible	Local purchases can lead to increase in local economic activities; however, it will only be of minor significance.
<b>Local Inflation</b>	Minor Negative (Construction)	Unlikely	The Project area is well connected to national roads and the number of Project workers and associated demand for local products will not be significant compared to the size of the local population.

### 16.3.2. Operational Phase

#### Local Employment

Employees will be required during the operational phase of the Project, but the number of employees will be significantly lower than during construction. The Project is expected to employ 15-25 employees of which at least 50% would be local hires. This will provide a direct income source to the local communities.

#### Provision of Electricity to the National Grid



The main aim of the Project is to use a renewable energy source to generate electricity for the national grid. Reliable electricity supply is a necessity in Armenia and an enabler for further independence, sustainable economic and social development.

**Table 145 Economic Impacts- Impact Magnitude- Operational Phase**

Impact	Impact Magnitude	Likelihood	Justification
<b>Frustrated Community Expectations</b>	Moderate Negative	Possible	Community expectations usually raise beyond the Project’s capacity to deliver if not adequately managed. The impact on the relationship between the community and the Project can be significant.
<b>Local Employment</b>	Minor Positive	Likely	A small number of permanent jobs will be offered to local people during the construction phase. The number of jobs is lower during operations.

### 16.3.3. Decommissioning Phase

The decommissioning impacts are likely to be similar to those of the construction phase but of a lower magnitude.

## 16.4. Impact Assessment

Table 146 Economic Impacts- Impact Assessment- Construction Phase



Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>Frustrated Community Expectations</b>	Moderate Negative	Possible	Local Communities	Medium	Moderate Negative
<b>Local Employment</b>	Moderate Positive	Likely	Local Households	Medium	Moderate Positive
<b>Dissemination of Skills</b>	Minor Positive	Possible	Local Communities	Medium	Minor Positive
<b>Purchases from the local economy</b>	Minor Positive	Possible	Local Economy	Medium	Minor Positive
<b>Local Inflation</b>	Minor Negative	Unlikely	Local Economy	Medium	Negligible Negative

Table 147 Economic Impacts- Impact Assessment- Operational Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>Local Employment</b>	Minor Positive	Likely	Local Economy	Medium	Moderate Positive
<b>Frustrated Community Expectations</b>	Moderate Negative	Possible	Local Community	Medium	Moderate Negative

Decommissioning phase impacts are similar to construction impacts but with a lower magnitude and duration.



## 16.5. Management Measures

Table 148 Economic Impacts- Management Measures- Construction Phase



Impact / Risk	Management Measure
<b>Frustrated Community Expectations</b>	Implement a Stakeholder Engagement Plan (SEP) to ensure ongoing communication with Project affected communities and to manage expectations in relation to employment, local purchases and the Community Development Plan.
	Communicate jobs and labour requirements in advance of construction to manage expectations, directly to the communities through the CLOs.
	Continue to provide timely and transparent information regarding employment opportunities and other Project activities.
<b>Local Employment</b>	Develop Local Recruitment requirements within the Human Resources Policy, including provisions to priorities local recruitment whenever possible. Develop a Local Recruitment Procedure within the Labour and Working Conditions Management Plan (LWCMP).
	Put in place transparent and fair recruitment procedures.
	Preference will be given to those within the Project area, candidates will only be sourced outside the Project area of influence when skills and experience are not available locally. It is expected that between 25-75% will be recruited locally.
	Ensure the personnel are aware of the recruitment process and dates (through appropriate and transparent information dissemination).
	Specific attention will be given to providing employment opportunities to the youths.
	The available employment opportunities shall be distributed in equitable manner taking into specific consideration opportunities to employ women and people with disabilities. It is expected that jobs that can be undertaken by both men and women will include at least 30% semi-skilled and skilled female workers if local women are interested and qualified for the relevant positions.



Impact / Risk	Management Measure
Dissemination of Skills	A training programme will be developed as part of the ESMS.
	Local employees will be given training certificates for the training modules that they complete satisfactorily.
Purchases from the local economy	Procure goods and services locally wherever possible (i.e. price and quality criteria will be considered together with local production).
Local Inflation	There are no mitigation measures because the risk of local inflation is considered to be negligible due to the good connectivity with main roads and markets.

**Table 149 Economic Impacts- Management Measures- Operational Phase**

Impact / Risk	Management Measure
Local Employment	Put in place transparent and fair recruitment procedures.
	Preference will be given to those within the project area, candidates will only be sourced outside the project area of influence when skills and experience are not available locally.
	Ensure the personnel are aware of the recruitment process and dates (through appropriate and transparent information dissemination).
	The few available employment opportunities shall be distributed in equitable manner. It is expected that as a minimum 30% of the workshop will be women.



## 16.6. Residual Impact

Table 150 Economic Impacts- Residual Impacts- Construction Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
<b>Frustrated Community Expectations</b>	Moderate Negative	Yes	Negligible Negative
<b>Local Employment</b>	Moderate Positive	Yes	Moderate Positive
<b>Dissemination of Skills</b>	Minor Positive	Yes	Moderate Positive
<b>Purchases from the local economy</b>	Minor Positive	Yes	Minor Positive
<b>Local Inflation</b>	Negligible Negative	No	Negligible Negative

Table 151 Economic Impacts- Residual Impacts- Operational Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
<b>Local Employment</b>	Moderate Positive	Yes	Moderate Positive
<b>Frustrated Community Expectations</b>	Moderate Negative	No	Negligible Negative



## 16.7. Monitoring Measures

Table 152 Economic Impacts- Monitoring Measures- Construction Phase

Impact / Risk	Monitoring Measure
<b>Frustrated Community Expectations</b>	Monitoring number of community engagements.
<b>Local Employment</b>	Monitoring of number of local employees, including employees from vulnerable groups.
<b>Dissemination of Skills</b>	Monitoring the provision of training certificates to local workers.
<b>Local Purchases</b>	Monitoring of the number of local suppliers.

Table 153 Economic Impacts- Monitoring Measures- Operational Phase

Impact / Risk	Monitoring Measure
<b>Local Employment</b>	Monitoring of number of local employees, including employees from vulnerable groups.
<b>Frustrated Community Expectations</b>	Monitoring of grievance records.

## 17 Social Welfare

This chapter describes the systems that are in place to maintain the well-being of society, including healthcare and education, and all other organizations and structures operating in the Project area to support the communities or specific social groups.

Potential Project impacts discussed in this chapter include negative impacts on social infrastructure (e.g., added pressure on the local healthcare system), the spread of communicable diseases on community health and indirectly on the healthcare system, potential impacts on social support networks, and potential positive impacts such as support from the Project to the education and healthcare system.



### 17.1. Observations and Baseline Conditions

#### Education

In Armenia illiteracy was eradicated during the soviet period, when universal schooling was achieved. Since independence, the law requires schooling from the ages of six to 16. Primary and secondary education in Armenia is free, and completion of secondary school is compulsory.





Armenian education has observed some trends in recent years relating to male and female secondary school enrolment rates. Unlike many other parts of the world, there are many more females than males enrolled in secondary education. In 2014, about 100% of females were enrolled in upper secondary education, while only 89 percent of males were enrolled. Of Armenians who are age 15 and over, 100 percent are literate, placing Armenia near the 99th percentile for access and literacy across the world.

The provision education services in the local communities is at a sufficient level but residents from affected communities tend to move to Yerevan for university education.

The city of Talin has two schools, one high school and one college; The Aragatsotn Regional State College. There are two kindergartens, one music school and libraries. One of the schools operating in the city is a children's art school. The community has a newly built sports school and football stadium. The latter needs improvement and partial renovations.

There is one secondary school and a training building in the Dashtadem community. The school building is a standard facility built-in 1976 for 240 students. The training building is two-stories and has an adjoining gym. There is also a two-story pre-school in the community with a capacity for 140 children.

Katnaghbyur community has a public secondary school and a kindergarten. In the Ashnak community, there is a secondary school and a pre-school.

All adult community members have primary education and 97.2% secondary, vocational or higher. 37% of community members surveyed have obtained a secondary school education. There are 21.1% of household members with higher education and 15.8% who hold a secondary professional education. 21.4% of household members are children under 16 who are in full time education or are starting school. The majority of household heads (41.3%) also have secondary education. Following this, the second largest percentage regarding education is related to household members with vocational education along with those in higher education, respectively 33.8%, 23.8%

**Table 154 Location of Education Institutions in the Project Area**

Settlement	Primary School	Secondary School	College
Talin	None	Basic School No.2	Aragatsotn Regional State College
Dashtadem	None	Dashtadem School	None
Katnaghbyur	Katnaghbyur primary school	Katnaghbyur Secondary School	None
Ashnak	Ashnak primary school	Ashnak secondary school	None

**Table 155 Level of Education (%)**

Settlement	Primary School	Secondary School
Incomplete secondary	2.8%	1.3%
Secondary	37%	41.3%
Vocational	15.8%	33.8%
Incomplete Higher/student	1.9%	0%
Higher	21.1%	23.8%
Under 16	21.4%	-
Total	100%	100%



**Health Facilities**

Healthcare in Armenia during the Soviet era was a public, universal and centralized medical system. When Armenia declared independence in 1991, Local governments took over primary health care sectors while regional governments gained ownership over hospitals. Armenia’s State Health Agency is now in charge of the healthcare system. Since 2006, primary health care services have been free of charge. In 2019, the Government of Armenia made healthcare free for all citizens under the age of 18.

Data collected from desk studies indicates that there are 22 healthcare organizations in the Aragatsotn Marz region. Six of these organizations provide hospital services while 16 provide outpatient polyclinic services. In the Aragatsotn Marz region, there are 167 beds in the medical institutions. The workforce within these organizations comprises of 231 doctors and 535 nurses who work there on a part time or permanent basis. Talin Medical Centre CJSC operates in the Talin community, three more rural dispensaries are located in nearby communities but not in the affected communities.

**Prevalent Diseases**

The available official documents provide generalized information on diseases in the Aragatsotn Marz region, but do not contain specific information about the diseases spread among the population of the local communities. According to the "Regional Health Systems Mapping, Armenia 2020" report, the two most common diseases among the adult population of the Aragatsotn Marz region are circulatory system and respiratory diseases, which are almost equally common in the list of diseases. Diseases of the endocrine system, nutritional disorders, diseases of the eye and its appendages are also common. Diseases of the digestive organs and genitourinary system are also relatively common in the Aragatsotn Marz region.

**Table 156 Disease Breakdown of the Adult Population of the Aragatsotn Marz**



Diseases	18 Years Old and Above	
	A.N.*	R.N.*
Diseases of the circulatory system	10,094	10,807.3
Diseases of the respiratory	10,051	10,761.2
Diseases of the endocrine system, nutritional disorders	5,635	6,033.2
Diseases of the eye and its appendages	5,176	5,541.8
Diseases of the digestive organs	3,305	3,538.5
Diseases of the genitourinary system	3,222	3,449.7

**A.N.\*:** Represents absolute number.

**R.N.\*\*:** Represents the relative number per 1,000 population.

The most common juvenile diseases are respiratory diseases. The total number of recorded patients with respiratory diseases is 11,324, amounting to 19.6% of the population aged 0-17 who have experienced a form of respiratory disease. Diseases of the digestive organs and the eye and its additional apparatus are relatively common but 5.5 times less prevalent when compared to respiratory diseases in the Aragatsotn Marz region.

**Table 157 Disease Breakdown of the Juvenile Population of the Aragatsotn Marz**

Diseases	0-14 years old		15-17 years old	
	A.N.*	R.N.*	A.N.*	R.N.*
Diseases of the respiratory	9,672	35,822.2	1,652	35,148.9
Diseases of the digestive organs	1,618	5,992.6	465	9,893.6
Diseases of the eye and its appendages	1,101	4,077.8	660	1,404.6

**A.N.\*:** Represents absolute number.

**R.N.\*\*:** Represents the relative number per 1,000 population.

There are high mortality rates of the population associated with developing diseases. According to the above-mentioned report, the most common deaths in the Aragatsotn Marz region are caused by diseases of the circulatory system. The total number of recorded deaths in 2019 was 1,168 persons, 661 deaths (56.6%) of which were due to diseases of the circulatory system. From initial research, circulatory system related deaths are more common in

women rather than men. Deaths from ischemic heart disease and other chronic diseases make up 363 (31%) of the recorded deaths, 11 cases were found to be more common in women. The death rate due to neoplasms is relatively high with 221 (18.9%) recorded mortality cases. The mortality rate from this disease is higher among men.



**Table 158 Mortality Rates and Causes of the Population of Aragatsotn Marz by Sex**

Diseases	18 Years Old and Above		Totals
	A.N.*	R.N.*	
Diseases of the circulatory system	310	351	661
Ischemic heart disease and other chronic diseases	176	187	363
Neoplasms	132	89	221

Source: 2020 Regional Health Systems Mapping, Armenia report.

Following the desk study on diseases within the Aragatsotn Marz region, the social survey included questions related to chronic diseases to gauge the health status of community members. According to the survey data, 32 people (27 household members) have at least one family member with a chronic disease. Some respondents have more than one disease. The most common disease is diabetes and high blood pressure. People suffering from the following diseases have also been met: cardiovascular failure, thyroid gland, osteochondrosis, vertebral hernia, atrial fibrillation, chronic kidney disease, chronic lung disease, rheumatism and arthritis. 26.3% of households who participated in the survey

stated that there are mandatory monthly expenses, ranging from 2,000 -200,000 AMD for the medical care and treatment of the disabled and chronic patients. 52.4% pay between 20,000 -50,000 AMD per month on medical expenses, 38.1% pay up to 20,000 AMD while 52.4% of respondents use the services of the Talin Medical Center. There are a small number of respondents who have applied to different medical centres in Yerevan. This data is summarized in Table 155.

**Table 159 Questions Related to Patient Care**

<b>Expenses/Services</b>	<b>AMD</b>	<b>Percentage (%)</b>
<b>Costs</b>	Up to 20,000	38.1%
	20,001-50,000	52.4%
	50,001 Plus	9.5%
	<b>Total HH Surveyed</b>	100%
<b>Medical Institutions</b>	<b>Medical Centre</b>	<b>Percentage (%)</b>
	Talin	52.4%
	Yerevan	47.6%
	<b>Total HH Surveyed</b>	100%



**Disabilities/ People Living with Disabilities**

The social survey included questions related to the health of household members. The results of the social survey revealed that there are quite a large number of people with disabilities in the surveyed households. In total, there were 322 people who live in the 80 households that participated in the survey. There are 8.4% of survey respondents who hold the status of disabled.

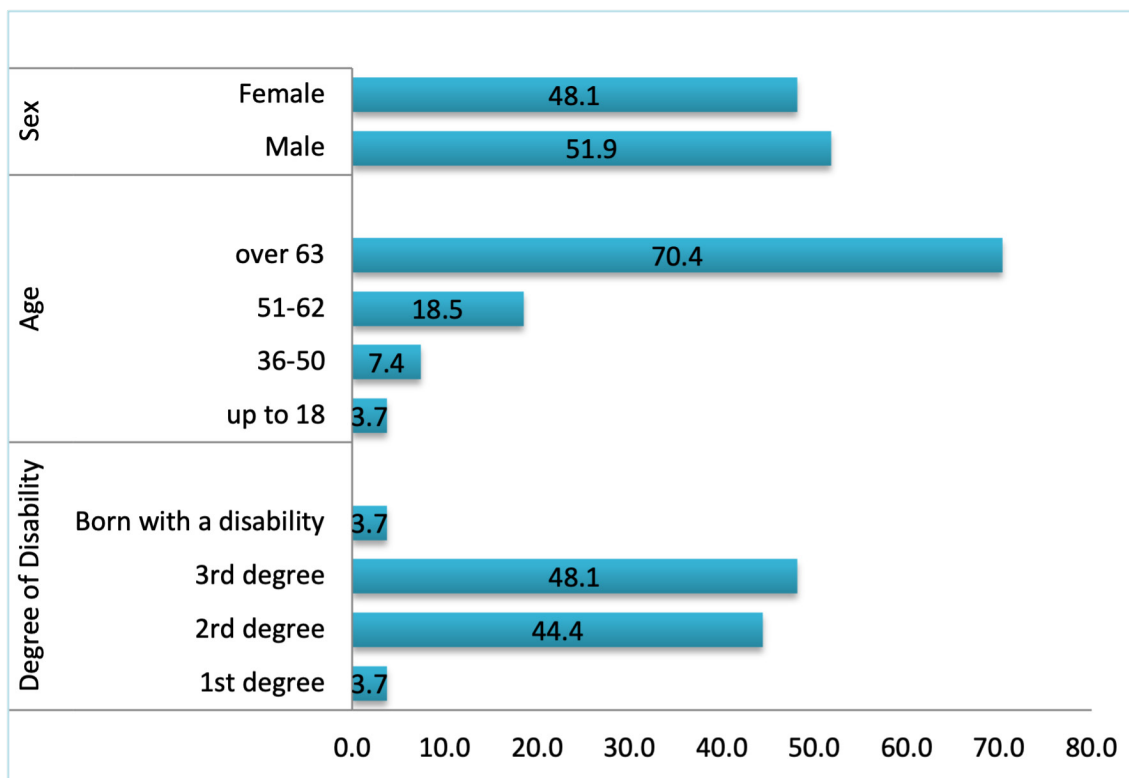
According to the data in Figure 32, there are 48.1% respondents who have a 3rd degree disability and 44.4% who have a 2nd degree disability categorization.

There was one survey respondent who has a grade 1 disability and one person, an 11-year old boy, was born with a disability. In Armenia, families receive an allowance for children with disabilities of 37,000 AMD per year. The analysis shows that the majority of disabled people, 70.4%, are people aged 63 and older. We can confirm that people acquire this or that disease in old age, as a result of which, also the category of disability.

Those under 63 make up a total of 29.6% of the respondents surveyed who have a disability. Moreover, it should be noted that as the age limit increases, the percentage of disabled people also increases which is displayed in Figure 32. Males and females make up an almost equal mass in the disabled group.



Figure 39 Data on Surveyed Community Members with Disabilities (%)



### Non-Governmental Organization

A non-governmental organization (NGO) is a non-profit group that functions independently of any government. NGOs, sometimes called civil societies, are organized on community, national and international levels to serve a social or political goal such as humanitarian causes or the environment.

Armenia acknowledges civil society participation as an important component of public administration processes, in particular the role of non government organizations (NGOs). NGO participation in the country's democratization processes has been significant.

In Armenia, the State Register reported 45 international NGOs and 5,700 local NGOs. However, out of the total number of local NGOs registered, only 977 are continuously operational.

The NGOs registered in Armenia are organizations related to humanitarian aid organizations, gender, children, youth, and minorities, sustainable development, human rights, civil society, and democracy, environmental, cultural, art, and sports, legal services, accountancy and management services, social services for disabled and elderly people, infrastructure and capacity building.

There are a number of NGOs operational in the region focussing on environmental aspects such as wilderness preservation and the reduction of human impact on the environment, promoting a harmonious relationship between society and nature, increase the awareness about environmental problems and sustainable development. Other organizations provide platforms to engage citizens and women to protect, empower and support human rights

giving women necessary tools to become active members in society through a range of activities and support. There are also NGOs that aim to strengthen national capacities of authorized / competent agencies and industrial enterprises in Armenia.



The table below describes the activities undertaken by community groups identified.

**Table 160 Community Groups in Armenia**

Group	Activity
<b>WWF Armenia</b>	This is a global organization which focuses on wilderness preservation and the reduction of human impact on the environment. They aim to "stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.
<b>Aarhus Centers</b>	The Aarhus Centers in Armenia provide platforms to engage citizens, governments and the private sector in a dialogue on environmental challenges. Access to information, public participation in environmental decision-making and access to justice in environmental matters are the three pillars of the 1998 Aarhus Convention.
<b>Biosophia Environmental</b>	This NGO aims to promote a harmonious relationship between society and nature, the solution of environmental problems on the principles of sustainable development and ecosystem approach.
<b>EcoLur Informational</b>	EcoLur is an informational resource and provides information to public that aims to increase the awareness about environmental problems and organize media campaigns for nature and environment protection.
<b>Shoger NGO</b>	This is an NGO aimed at promoting sustainable development in Armenia
<b>Eco Peace NGO</b>	This NGO aims to strengthen national capacities of authorized and competent agencies and industrial enterprises in Armenia.
<b>Armenian Women for Health and Healthy Environment</b>	This group aims to explore the issues of environment pollution in Armenia, to advocate the human right to live in a healthy environment, to promote the reduction of health risks from environmental pollution and hazards, including climate change, support the organic farming and the usage of safe alternatives to pesticides, as well to promote healthy lifestyles focusing especially on children and women



<b>Association of Women with University Education</b>	This NGO aims to give women necessary tools to become active members of society through various types of teaching, training, and support.
<b>Women’s Resource Centre</b>	The Women's Resource Center is a feminist organization working with and for women. Its main goal is to give women the necessary tools and empower them to become active citizens of the Armenian community, through education and support.
<b>Human Rights House</b>	Human Rights House is committed to a safe, accessible, and common space for activists, civil society organisations, movements, civic initiatives, and human rights defenders, who are often targeted for the work they do. Its mission is to protect, empower, and support human rights defenders and organisations in Armenia.

**Table 161 Social Conditions- Sensitive Receptors**

<b>Receptor</b>	<b>Receptor Sensitivity</b>	<b>Justification</b>
<b>Local Dispensary</b>	Medium	There is a medical centre in Talin and three dispensaries around the Project area. The influx of employees as a result of the project may put their capacity and resources under strain to cope with local demand for healthcare.
<b>Communicable Diseases</b>	High	The interaction between the workforce and the local population can result in the proliferation of communicable diseases, including Sexually Transmitted Diseases.

## 17.2. Impacts

### 17.2.1. Construction Phase

#### Spread of Communicable Diseases / STDs / COVID 19

The interaction between the workforce and the local population can result in the proliferation of communicable diseases, including Sexually Transmitted Diseases.

In the event of a new strain of the pandemic causing renewed concerns, specialized engineers from outside Project areas and likely international staff pose a risk to spread COVID 19 in rural communities.

#### Increased Pressure on Medical Services



The Project employees will require medical services, particularly during the construction phase of the Project. If the Talin Medical Centre CJSC or nearby rural dispensaries were used, this would put additional strain on the limited health care resources available in the area.

There will be a donation agreement for Talin and Dashtadem communities that will be invested in public services that will have a positive impact on the population. These funds will be managed by the local authorities, Masdar will participate in the assessment of potential community development actions through the CDP.

**Table 162 Social Welfare- Potential Impact Magnitude**

Impact	Impact Magnitude	Likelihood	Justification
<b>Spread of communicable diseases/ STDs</b>	Major Negative	Unlikely	The spread of STDs or other communicable diseases would have a significant impact on the affected persons.
<b>Spread of COVID 19</b>	Moderate Negative	Unlikely	The risks from COVID 19 are likely to remain low during 2023. Specific measures are described to be applied in the event of a new strain of the pandemic causing renewed concerns.
<b>Increased pressure on medical services</b>	Moderate Negative	Possible	The Project could increase pressure on local medical services, impacting their availability for local community members.
<b>Community Development Actions</b>	Major Positive	Certain	The Project will implement Community Development actions to benefit the local population, most likely including support for social infrastructure.

### 17.2.2. Operational Phase

The impacts during operation are likely to be similar to those of the construction phase, but of lower magnitude.

### 17.2.3. Decommissioning Phase

The decommissioning impacts are likely to be similar to those of the construction phase but of a lower magnitude.



Flowers identified on-site



## 22.4. Management Measures

Table 163 Social Welfare- Impact Assessment- Construction and Operations



Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>Spread of communicable diseases/ STDs</b>	Major Negative	Unlikely	Local Dispensary & Community	High	Major Negative
<b>Spread of COVID 19</b>	Moderate Negative	Unlikely	Local Dispensary & Community	High	Major Negative
<b>Increased pressure on medical services</b>	Moderate Negative	Possible	Local Dispensary & Community	High	Moderate Negative
<b>Community Development Actions</b>	Major Positive	Certain	Community Services	High	Major Positive

Table 164 Social Welfare- Management Measures- Construction & Operational Phase



Impact / Risk	Management Measure
<b>Spread of Communicable Diseases / STDs</b>	Conduct medical checks for Project personnel and provide vaccination and/or other mitigating measures when required.
	Conduct awareness raising activities on communicable diseases.
	Develop and implement the following: <ul style="list-style-type: none"> <li>• Workforce Code of Conduct (in relation to worker-community interaction);</li> <li>• Grievance Mechanism;</li> <li>• Site Management Plan (including food hygiene procedure);</li> <li>• Emergency Response and Preparedness Plan; and</li> <li>• Worker Induction Programme.</li> </ul>
<b>Spread of COVID 19</b>	In the event of a new strain of the pandemic causing renewed concerns, the following measures shall be considered: Implement the hierarchy of controls to reduce the risk of COVID 19. The hierarchy consists of five ways to eliminate or mitigate a hazard that are ranked in order of effectiveness and, therefore, preference. <ul style="list-style-type: none"> <li>• Elimination: Elimination of the virus is not possible at the company level, it can only be successfully eliminated at the social level.</li> </ul>



Impact / Risk	Management Measure
	<ul style="list-style-type: none"> <li>• Substitution: Refers to changing a hazard for something less hazardous. While not applicable directly to the virus, it can be applicable to activities (e.g. on-site work substituted by work from home).</li> <li>• Engineering Controls: Involve isolating people from a hazard or placing a barrier between them. Glass or Plastic separations inside vehicles, worker accommodation areas or offices to avoid transmissions are examples of engineering controls. Masks also act as a barrier and reduce transmission from infected persons.</li> <li>• Administrative controls: Involve changing the way people work or act, include changes in policy or procedures to reduce or minimize hazard exposure. Frequent hand washing, regular disinfection of exposed surfaces, social distancing, isolation of suspected and confirmed cases, limiting the size of teams working together, the number of people per vehicle / lift, etc.</li> <li>• Personal Protective Equipment (PPE): PPE is worn by the worker to put a barrier between him / her and the hazard. It is considered the least effective control as per the hierarchy, but has a significant importance to reduce the infectivity of the virus through the use of masks, glasses and face shields.</li> </ul> <div style="text-align: center;"> <p>Elimination</p> <p>Substitution</p> <p>Engineering Controls</p> <p>Administrative Controls</p> <p>PPE</p> </div>



Impact / Risk	Management Measure
	<p>In the event of a new strain of the pandemic causing renewed concerns, the following measures shall be considered: Incorporate the COVID-19 management measures to the following ESMS Plans:</p> <ul style="list-style-type: none"> <li>• Occupational Health and Safety Management Plan (OHSMP), including, but not limited to:                             <ul style="list-style-type: none"> <li>– Social distancing at work whenever possible.</li> <li>– Personal Protective Equipment.</li> <li>– Provide training and sensitization to workers when there are suspected or confirmed cases.</li> </ul> </li> </ul>
<p><b>Increased Pressure on Medical Services</b></p>	<p>Provide health facilities on site to avoid adding pressure to local facilities, including a site clinic to provide day to day check ups, emergencies and medical care.</p>
<p><b>Community Development Actions</b></p>	<p>Implement a Community Development Plan (CDP). The CDP will include a needs assessment, a risk assessment, a monitoring plan and clear implementation responsibilities.</p> <p>Implement Community Development actions to benefit the local communities (e.g. healthcare facilities improvement, water provision, etc.).</p>

The management measures listed for the construction phase will be applied during decommissioning, as relevant.

## 22.5. Residual Impact

Table 165 Social Welfare- Residual Impacts- Construction & Operational Phase



Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
<b>Spread of communicable diseases/ STDs</b>	Major Negative	Yes	Minor Negative
<b>Spread of COVID 19</b>	Major Negative	Yes	Minor Negative
<b>Increased pressure on medical services</b>	Moderate Negative	Yes	Negligible Negative
<b>Community Development Actions</b>	Major Positive	Yes	Major Positive



## 22.6. Monitoring Measures

Table 166 Social Welfare- Monitoring Measures- Construction & Operational Phase



Impact / Risk	Monitoring Measure
<b>Spread of communicable diseases/ STDs</b>	Monitoring of HIV/AIDS preventive activities (e.g. sensitisation, provision of condoms, voluntary testing)
	Monitoring of the number of incidents related to communicable diseases / STDs..
	Monitor compliance with the workers Code of Conduct.
	Monitoring of the number of grievances related to communicable diseases / STDs.
<b>Spread of COVID-19</b>	In the event of a new strain of the pandemic causing renewed concerns, the following measures shall be considered: Monitoring of COVID-19 preventive actions and preparedness activities.
<b>Pressure on medical services</b>	Monitor the level of compliance of the onsite clinic in terms of staff and resources.
<b>Community Development Actions</b>	Monitor the successful implementation and delivery of CDP actions, including its impact on the community.
	Monitoring of the community perception about the Project.
	Monitoring of grievances.

The monitoring measures listed for the construction phase will be applied during decommissioning, as relevant.

## 18 Security

Project related activities can result in increased safety and security risks to the local communities who live and work in the Project area. This chapter focuses on the risks associated with site security, conflicts with local communities, and risks to community safety caused by construction activities, Project traffic and employment.

### 18.1. Observations and Baseline Conditions

#### Conflicts and Security

Armenia is considered one of the safest countries in the world regarding crime rates but crime still does occur in the country. The crime rates in Armenia tend to fluctuate on a yearly basis. For example, the crime rate in 2018 observed a 28.74% decline in comparison with the 2017 crime rate statistics whereas 2016 saw a 15.58% increase in crime from 2015.

The data in table 163 shows how many crimes were registered in 2019 in the Armenia Police Departments in general, separately in the Aragatsotn Region Departments and in the Talin Police Department. A total of 26,850 crimes were registered in Armenia in 2019, of which:



- Crimes against a person – 4,293;
- Crimes against public safety, public order and population health – 3,987;
- Crimes against property – 14,199 (12,737, theft of personal property);
- Crimes against economic activity - 924;
- Crimes against state power, service and order – 3,055;
- Other - 392.



**Table 167 Number of Registered Crimes, 2019**

Type	Average
Talin Police Department	185
Departments of Aragatsotn Marz	1,528
Total crime in Armenia	26,850
<b>Percentage Aragatsotn Marz region &amp; Talin contributes to total crime</b>	
The weight of regional cases in Armenia, %	5.7%
The weight of Talin cases in the Marz, %	12.1%
The weight of Talin cases in Armenia, %	0.7%

The number of such cases in the Aragatsotn Marz region is 1,528 registered cases, which equates to 5.7% of the total number of cases in Armenia. In the Talin Police Department, which serves the city of Talin and the surrounding rural settlements, including the local communities, 185 crimes were registered in 2019. Crime cases in the Talin region makes up 0.7% of the total crime cases recorded in Armenia which is quite low.

There has been an increase in the number of crimes in both Armenia and Aragatsotn marz in 2020. 6089 cases were registered in January-March in 2019. During the same period in 2020, there was a 14.4% increase in the crimes registered. In the Aragatsotn marz, although relatively small, the number of crimes increased by 9.1%. Subsequently, this increase has contributed to an increase in the percentage of regional cases recorded in Armenia.

In contrast to the general indicators of the Republic of Armenia, in the Aragatsotn

Marz region, crimes of medium severity are considered predominant. Particularly serious crimes are low in the region compared to the national average which is depicted in table 163. The data presented in the table below indicates that there has been an increase in the number of crimes in both Armenia and Aragatsotn marz in 2020. 6089 cases were registered in January-March in 2019, then during the same period, it increased by 14.4% in 2020. In the Aragatsotn marz, although relatively small, the number of crimes increased by 9.1%.

In the Aragatsotn Marz region, crimes of low and medium severity are considered predominant. Particularly serious crimes are low in the region compared to the national average which is depicted in table 164. According to the mayors of the local communities, the population in the local communities are fully protected and free from the risk of crime. Only one case of cattle theft was mentioned, which took place Dashtadem community in 2019.

**Table 168 Number of Registered Crimes by Severity, January- March 2020**

Diseases	Total	Including			
		Not very grave	Medium gravity	Serious	Particularly serious
Aragatsotn Marz	226	106	92	27	1
Armenia	6,965	3,616	2,171	1,101	77
Weight of regional cases in Armenia in Percentages	3.2%	2.9%	4.2%	2.4%	1.3%



### Violence Against Women

Amnesty international have reported that gender based violence is prevalent in Armenia. Gender based violence comprises the physical force or psychological abuse inflicted by men on women, often inside the couple or marriage. Statistics on the prevalence of domestic violence in Armenia vary due to severe under-reporting of the crime. However, even under-reported statistics reflect the pervasiveness of gender based violence in Armenian society and indicate extreme cause for concern. Armenia ranks 54th on the WHO's Gender Inequality Index.

Armenia's Women's Support Centre reported in 2017 that at least 1 in 4 Armenian women are victims of intimate partner violence. According to an interview with Armenia's Coalition to Stop Violence Against Women in 2018, one-third of murders in Armenia are cases of violence against women.

Drug and alcohol abuse are a risk factor for all types of violence. Generally, in Armenia drugs and substance abuse is a major issue affecting the youth with the most prevalent drug being alcohol.

The Council of Europe together with Armenian law enforcement have implemented the Preventing and Combating Violence Against Women in Armenia initiative in 2018. The Project "Preventing and Combating Violence against Women and Domestic Violence in Armenia" is aimed at strengthening the capacity of key stakeholders involved in preventing and combating violence against women and domestic violence.

### Alcohol and Drug Abuse

In 2018, the Armenian law enforcement agencies registered a 7-fold increase of seizures of narcotic drugs, psychotropic substances and precursors as compared to 2016. The observed trends of the increasing use of drugs and new psychoactive substances, has given additional impetus to the relevant national authorities to engage in programs aiming at the reduction of their supply and demand.

In 2014 the Government of Armenia has approved the National Strategy for combating drug addiction and drug trafficking. One of the priorities of the Strategy is strengthening of the regional and international cooperation in combating illicit trafficking of drugs, psychotropic (psychoactive) substances and fight against drug abuse. Each year a National

Program of Action and the schedule of its implementation are devised and adopted. There is no specific information about the use of drugs in the Project area.

**Traffic Safety**

With a population of around 3 million, Armenia has a high road fatality rate of 9.4 deaths per 100,000 people. In 2019, road crash fatalities were more than double the European Union (EU) average, and the socioeconomic costs of road crashes are estimated at 5.7 percent of Armenia’s GDP.

Intra-community roads are in poor condition in all rural areas. Compared to the intra-community roads, the inter-community roads particularly in Talin and Dashtadem are in a slightly better condition. The M9 interstate road passes through the Dashtadem community, which in 2014-2015 has been completely rebuilt.

The North-South highway is 0.9km from the Project site. It is a new development and construction works have begun, the highway will be particularly useful to the Project as it will ensure efficient and safe road corridor traffic management. It will also be useful when transporting construction materials and PV panels to the site in a time efficient manner and in accordance with international standards.



**18.2. Sensitive Receptors**

**Table 169 Community Safety and Security- Sensitive Receptors**

Receptor	Receptor Sensitivity	Justification
<b>Local Communities</b>	Medium	The security and safety conditions within the local communities is generally good but could be sensitive to external impacts.
<b>Vulnerable Groups</b>	High	Vulnerable groups are significantly more likely to be the victims of conflicts and human rights abuses.
<b>Road Users</b>	Moderate	Road users in rural roads show a moderate vulnerability to risks associated with increased traffic of heavy vehicles.



## 18.3. Impacts

### 18.3.1. Construction Phase

#### Conflict Workforce – Local Population

Conflicts could potentially arise between communities and the Project workforce due to ethnic or religious differences, mistrust of foreigners, misbehaviour of the project workforce, etc.

#### Conflict Security Staff – Local Population

Conflicts could potentially arise between communities and the Project’s security staff, who are in a position of authority, trained in the use of force and may carry weapons.

#### Alcohol, Drug Abuse and Violence against Women

Increased disposable income for men as a result of employment in the Project or supply contracts could potentially lead to increased alcohol or drug consumption and result in intra community conflict and/or incidents of violence against women.

#### Traffic Accidents

The presence of heavy and special vehicles used during the construction phase pose a traffic accident risk to road users, community members and project employees.

Vehicles will use access roads, and existing tracks to access the site. There are three potential access roads that are being considered. Two of these access roads cross populated areas while the remaining road allows site access from the main highway without crossing any of the affected communities. Currently, the third access road option is the preferred given the lower impact it will have on local communities. As the tracks may be utilized by livestock the risk of vehicle collisions poses a threat to both drivers, passengers, bystanders and animals.



**Table 170 Community Safety and Security- Impact Magnitude- Construction Phase**

Impact	Magnitude	Likelihood	Justification
<b>Conflict – workforce / local residents</b>	Moderate Negative	Unlikely	The potential for conflict between the workforces and local communities is considered to be unlikely as unskilled and semiskilled labour will be source locally when possible and few expatriate workers will be required.



Impact	Magnitude	Likelihood	Justification
<b>Conflict – security contractor / local residents</b>	Major Negative	Unlikely	The potential conflict between the security contractor and local communities is considered to be unlikely but of a high negative magnitude should it occur.
<b>Increased substance abuse</b>	Moderate Negative	Unlikely	The use of disposable income for substance abuse is considered unlikely but should be considered as a Project risk and mitigated.
<b>Road accidents</b>	Moderate Negative	Possible	Over-speeding on the existing roads and increased Project activities may lead to increased accidents in the Project area.

### 18.3.2. Operational Phase

The risks outlined for the construction phase will continue during the operational phase, but their magnitude will be lower as the as the number of workers, security guards and vehicle movements will be significantly reduced during operations.

### 18.3.3. Decommissioning Phase

The decommissioning impacts are likely to be similar to those of the construction phase but of a lower magnitude.

**Table 171 Community Safety and Security- Impact Magnitude- Operational Phase**

Impact	Magnitude	Likelihood	Justification
<b>Conflict – workforce / local residents</b>	Minor Negative	Very Unlikely	The potential for conflict between the workforces and local communities is considered to be unlikely due to the small number of operational worker required.
<b>Conflict – security contractor / residents</b>	Moderate Negative	Unlikely	The potential conflict between the security contractor and local communities is considered to be unlikely.
<b>Road accidents</b>	Minor Negative	Very Unlikely	The Project will require very few vehicles and trips for the operational phase.



## 18.4. Impact Assessment

Table 172 Community Safety and Security- Impact Assessment- Construction Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>Conflict – workforce / local residents</b>	Moderate Negative	Unlikely	Local Communities / Vulnerable Groups	High	Minor Negative
<b>Conflict – security contractor / local residents</b>	Major Negative	Unlikely	Local Communities / Vulnerable Groups	High	Moderate Negative
<b>Increased substance abuse</b>	Moderate Negative	Unlikely	Local Communities	Medium	Minor Negative
<b>Road accidents</b>	Moderate Negative	Possible	Local Communities/ Road Users	Medium	Moderate Negative

Table 173 Community Safety and Security- Impact Assessment- Operational Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>Conflict – workforce / local residents</b>	Minor Negative	Very Unlikely	Local Communities / Vulnerable Groups	High	Negligible Negative
<b>Road accidents</b>	Minor Negative	Very Unlikely	Local Communities/ Road Users	Medium	Negligible Negative



Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>Conflict – security contractor / local residents</b>	Moderate Negative	Unlikely	Local Communities / Vulnerable Groups	High	Minor Negative

Decommissioning phase impacts are similar to construction impacts but with a lower magnitude and duration.

## 18.5. Management Measures

Table 174 Community Safety and Security- Impact Assessment- Construction Phase

Impact / Risk	Management Measure
<b>Conflict – workforce / local residents</b>	Implement a Workforce Code of Conduct (in relation to worker-community interaction).
	Provide trainings to workforce on code of conduct, gender sensitivities and local cultural sensitivities.
	Implement grievance mechanisms for external stakeholders and for workers.
<b>Conflict – security contractor / local residents</b>	Implement a Security Management Plan (SMP) in line with the IFC PS4, EBRD PR4 and ADB Safeguards and the UN Voluntary Principles on Security and Human Rights.
	Implement a Project’s Security Code of Conduct that establishes the rules of conduct and standard response for the security personnel.
	Engage with reputable security providers with no record of human right abuses. Screen all security guards to ensure no history of past abuses or violent behaviour.
	Ensure ongoing communication with local authorities to capture information in relation to conflicts resulting from Project activities and help to resolve them.



Impact / Risk	Management Measure
	<p>Provide trainings to security personnel on the code of conduct, conflict de-escalation, gender sensitivities and local cultural sensitivities or ensure the security subcontractor provides its personnel with similar trainings.</p> <p>Implement grievance mechanisms for external stakeholders.</p>
<b>Increased substance abuse</b>	<p>Implement a zero-tolerance policy for drugs and alcohol on the work place. All employees are strictly prohibited from being in possession, sale, use or being under the influence of alcohol or illegal drugs while at work/ on site.</p> <p>All employees can be tested for alcohol and any drug abuse. Any person reporting for duty under the influence (or suspected of being under the influence), or in the possession, of drugs and /or alcohol will be immediately asked to leave the site and be subject to disciplinary measures – no exceptions.</p>
<b>Road accidents</b>	<p>Develop and implement a Traffic Management Plan (TMP) to minimise risk to road users. The measures described below will be included in the TMP in the ESMS.</p> <p>Speed limits will be enforced along transport routes.</p> <p>Check driver’s licenses, develop a driver Code of Conduct and train drivers on defensive driving.</p> <p>Notify communities of when construction traffic (particularly oversized loads) will be transported through or close to residential areas. Inform the communities regarding signage as well as hazards associated with Project traffic, machinery and construction activities.</p> <p>The EPC shall prepare a logistics study to confirm the maximum size of equipment that can reach the project area through existing highways and roads, and determine where roads will need to be reinforced.</p> <p>Coordination between the Project proponent and the government agencies responsible for road maintenance to identify necessary road repairs prior to and during Project construction.</p> <p>Warning signs indicating the presence of the Project along access roads (to be installed during both construction and operation) to inform local people of the dangers posed by the Project</p>





Impact / Risk	Management Measure
	Access roads that cross local communities poses a significant risk and shall be avoided whenever possible, access roads that allow direct access from national roads without crossing communities shall be favoured.
	Access roads crossing local communities shall only be used when there are no reasonable alternatives and only for specific parts of the site.
	Maintain / repair of access roads as required.

## 18.6. Residual Impact

Table 175 Community Safety and Security- Residual Impacts- Construction Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
<b>Conflict – workforce / local residents</b>	Minor Negative	Yes	Negligible Negative
<b>Conflict – security contractor / local residents</b>	Moderate Negative	Yes	Minor Negative
<b>Increased substance abuse</b>	Minor Negative	Yes	Minor Negative
<b>Road accidents</b>	Moderate Negative	Yes	Minor Negative



Table 176 Community Safety and Security- Residual Impacts- Operational Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
<b>Conflict – workforce / local residents</b>	Negligible Negative	Yes	Negligible Negative
<b>Conflict – security contractor / local residents</b>	Minor Negative	Yes	Minor Negative
<b>Road accidents</b>	Negligible Negative	Yes	Negligible Negative

## 18.7. Monitoring Measures

Table 177 Community Safety and Security- Monitoring Measures- Construction Phase

Impact / Risk	Monitoring Measure
<b>Conflict – workforce / local residents</b>	Monitoring of grievance records and community liaison.
	Monitoring training records (Code of Conduct) for workers.
<b>Conflict – security contractor / local residents</b>	Monitoring records of security incidents.
	Monitoring grievance records and community liaison.
	Contractor auditing.



Impact / Risk	Monitoring Measure
	Monitoring training records for security personnel.
<b>Increased substance abuse</b>	Daily assessment of potential drug abuse or possession.
<b>Road accidents</b>	Monitoring traffic training records and vehicle inspection records.
	Monitoring grievances related to vehicle movements.
	Monitoring incidents and near misses related to vehicle movements.
	Monitoring records of injuries, loss of life or conditions that could potentially lead to these situations.

**Table 178 Community Safety and Security- Monitoring Measures- Operational Phase**

Impact / Risk	Monitoring Measure
<b>Conflict / traffic</b>	The monitoring measures listed for the construction phase will be incorporated into the operational ESMS.

The monitoring measures listed for the construction phase will be applied during decommissioning, as relevant.

## 19 Archaeology & Cultural Heritage

This chapter focuses on the potential cultural heritage impacts of the Project. Archaeological and cultural resources are finite, therefore their preservation must be appropriately addressed. The archaeological resources include, but are not limited to:

- Archaeological remains, buried and/or above ground and artefacts;
- Historical structures and sites (e.g., tombs or forts), sacred or culturally significant sites;
- Cultural / historical landscapes; and
- Intangible Cultural Heritage, which includes cultural knowledge and practices of communities with traditional lifestyles.



### 19.1. Baseline Conditions

Armenia is a region with a rich cultural heritage whose roots go through the depth of the centuries. In this country, about 33,000 historical and cultural monuments are found in 4,500 complexes with a total territory of 20,000 hectares.

The Protected Cultural Heritage in Armenia is defined as local or Republican. Features of historical, architectural, scientific, artistic, and cultural value are especially important and significant, of which there are 80 complexes (with about 400 Historic Structures of Architectural value). In the past, these were included in the USSR's list of the cultural and historical significance of all-Union.

The UNESCO World Heritage List, which since 1963 has identified more than 630 historical features and Historic or Cultural Landscape all over the world, includes several Archaeological Sites on the territory of Armenia: Haghpat and Sanahin Monastic Complexes and old bridge, and the historical centers of Ejmiatsin, Zvartnots, and Geghardavank. Other Armenian Archaeological Sites have been proposed for the UNESCO World Heritage List: the Noravank Monastic Complex, the Persian Blue Mosque, and the historical capital of Armenia, Dvin.

The region where the Project is located is part of Mt. Aragats volcanic area (spread on the south western fringes), shaped by a suite of several mafic lava flows and pyroclastic deposits which can be traced along the Karmrashen River caption and its tributaries.

The Project area is part of the wide Talin-Karmrashen Plateau, which belongs to the Ararat Depression, overlooking the Araxes River valley Mt. Aragats stratovolcano, Mt. Arteni, Mt. Ddmasar, and other eruptive centers are visible from there. Those were mainly formed during Late Pleistocene and Early Holocene climatic cycles, and their developments continue nowadays.

As a whole, the mentioned small water bodies, together with the hills shaped by intensive weathering of the slopes, and surfaces of rock formations played a significant role in the formation and development of the local Cultural Heritage, representing landforms of exploitation and survival (Historic-Cultural Landscape). They also served as a source of significant construction materials like volcanic tuff, different types of basalts, and dacite, which allowed to incorporate the artificial features with the natural forms, creating Cultural Heritage elements such as kites, towers, enclosures, burial mounds, and other cultic elements.

According to our current knowledge and archaeological data, it is possible to identify the modifications that make up the Historic-Cultural Landscape in this area on the southern fringes of Mt. Aragats. Chains of Archaeological Structures called Desert Kites (created for hunting, trapping, animal husbandry, and cultic function) with supporting enclosures, as well as agglomerative (jellyfish, wheel, cells) and coral settlements, towers, and graveyards can be observed throughout the region. Those Historic-Cultural Landscapes were shaped over millennia (at least from Lower Palaeolithic to the Iron Age onwards) and later on intensively exploited during the Medieval Period, some in the local area serving as gardens and facilities for wine production.

There are structures of high cultural significance in the Project area. St Kristaphor's Monastery is 1.3 km away from the Project site and Dashtadem fortress is located 1.5 km away from the site boundary. Dashtadem fortress was constructed during the 7th and 19th centuries AD. In addition, remains of villages, cemeteries and cultural assets of local significance known





as khachkars are within the Project area. These historical monuments together with traces of large settlements and historically shaped economic landscapes in the surrounding area have affected the formation of the ancient economy and political life.

The same landscapes were significantly modified during Soviet period population for agricultural purposes. In the aforementioned periods (medieval and Soviet), many of the stone-built structures of the previous times were preserved, while others were dismantled.

Recent archaeological investigations prove that Armenia and the Armenian Highlands were one of the most prominent areas of the ancient hunting and trapping systems, the “motherland, and capital of the desert kites” and such structures are widespread in the Study Area.

Based on current knowledge from preliminary baseline surveys and desk studies, the archaeological data in the Aragatsotn Marz region is one of the most intensively modified landscapes. Results found that within the Project site, there were distributions of desert kites which are structures created for hunting, trapping, animal husbandry. Agglomerative jellyfish settlements, towers and graveyards were also found on site during site investigations. The landscape and archaeological findings that were uncovered on the Project area have been shaped during millennia.

There are no specific desktop records or previous investigations of the Project site.

## 19.2. Site Studies



Archaeological site studies were carried out in 2022 to identify and assess cultural heritage values within the Project site and its immediate vicinity. The objectives of the archaeological studies are as follows:

- To undertake desk and field studies of the Archaeological Sites within the study area, identify the known and newly discovered Cultural Heritage.
- Identify the potential impacts of the Project on Cultural Heritage (Tangible and Intangible), whether Replicable, Non-Replicable, or Critical, and its main elements: Archaeological Sites, Historic Structures, Historic Districts, Historic-Cultural Landscapes, and Artefacts.
- To provide archaeological input to the ESIA and ESMS and develop recommendations on mitigation and monitoring measures.

The detailed archaeology reports are available in the annexes provided. The assessment scope comprises of impacts on physical heritage- buried heritage assets (archaeological remains) and above ground heritage assets (e.g. buildings, structures, monuments and areas of heritage interest) – as well as intangible heritage, within, or for the latter, associated with, the Project. The geographical scope (henceforth the ‘Study Area’), comprises the Project footprint, and a 100m buffer around it.

The Project comprises all elements that are to be constructed and operated as part of the Project. The only exception are access roads, which are undergoing a preferred route selection-process. For this reason, access roads were not surveyed as part of the baseline surveys which informed

the Archaeological Survey. It is understood that any access roads outside of the Study Area will be subject to an archaeological walkover survey, and any design alteration recommendations or impacts assessed will be managed through a later stage of the Cultural Heritage Management Plan (CHMP).

A number of cultural heritage features which lie more than 100m away from the Project, but are within areas which are, in essence, surrounded by The Project. These cultural heritage assets could be considered at risk of construction activities – especially by unplanned vehicle traffic or ad-hoc construction works.

### 19.2.1. Survey Methodology

To achieve the above-mentioned goals the following type of methodologies were used:

#### **Preliminary Desk Study:**

Collection of information about the Cultural Heritage from unpublished (archival) and published literary sources, their identification with the list of the archaeological and historical monuments of the Aragatsotn Province. This was carried out in 2021.

#### **Intensive Site Screening:**

An initial screening survey was undertaken during ESIA scoping by a group of 3 archaeologists and 1 GIS specialist over 4 days in October 2021. The initial survey aimed at determining if there were archaeological risks in the Project area. The specialists identified a significant number of features of potential archaeological interest and determined that a detailed survey / site inventory was required for the ESIA.

#### **Systematic survey of the Project Site:**

The systematic survey of the Project Site was carried out during the month of April, May and June 2022, with a team of researchers organized by the “Areni-1 Cave” scientific-research foundation represented by 4 archaeologists, 1 GIS specialist, and 1 drone specialist.

Two archaeologists from the Spanish archaeological company “Cortés Arqueología” also participated in the design of the survey, fieldwork activities as well as provided input for finalizing the methods of recording the discovered historical-cultural units.

After finalizing the fixation of the units which may have historical-cultural, spiritual, and archaeological significance, the Project Site was photographed by drone, in order to understand the formation processes of the cultural landscapes from the past and the potential negative impact of the Project.

During the implementation of the systematic survey, the members of the team covered the entire Project Site and buffer area by walking, and recording all the targeted features (Plate 10). For each unit, a special context sheet was used, recording the Number, Location, Date, Start time, Visibility, GPS coordinates as well as Graphic material (Photographic view from four sides), General Description, Comments on the mitigation measures, if applicable, and the Numbers of the photographic images (Figure 34).



The above information was collected into one united database, information used to compose the survey and assessment reports included in the annexes.

### Intangible Heritage Study

The intangible heritage study was carried out by an Armenian Ethnographer & Anthropologist. The study focused on identifying the traditional knowledge, practices, and expressions that are unique to the four communities: Talin, Dashtadem, Katnaghbyur and Ashnak. The study documents the intangible heritage of the local community, which is an important aspect of their cultural identity. The methodology for this study involved conducting interviews with local community members to identify and document their traditional knowledge and practices. This study aims to identify the intangible cultural heritage of the local community and areas surrounding the Project. This may include traditional knowledge, rituals, practices, beliefs, songs, dances, storytelling, crafts, and other forms of intangible heritage that are practiced and transmitted within the community.

### 19.2.2. Consultations

The Government of Armenia assigned the site to this Project through a presidential decree after consultation and approval of the affected communities and relevant ministries.

Communications with the Ministry of Culture and other key stakeholders like the Institute of Archaeology and Ethnography were conducted throughout the ESIA process, the summary of these communications are detailed below.

### 19.2.2.1 Physical Cultural Heritage

The baseline surveys undertaken by the Areni 1 Cave Scientific Research Foundation & Cortes Arqueologia were undertaken with the approval of the Armenian Ministry of Culture and with the participation of members of the Armenian Institute of Archaeology and Ethnography.



The results of the survey were submitted to the Ministry of Culture by Dr Boris Gasparyan of the Institute of Archaeology and Ethnography (part of the National Academy of Sciences of Armenia), who has submitted a work-plan for evaluation and mitigation in line with the recommendations set out in this report. This was approved by the Ministry of Culture on conditions that the site is photographed in order to create a 3D model of all archaeological sites before construction commences.

Before intrusive works can take place, a method statement needs to be approved by the Archaeological Commission which advises the Ministry of Culture.

### 19.2.2.2 Intangible Cultural Heritage

Meaningful consultation of local residents and stakeholders from Talin, Ashnak, Katnaghbyur and Dashtadem of the Aragatsotn province has been undertaken as part of the 5 rounds of community consultations and meetings. In these consultations, the communities were asked if features or places of intangible cultural heritage value existed within the project area.

Further to these broad consultations with focus groups, an Armenian ethnographer undertook consultation with specific regard to cultural heritage in May 2023. He again identified the

communities Talin, Ashnak, Katnaghbyur and Dashtadem which might have intangible cultural practices and traditions that could be of risk of being impacted by the Project. Key informants were identified in each community. Interviews with these individuals were undertaken and the results set out in the Intangible Heritage Report.

### 19.2.2.3 EIA / ESIA Process

**Initial Submission:** The first Environmental and Social Impact Assessment (ESIA) report was submitted to the Ministry of Culture for review. After receiving feedback from the ministry, the initial submission was updated.

**Clarification Process:** Following the Ministry's feedback, a meeting was held with the Ministry to discuss and address their comments. The Ministry was provided with additional information to ensure a clear understanding of the AYG-1 environmental impact assessment.

**Consultation Rounds:** Over the course of the review period, several rounds of consultations were conducted with the Ministry of Culture. These consultations involved discussions, document exchanges, and addressing any queries they had regarding the ESIA report. The aim of this was to ensure alignment and address any potential issues.

**Positive Opinion:** Following a re-submission of the ESIA report including all revisions, the Ministry of Culture expressed a positive opinion for the ESIA report after the thorough consultation process. This positive outcome reflects our commitment to addressing environmental concerns and working collaboratively with relevant stakeholders.

## 19.3. Results

### 19.3.1. Desk Study



The main source for composing the Cultural Heritage of the Project area is the State List of Monuments of the Aragatsotn Province of the Republic of Armenia (The State List of Immovable monuments of the History and Culture of the Aragatsotn Province of the RA. Adopted May 29, 2002, government order N628). In addition, published sources such as Badalyan and Avetisyan (2007); Asatryan (2004) (in Armenian) and unpublished reports were used.

Based on the information collected from the above-mentioned sources, there are no features with archaeological and historical-cultural significance known or recorded previously in the study area.

The lack of records around the Project area can be explained because the territory of Armenia lacks systematic archaeological mapping and the Project area was never a main interest in any previous archaeological study and excavations. A short-term and preliminary recognition survey which may have information on the wider Project area was implemented in the frame of the Armenian-Israeli project on the study of the kites on the southern fringes of Mt. Aragats in 2012. However, the results of this project are not yet available.

Although no records were found during the desk study regarding the Project Site area, the known features elsewhere show the Historical-Cultural Landscape of the surroundings. The results of the desk study show that the southern fringes of Mt. Aragats (especially the Talin-Karmrashen

Plate 9 Systematic Survey Site Walkover



Recording an Enclosure at the Project Site



Measuring a Wall at the Project Site



Plateau) played an important and leading role in the shaping of historical-cultural landscapes of the past for the whole of Armenian and also from the regional perspective. This is home to the famous Mt. Arteni obsidian source, one of the biggest in the region and intensively utilized from the Lower Paleolithic to nowadays. This mountain lies around 10 km northeast of the Project Site and the high quality obsidian outcrops attracted humans from the dawn of history. World famous Satani-Dar Paleolithic site, which yielded the earliest known man-made artefacts in the area of the former Soviet Union is located on the southern slopes of Mt. Arteni. The recently discovered and excavated Middle Paleolithic site of Barozh-12 is also located in the vicinity of Mt. Arteni, showing activities of Neanderthals in this area for a very long time period.

The cultural development of this region continues at the final stages of the Stone Age and the Bronze Iron Ages. It is proven by the existence of Neolithic-Chalcolithic workshops near the obsidian outcrops, Chalcolithic settlements, and numerous Bronze through the Iron Age settlements and necropolis recorded and excavated. Among them are the Areguni Blur and Yerkaruk Blur workshops on the slopes of Mt. Arteni.

The seasonal Neolithic-Chalcolithic site of Ashnak, seasonal dwellings, cultic structures and burials of Bronze to Iron Ages in Talin can be listed as important among many others.

The area is also home to the economic and cultic landscapes for the timing of the Van or the Urartian kingdom (IX–VI centuries BC) as one of the important agricultural, horticultural, and farming centres of historical Armenia,

rich with fertile soils, freshwater sources, and springs, vineyards, alpine meadows.



Numerous Urartian rock-cut chambers are known in the region, and one of the most significant is located near the Dashtadem fortress. Classical period archaeological records are also well-known in the area. The first golden implements excavated in Armenia are known from the Hellenistic period burials in Ashnak.

The region played a very important role as a political, economic, and cultural centre during the entire Medieval Period. Among the high number of architectural monuments and religious centres well known, the Talin Cathedral/Basilica (VI century AD) can be mentioned as a jewel of Armenian early medieval architecture. St Khristaphor's Monastery is also famous, numerous village remains, cemeteries, and khachkars are known in close proximity to the Project Area.

The most important archaeological and historical-cultural feature in the region is Dashtadem fortress, together with traces of a large settlement or series of settlements and historically shaped economic landscapes in the surrounding, which affected the formation of the ancient economy and political life. Most of the outer circuit wall dates to the last Qajar khans of Yerevan, at the beginning of the XIX century.

Dashtadem fortress is believed to be constructed considerably earlier than the XIX century. It comprises of half-round towers attached onto an earlier Armenian fortress of the VII–X centuries. Beneath the citadel, there are substantial cisterns. There is also a chapel of St. Sargis beside it, dated to the X century. An elegant Arabic inscription in Kufic letters on the

wall of the citadel keep reads: “May Allah exalt him. In the blessed month of Safar in the year 570 (September 1174) the lord of this strong fortress, the Prince, the great Spasalar, the Pillar of the Faith, the Glorifier of Islam, Sultan son of Mahmud son of Shavur.” Sultan ibn Mahmud, known to Arab historians under the Persian name Shahanshah, was the last of a fascinating clan of Kurdish adventurers, the Shaddadids, who entered Armenian history in 951 at the city of Dvin. The fortress passed under the rule of the Zakarian brothers Ivane and Zakare, who re-established Armenian power in Aragatsotn in 1198. The fortress was functioning until 1828 when Eastern Armenia was conquered by the Russian troupes. Russian military authorities decided that it was not corresponding to the military concepts of the time and the fortress lost its significance as a military point.

The most valuable feature of the archaeological means is the above-mentioned economic space surrounding the fortress. The desk survey found details on traces of vineyards, orchards, and gardens, which are mostly from the XII-XIV centuries AD and surviving until the Soviet era. The Zakarian brothers revived the economic life of the Aragatsotn province where a large amount of grape production and wine making was established. Remnants of hundreds of High and Late Medieval period wine-producing facilities and complexes are still visible in the region, pair of which were excavated near the village of Ashnak by the Archaeologist Yesai Asatryan.

Desert kites were recently evaluated and discovered. Their study and record started in 2010 by the Armenian-French and Armenian-Israeli teams in the frame of Mt. Aragats kite study projects. Preliminary surveys recorded

more than 72 kites on the southern fringes of Mt. Aragats, which is a very large amount for this specific area. The preliminary excavations showed the time frame of their functioning from the Neolithic period to the Middle Ages onwards. Also some short-term and test excavations allowed to stress preliminary conclusions regarding their function, which was previously thought to be hunting traps.

It is clear now that kites vary by their shape and concept of construction and in addition to the hunting function, they also played a significant role in animal husbandry and domestication, breeding and training of military horses, ritual games, cultic performances, and others. In the Study Area, kite structures and related enclosures were not recorded in detail, but one or two were marked for future studies, especially the one in Dashtadem, in close proximity to the project implementation area and some in neighboring Ashank and Katnaghbyur community areas.

Overall, the desk study found that more than 30 kites have been evaluated and recorded in the Study Area. The structures of these desert kites and the accompanying enclosures have been found to be quite similar to each other and it could be argued that while desert kites in general hold archaeological and historical cultural value, the lack of uniqueness or originality, makes these structures rather common in the Study Area. Additionally, it must be highlighted that over the years, several kites in the Study Area have been partly/fully destroyed, while more than 30 have been well preserved and now conserved, thus protecting the archaeological and historical-cultural value.



### 19.3.2. Site Surveys

Numerous features of heritage interest were identified within the Study Area by each of the surveys. These comprise of wall fragments, enclosures, tombs/burial mounds, tower structures, kite structures, settlements, obsidian tools and implement scatters, concentrations of lithic artefacts and one-off features such as a petroglyph and a cultural asset of local significance known as a khachkar. In total, 251 potential units were recorded in and around the Project Site, and 171 within the site boundary.

Archaeological survival, for the majority of the Project footprint and Study Area, is considered to be relatively good. The differences between altered and untouched portions of the land strongly differ from each other in the Project Site. Meanwhile, there are two ways of alteration activities: by heavy machinery and by hand.

Large scale surface bulldozing was undertaken during the Soviet Period (pre 1991), notably to the west of the southern section of the Project, and immediately to the north of the northern section. Evidenced by satellite imagery, there is a minor overlap with the 100m buffered area of the project development boundary in these areas. The heavy machinery disturbance erased all the cultural features of the landscape, leaving flattened landmarks and collections of rocks and blocks, as some untouched portions of the land appearing as islands.

Modification by hand was implemented through rock collection by hand, as well as long walls which can be observed through collections of rocks or artificial mounds spread around in some areas of the Project Site. This makes archaeological work difficult, as it is necessary

to distinguish between Historic Structures and rock piles to clear land for agriculture. It also makes it difficult to distinguish ancient features from modern ones. The survey found that very often the old walls were reused, new walls were created as a continuation of the old features, or new ones appeared atop the old ones forming some noticeable stratigraphy. In this case, for the identification of the real features of cultural significance, experience and drone photography is very valuable (Plate 11).



Structures that are not concluded to be burial mounds are labelled as “potential tombs” and the conclusion can be drawn through the test excavations. In the case of possible burials related or located very close to each other, test excavations may be carried out only in a few of them, to draw conclusions. If after carrying out the test pits it is determined that they are not real burials, the Project work can continue in those areas without specific restrictions.

There has been no other modern construction on site. Further to this, the effect of erosion has meant that in many areas the surface is ‘deflated’ as the result of the removal of light sediment leaving behind only heavier objects including archaeological artefacts. This removes the potential to date objects by their place in the stratigraphic sequence.

The following types of archaeological sites and features appear in and around the Project Site:

- Portions of walls spread along the hills;
- Portions of walls spread on the gorge together with towers, which are probably kite elements;
- Separate towers atop the natural hills,







some of which are also elements of kite structures;

- Natural low and small hills which are separated from the rest of the landscape by walls or enclosures seem to carry cultic function, often containing what seems to be a secret or a hidden tomb;
- Small and large enclosures are often attached to the long walls or located very close to them, which are more probably also the elements of the kites;
- Enclosures-dwellings which are herding and or agricultural management units. Some of them have exceptional configuration and size and are new elements for the Armenian archaeology of agriculture;
- Chains or systems of enclosures of different configurations together with long walls are also exceptional and new elements of ancient herding activities of the past;
- Complete kite structures (so-called V-shape and star-like) or their head portions with towers and arms, which occupy large areas in the landscape (Plate 12);
- Large enclosures and enclosure systems related to the kites, also containing burial mounds or royal tombs spread over dozens of hectares, which are again newly discovered and exceptional phenomena in Armenian and regional archaeology;
- Petroglyphs (see the glossary) on shiny surfaces of the basaltic boulders or rocks appearing in close proximity to the kites and possibly reflecting their schematic distribution;

- Large tombs or burial mounds which escape the alteration thanks to their large size;
- Large tombs or burial mounds robbed? during the Medieval period. They look like dwellings constructed on the foundations of burial mounds;
- Potential tombs which can be also a collection of rocks after alteration;
- Hidden burials, which, as a rule, are attached to the natural rocks and cliffs with enclosures;
- Modern kchachkar (cross-stone), of which there is only one example on the Project Site and has aesthetic and spiritual meaning for the local population;
- Agglomerative settlements (jellyfish, wheels, or corrals), which are usually adjacent to the kite structures. They have different construction concepts, techniques, and sizes. From the geomorphological perspective some are based on natural hills, some on flat landmarks, which may also reflect differences in times and function;
- Seasonal and permanent settlements, which appear in flat portions of the local landscape, situated closer to the water bodies;
- Archaeological mega complexes containing systems of dwellings and adjacent enclosures, agglomerative settlements, burial mounds, etc., which also occupy large portions of land and are not characteristic of the Armenian archaeological landscape, are newly discovered phenomena;



Figure 40 Example of Archaeological Context Sheet Used

 		<b><u>ARCHAEOLOGICAL SURVEY SHEET</u></b>		No. 95
<b>Project:</b> Ayg-1		<b>Location:</b> head		<b>Date:</b> 18/04/2022
<b>Coordinates:</b>	40.359218	<b>Start Time:</b> 12:46 PM	<b>Visibility:</b> high	
	43.890663			
<b>Graphic Material</b>				
<b><u>Northern View</u></b>		<b><u>Eastern View</u></b>		
				
<b><u>Southern View</u></b>		<b><u>Western View</u></b>		
				
<b>General Description:</b> First in the group of collections of rocks, reminding tomb structures or potential tombs located on the slope of a hill. Time is unknown.				
<b>Additional Comments:</b> Requirers test excavations. If it will come out a tomb, then all such nearby structures in the group need to be test excavated, if not, then the group has no cultural value.				
<b>Results:</b>				
<b>Photos No.</b> DJI_0402, IMG_2123, IMG_2124, IMG_2125, IMG_3883, IMG_3884, IMG_3885, IMG_3886				





- Paleolithic-Neolithic open-air sites, which are attached to the natural cliffs or weathered shelters, on the flat rims of shallow gorges. Appear like a single find or concentrations of lithic artifacts. Most are reworked scatters, but some seem to preserve materials in situ;
- Caves and rock shelters situated in the gorges and valleys, some of which have also artificial origin (rock-cut structures) and possibly carry cultural meaning.

The types of features that exist in the limits of the Project Site are listed below. They span the time range between the Lower Paleolithic (Late Acheulian, 500 thousand years BP) to the late Medieval period. The assessment of all 171 assets is provided in the annexes.

There are currently no sites which have been identified as having ‘high’ significance, as per the categorisation outlined in the Methodology section. 48 sites that have been identified as having greater than a ‘Low’ level of significance. Due to their higher heritage value, these assets are of greater sensitivity and therefore risk to project. Of particular note are heritage assets #152 (a large, multi-period, archaeological complex), #159 (a multi-period agglomerative settlement site), #146 (an area of tombs), #157 (an area of tombs or structures), #166 (a system of structures and potential tombs), #168 and #170 (both large enclosure systems including walls, towers and tombs relating to each other and situated across of several gorges). These are larger complex sites, and so impacts are generally high due to the cumulative nature.

Also, as a feature type, tombs are generally considered to be of higher value, given the archaeological information potential they can hold.



Consideration of redesigning to avoid or minimise impact, and/or specific mitigation, monitoring measures and protocol will be required for these assets.

Furthermore, heritage features which are likely to contain tombs, are well preserved kite structures (or comprising elements, such as the Towers),

or well-preserved cultic structures also have potential to hold a higher (medium) heritage significance rating. The identified features of potential cultural significance and their sensitivity is depicted in the map overleaf.

**Table 179 Identified Features of Potential Archaeological Value**

Feature types identified	Count of Feature Type
Concentration of obsidian artifacts	5
Concentration of obsidian artifacts (Open-air site)	1
Cultic structure	2
Enclosure	28
Khachkar	1
Kite	2
Kite structure	1
Obsidian Tools Implements	1
Petroglyph	1
Potential (hidden) tomb	2
Potential tomb	6
Settlement	10
Structure	6
Tomb	28
Tombs	1
Tower	7
Tower and Enclosure	1
Tower and Wall	1
Wall	4
Wall fragment	50
Wall fragment and Enclosure	1
Wall fragment and tower	1
Wall fragments	10
Wall fragments with tower	1
<b>Grand Total</b>	<b>171</b>



### 19.3.3. Intangible Heritage - Findings

Talin's intangible cultural heritage that is closely tied to the daily lives of its residents. An example of the intangible cultural heritage in Talin is traditional Armenian dance. The town is home to several dance groups that practice and perform a wide range of traditional Armenian dances, including the Kochari, Yarkhushta and Shalakho.

These dances are often performed at weddings, festivals, and other cultural events in the community. The community in Talin is deeply connected to its intangible cultural heritage and takes great pride in preserving and promoting its cultural traditions. Overall, the intangible cultural heritage in Talin is an important part of the town's identity and is cherished by its residents. It plays a role in connecting the community to its past, present, and future, and serves as a source of pride and inspiration for generations to come.

Interviews conducted with a 18 year old male resident of Talin community detailed that he has a positive opinion on the AYG-1 Project, but indicated that it should follow applicable the norms and standards. He detailed that in his opinion, there are no intangible values in that area, at the same time he claims that it is not a pasture, it is an unusable area

The intangible cultural heritage in Dashtadem relates to traditional Armenian music. Dashtadem has a long history of musical culture, with many locals practicing and performing traditional Armenian instruments such as the duduk, the zurna, and the tar. The villagers also have their own unique style of singing, which has been passed down through the generations.

Another example of the intangible cultural heritage in Dashtadem is traditional Armenian cuisine. The village is known for its food, some of the most popular dishes include dolma, khorovats (barbecue), and khash (a traditional Armenian soup made from cow or sheep feet).

The community in Dashtadem is closely connected to their intangible cultural heritage, and many of the village's traditions and customs have been preserved through the efforts of local residents. For example, the village hosts an annual festival to celebrate its cultural heritage, featuring traditional music, dance, and food. The festival is an important event for the community, providing an opportunity for locals to come together and share their cultural traditions with visitors.

Interviews conducted with an 19 year old male resident of Dashtadem emphasized that he believes that there are no intangible heritage objects on the lands at the Project site, he explained that what is preserved is preserved in the community.

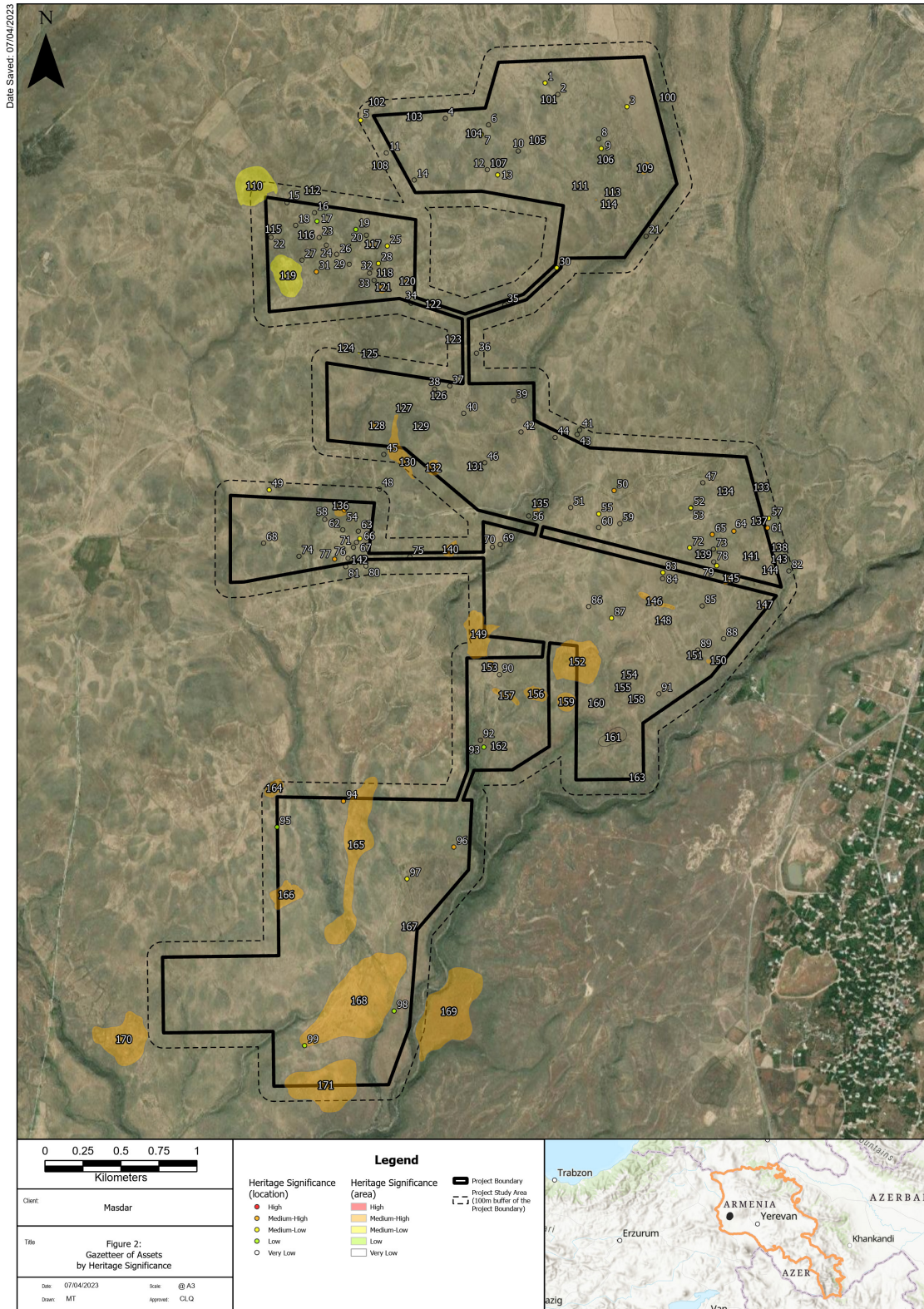
Katnaghbyur's intangible cultural heritage is also closely tied to the daily lives of its residents. An example of the intangible cultural heritage in Katnaghbyur includes traditional Armenian embroidery. The village is known for its skilled artisans who produce intricate and colourful embroidery designs on various fabrics, such as tablecloths, pillowcases, and traditional Armenian costumes. Many of these embroidery designs have been passed down through generations and are still practiced and taught by local families today. Similar to Dashtadem, another example of the intangible cultural heritage in Katnaghbyur is traditional Armenian cuisine. The community in Katnaghbyur is connected to its intangible cultural heritage which is an important part of the village's identity and is preserved by its residents.



Interviews conducted by an Ethnographer with an 54 year old male Pedagogy and educator resident of Katnaghbyur community detailed that in his opinion, times have changed and believes that development projects such as AYG-1 are very important for the communities, also believes that the place is unusable for other activities and there are no preserved features in terms of intangible heritage.

Ashnak has a unique intangible cultural heritage when compared with the above mentioned 3 communities (Talin, Dashtadem, Katnaghbyur). Since in 2019, Ashnak has been included in the RA Government approved Decision №241-N “Approving the criteria for defining cultural spaces.” The appendix was completed on 12.09.19 N 1302-H). An example of intangible cultural heritage in Ashnak is traditional Armenian music. The village is known for its skilled musicians who play a wide range of traditional Armenian instruments, including the duduk , the tar, and the kamancha. The village is also home to several dance groups that practice and perform a wide range of traditional Armenian dances, including the Kochari , Shalakho, and Yarkhushta. These instruments are often played at local weddings,

Figure 41 Assets of Cultural Significance





festivals, and other cultural events, and are an important part of the village's cultural identity.

The community in Ashnak is connected to its intangible cultural heritage and takes pride in preserving and promoting its cultural traditions. The village hosts several annual festivals and events that celebrate its cultural heritage, including the Ashnak Music Festival, which showcases the village's musical traditions, and the Ashnak Dance Festival, which highlights the region's unique dance heritage.

Interviews conducted by an Ethnographer with an 71 year old retired resident of Ashnak complained that there is a water problem, indicated that the Project area does not even serve as a pasture, It's a wasteland. He says that his ancestors came here from Western Armenia, but he does not remember that the Project site and area or surroundings have ever served as an intangible cultural space.

Based on the interviews it seems to suggest that the residents view that land( Project area) as a place that is considered unusable. Additionally, it appears that the residents do not have any attachment to the cultural heritage of the area, and do not express concern of existence of any intangible cultural heritage related to the site. It appears that there may not be any intangible cultural heritage associated with the land, and as it is known the historical and cultural significance of the area also its not played a significant role in the community's history or have symbolic meaning.

The only site with intangible significance within the project area mentioned during these consultations was site #141, a khachkar (a memorial, not a grave) erected in the 1990's, commemorating the death of a local resident. This site is considered to have local significance, in particular to one local household.



## 19.4. Impact Assessment

### 19.4.1. Construction Impacts

Project construction can potentially result in the partial or complete loss of buried heritage assets in areas where ground disturbance is proposed and/or partial or complete loss of non-designated above ground heritage assets due to demolition or alteration. Temporary impacts may result from the use of access/haul roads and borrow pits, on heritage assets through effects from noise, vibration or emissions.

Construction impacts include anything that would cause ground disturbance (such as preliminary ground works, site strip/topsoil removal and storage, construction compounds, laydown areas, landscaping, piling, post holes, excavation for foundations, services, drainage, fencing, cabling, piping and lighting).

For the Project, the piled holes which will be required for the PV panel supports, the fencing, gates, and foundations for buildings, high voltage equipment, power and weather stations will result in partial disturbance of the heritage assets within the construction footprint. Post-holes cause impacts within the footprint of the post-hole and can cause damage to the adjacent area. Groupings of post-hole have the effect of making the area within the group



inaccessible to future investigation and is thus equivalent to the total loss of the affected area.

The impact of construction or upgrading of access roads and laydown areas are dependent on the depths of construction required, material used for surfacing, and the types of vehicles likely to utilise the road/laydown area. Whilst some deeper archaeological strata may not be impacted, it should be assumed that construction of roads and tracks will require the complete removal or destruction of both above ground and buried heritage features.

Impacts caused by ‘imposed loads’ are also a possibility. Construction of embankments, laydown areas, and/or heavy vehicle tracking, can cause significant loading and potentially lead to sediment deformation and damage to buried features and artefacts.

As per the latest design and layout (which is expected to be optimised further to maximise impact avoidance), prior to mitigation there are 21 assets that would result in an ‘Major’ adverse effect, and 45 that would result in an ‘Moderate’ adverse effect; a result in nearly all cases of a ‘high’ magnitude of impact on a site of ‘Medium-High’ or ‘Medium-Low’ value.

The Project will have no impact of any kind including influx, noise, dust, visual, access restrictions on Dashtadem Fortress. Furthermore, there will be no influx, noise, dust, access restrictions to the St Kristapor monastery, only a minor visual impact as outlined in the landscape chapter.

Impacts on intangible heritage generally occur, during the project life-cycle, when the tangible manifestation of intangible values are affected by development.



### 19.4.2. Operational Impacts

During operations, physical impacts on buried or above ground archaeology as the result of operational traffic or secondary development.

It is assumed that once the Project has been completed, no further direct ground disturbance would occur. Whilst operational traffic is likely in the form of movement of vehicular transportation along the access, main, peripheral and internal roads as well as the laydown areas, this activity will be intermittent. Therefore, the assessment of operational stage impacts has by and large been deemed minimal. Only minor visual impacts and minor impacts on landscape character will occur during operations on Dashtadem fortress and the St. Kristapor monastery.

### 19.4.3. Decommissioning Impacts

During decommissioning, physical impacts on buried or above ground archaeology may occur as the result of decommissioning of the site, inclusive of all tasks undertaken within the approach to deactivating the project or facility from service and removal of permanent and temporary infrastructure. It is anticipated that, on the assumption that no additional infrastructure or tracking will need to be created or constructed, there will be no additional impacts on buried or above ground archaeology as the result of decommissioning of the Project.

## 19.5. Mitigation Measures

An appropriate mitigation strategy aims to offset or reduce any negative effect. Measures to mitigate effects normally consist of design adjustments in order to allow archaeological resources to be protected and retained (preservation in situ) or, where this is not feasible, investigation and recording in advance of development (e.g. archaeological excavation) followed by analysis and reporting.

Where cultural heritage impacts can only be identified in broad terms either due to constraints on the nature/quality of baseline data or due to uncertainties regarding precise impacts (as in this case), then mitigation must be designed on a more generic basis.

For certain heritage assets, further non-intrusive surveys may be required in order to help clarify

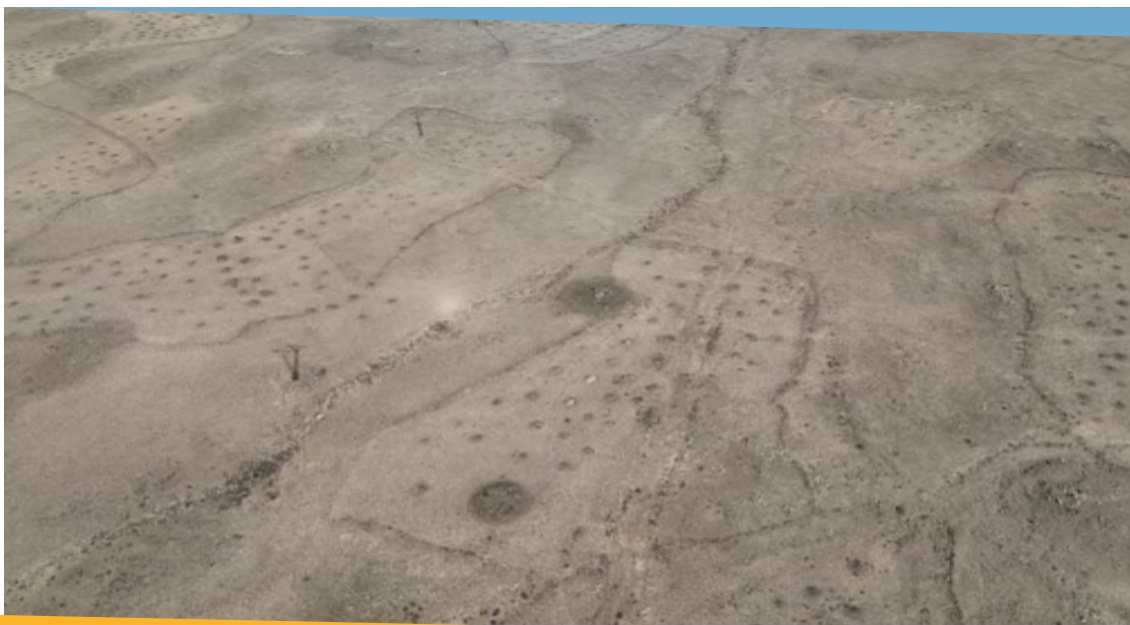
the nature, survival, condition and extent of any archaeological assets that may be affected. This will need to be carried out in advance of construction as a part of an additional pre-construction assessment, alongside the Engineering Procurement and Construction (EPC)’s detailed design stage. The results of this further evaluation would inform a more detailed mitigation strategy for the heritage asset.



The ‘mitigation hierarchy’ as defined through the IFC and EBRD guidance can be summarised as follows :

- i) Avoidance of impact through design (preservation of heritage resource in-situ), and/or
- ii) Minimise impact (e.g. by moving/ adjusting PV panel supports), and/or
- iii) Monitor and Record impacted portion of the heritage resource, through feature-type specific methodologies (e.g. through

### Plate 10 Aerial Photography from Systematic Survey



Aerial Picture of rock piles collected to clear agricultural land, and Tombs or Burial Mounds (larger dark areas) at the Project Site

sampling, evaluation, photographic record, 3d modelling or pre-construction excavation).

- iv) Full documentation of affected cultural heritage resources through pre-construction excavation and/or other means.

The site boundary was modified by the government to avoid the core part of #152. This is perhaps the best conserved/high priority site.

The Project Design has been informed by preliminary E&S studies. As part of this, a number of features of archaeological value were identified, and the design was modified to take account of these sites. Redesign for avoidance purposes is favoured, given most cultural heritage is best protected by preservation in its place. It is the first step in mitigation hierarchy when addressing both buried and above ground heritage

The design changes to avoid / minimise impacts were comprised of:

- the discarding of plans to grade/strip the land surface. The new plant design / layout will largely leave the natural topography of the site intact,
- avoidance of steep slopes where potentially damaging cut and fill activities would be necessary,
- raising the height of the panel mounting structures to ensure there is plenty of ground clearance, to minimise potential impacts to heritage features,
- redesign of internal roads, cable trenches and access roads to minimize impacts on archaeological features,

- micro-siting of MV stations to minimise overlap with archaeological features.

These actions have thus been incorporated into this assessment, and the impacts have been significantly reduced as a result of this early mitigation effort.

There will be an additional phase of detailed design, where mapping of high sensitivity archaeology are used to refine the current design, for example micro-siting PV panel supports to avoid key features (eg tombs and/or valuable structures).

The recommended mitigation approaches are summarised, by heritage feature-type in the Table overleaf, which assigns different mitigation actions depending on the asset type, setting out how the mitigation/monitoring would be secured and implemented.

There are a variety of mitigation options/methods depending on the feature type, and the detail known of the nature, survival, condition and extent of the affected asset. It is important to note that to date only reconnaissance and site-walk over surveys have taken place (i.e. no intrusive surveys have occurred). There are also a number of heritage features of considerable size, containing elements of varying importance (eg enclosures with buildings attached). The effect of constructing PV panels within such sites would lead to varying impacts depending on their location, potentially requiring a combination of mitigation methods. For all sites, the specific mitigation approach will need to be assessed in detail on a case-by-case basis, according to procedures set out in the Cultural Heritage Management Plan (CHMP).



Evaluation surveys and mitigation shall occur in advance of the commencement of ground works across all areas where impacts have been identified and detailed in the Cultural Heritage Management Plan. The programme of mitigation work can be designed to take into account the requirements of the construction programme.

## 19.6. Residual Impacts



Based on the mitigation approach indicated above, Construction stage impacts, result in:

- 62 assets experiencing an adverse ‘Minor’ Significance of Effect,
- 109 assets experiencing an adverse ‘Negligible’ Significance of Effect,

The design optimisation has managed to reduce direct impacts on archaeological features to less than 1% (i.e. 99% avoidance of direct impacts by exclusion from the footprint, as depicted on Figure 13, pages 66 - 71).

### Plate 11 Kite Structures at the Project site



V-Shaped Kite Structure at the Project Site



**Table 180 Mitigation Options by Archaeological Feature Type**

Asset Type	Mitigation
Artifact scatter/ tools/ implements	<p>Avoidance of impact through design, or, if avoidance not possible, minimise impact by</p> <ul style="list-style-type: none"> <li>• No vehicle movement over, through or within 5m of limit of resource.</li> <li>• Extent of scatter defined by polygon. Or if extent unknown; 10m limit around recorded point location.</li> </ul> <p>And</p> <ul style="list-style-type: none"> <li>• Record impacted portion of the site through photographic documentation, sample collection, quantitative assessment and description survey</li> </ul>
Remnant structure (cultic structure, tower, wall)	<p>Avoidance of impact through design, or , if avoidance is not possible, minimise impact by</p> <ul style="list-style-type: none"> <li>• No vehicle movement over, through or within 5m of limit of resource.</li> </ul> <p>And, for section of asset being physically impacted, record though one or a combination of the following:</p> <ul style="list-style-type: none"> <li>• Mapping of location</li> <li>• Photograph record</li> <li>• 3d model record, and/or</li> <li>• Historic Building Recording (HBR) documentation (level dependent on heritage value of asset – case by case basis)</li> </ul>
Khachkar (local cultural asset)	<p>Avoidance of impact through design, or , if avoidance is not possible, minimise impact by</p> <ul style="list-style-type: none"> <li>• Relocate (for duration of project operation) to the best/most appropriate location, as agreed with local community.</li> <li>• Record through photogrammetry and documentation survey</li> </ul>





Asset Type	Mitigation
Petroglyph	<p>Avoidance of impact through design, or , if avoidance is not possible, minimise impact by</p> <ul style="list-style-type: none"> <li>• No vehicle movement within 5m of limit of resource.</li> <li>• Apply additional survey of the petroglyph area to confirm no further petroglyphs (prior to construction)</li> </ul> <p>And, for section of asset being physically impacted record though</p> <ul style="list-style-type: none"> <li>• Detailed photograph record &amp; research/interpretation</li> <li>• 3d model record</li> <li>• mapping of location of petroglyph;</li> </ul>
Tomb	<p>Avoidance of impact through design, or , if avoidance is not possible, minimise impact by</p> <ul style="list-style-type: none"> <li>• No vehicle movement over, through or within 5m of limit of resource if Tomb’s extent is defined (by a polygon).</li> <li>• Or if extent unknown; 15m limit around recorded point location</li> <li>• moving impacts away from central areas to periphery of asset/resource</li> </ul> <p>Record through photogrammetry and documentation survey</p> <p>And</p> <ul style="list-style-type: none"> <li>• Monitor; a watching brief during construction in area of tombs or potential tombs where less than 25% of tomb disturbed., or record; where greater than 25% of tomb affected full pre- construction open-area excavation unless an alternative method is identified as appropriate on a case-by-case basis) or If monitoring identifies archaeology, record through archaeological survey open-area excavation (unless an alternative method is identified as appropriate on a case-by- case basis) and/or Historic Building Recording (HBR) documentation (level of HBR dependent on heritage value of asset – case by case basis)</li> </ul>



Asset Type	Mitigation
Potential tomb	<p>Avoidance of impact through design, or , if avoidance is not possible, minimise impact by</p> <ul style="list-style-type: none"> <li>• No vehicle movement over, through or within 5m of limit of resource if Tomb's extent is defined (by a polygon).</li> <li>• Or if extent unknown; 15m limit around recorded point location</li> <li>• moving impacts away from central areas to periphery of asset/resource</li> </ul> <p>Record through photogrammetry and documentation survey</p> <p>And,</p> <p>Sample a small section of the first example through an archaeological survey sampling approach where an impact will occur. If archaeological material found continue following 'tomb' approach for all further 'potential tombs' of similar characteristics in the area.,</p> <p>If no archaeological material found, record though one or a combination of the following:</p> <ul style="list-style-type: none"> <li>• Detailed mapping of location</li> <li>• Detailed photograph record</li> <li>• 3d model record.</li> </ul>

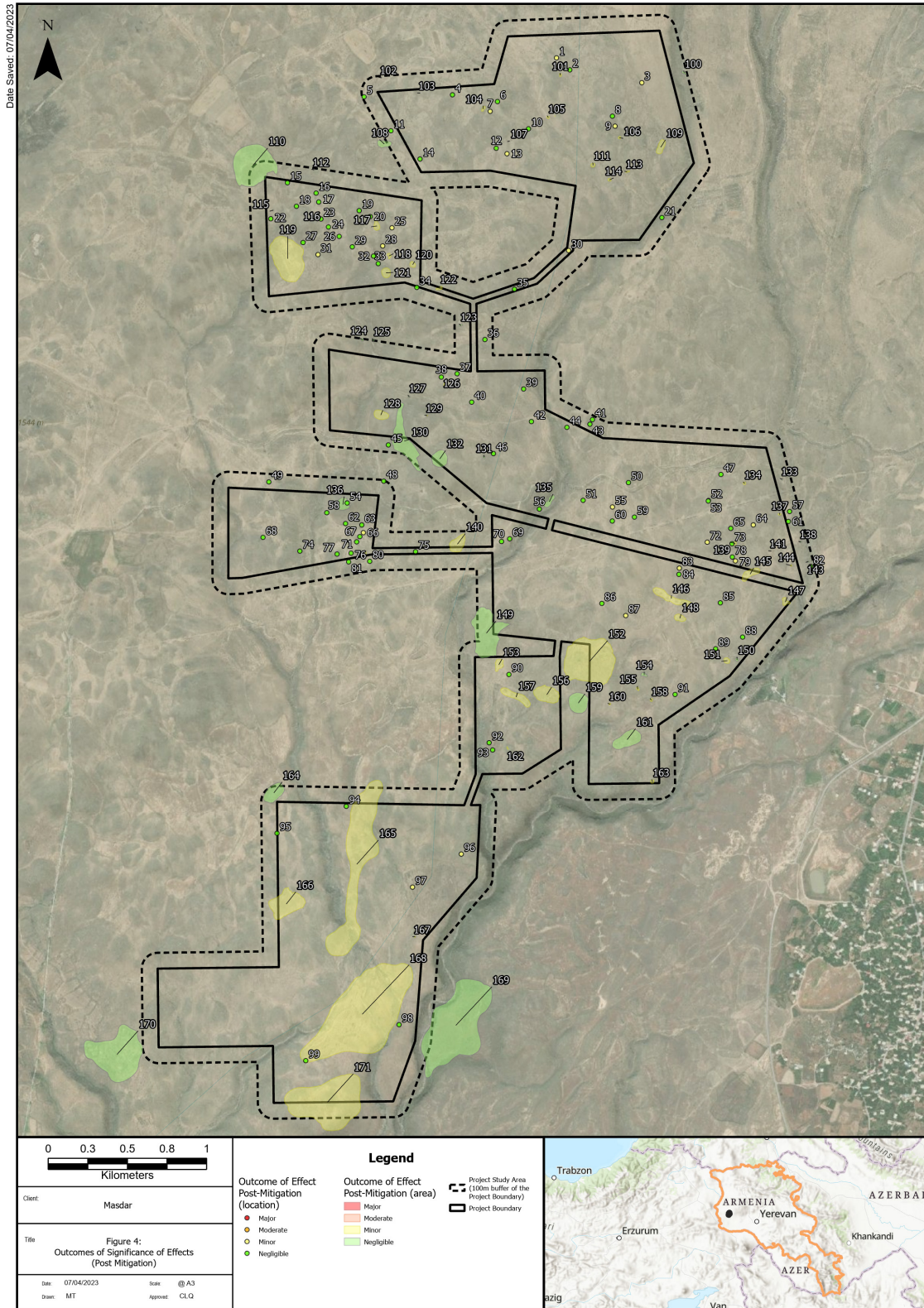


Asset Type	Mitigation
<p>A bounded area (single enclosure, kite)</p>	<p>Avoidance of impact through design, or, if avoidance is not possible, minimise impact by</p> <ul style="list-style-type: none"> <li>• No vehicle movement over, through or within 5m of limit of resource if settlement/enclosure is defined (by a polygon).</li> <li>• Or if extent unknown; 25m limit around recorded point location</li> <li>• moving impacts away from central areas to periphery of asset/resource</li> </ul> <p>Record through photogrammetry and documentation survey and, for section of asset being physically impacted;</p> <ul style="list-style-type: none"> <li>• Monitor; a watching brief during construction within area impacted where less than 25% of enclosure/settlement disturbed. Or</li> <li>• Record; where more than 25% of the site impacted, record through archaeological survey which could comprise one, or a combination, of the following; Evaluation (Informative) Trial Trenching, Sample Excavation (Strip, Map, and Sample) or Open-Area Excavation, identified on a case-by-case basis, and/or a Historic Building Recording (HBR) documentation (level dependent on heritage value of asset) or</li> <li>• If monitoring identifies archaeological items, record through archaeological survey which could comprise one, or a combination, of the following; Evaluation (Informative) Trial Trenching, Sample Excavation (Strip, Map, and Sample) or Open-Area Excavation, identified on a case-by-case basis, and/or Historic Building Recording (HBR) documentation (level dependent on heritage value of asset – case by case basis)</li> </ul> <p>For section of asset not being physically impacted (defined as a 5m buffer from the nearest impact), preservation in-situ applied.</p>



Asset Type	Mitigation
Settlement/ multiple enclosures	<p>Avoidance of impact through design, or, if avoidance is not possible, minimise impact by</p> <ul style="list-style-type: none"> <li>• No vehicle movement over, through or within 5m of limit of resource if settlement/enclosure is defined (by a polygon).</li> <li>• Or if extent unknown; 25m limit around recorded point location</li> <li>• moving impacts away from central areas to periphery of asset/resource</li> </ul> <p>Record through photogrammetry and documentation survey and, a) for section of asset being physically impacted;</p> <ul style="list-style-type: none"> <li>• Monitor; a watching brief during construction within area impacted where less than 25% of enclosure/settlement disturbed, or</li> <li>• Record; where more than 25% of the site impacted, record through archaeological survey which could comprise one, or a combination, of the following; Evaluation (Informative) Trial Trenching, Sample Excavation (Strip, Map, and Sample) or Open-Area Excavation, identified on a case-by-case basis, and/or a Historic Building Recording (HBR) documentation (level dependent on heritage value of asset) Or</li> <li>• If monitoring identifies archaeology, record through archaeological survey which could comprise one, or a combination, of the following; Evaluation (Informative) Trial Trenching, Sample Excavation (Strip, Map, and Sample) or Open-Area Excavation, identified on a case-by-case basis, and/or Historic Building Recording (HBR) documentation (level dependent on heritage value of asset – case by case basis)</li> </ul> <p>b) for section of asset not being physically impacted (defined as a 5m buffer from the nearest impact), preservation in-situ applied.</p>
CHMP Consultations	<p>The Project will consult and agree on the approach proposed in the Cultural Heritage Management Plan (CHMP) with key stakeholders, like the Ministry of Culture, and engage with other potentially interested stakeholders (e.g. biodiversity NGOs) on the proposed CHMP. Consultations are further defined in the CHMP.</p>

Figure 42 Archaeology - Residual Impact Magnitude







## 20 Labour & Working Conditions

This chapter addresses the risks related to the labour and working conditions of the Project workforce, including employment rights, non-discrimination and equal opportunities, child and forced labour, worker organizations and worker accommodation.

### 20.1. Baseline Conditions

#### Working Conditions

Employment relations in Armenia are regulated by constitutional rights; statutory rights, as set out in statutes and regulations; rights set by collective agreements and extension orders of collective agreements; and individual labour contracts.

The labour legislative framework in the Republic of Armenia is contained in the Constitution, as well as the Labour Code and other legal acts in the social and economic field. The main inspiration of labour regulation is provided in the constitutional provisions. The Constitution emphasizes that the basic tasks

of the State in the economic, social and cultural spheres is, first and foremost, to contribute to employment and the improvement of working conditions for the population.

The freedom to choose a profession is guaranteed, as well as the right to working conditions which are in compliance with safety and hygiene requirements. The Labour Code defines the contract of employment as an agreement between an employee and an employer, according to which the employee undertakes a duty to perform work of a certain profession, qualification or to perform specific duties in accordance with the work regulations established at the workplace. The employer undertakes a legal obligation to provide the employee with the work specified in the contract of employment, to pay him/her the agreed wages and to ensure working conditions as set out in labour legislation, other legal acts, collective agreements, and the agreement between the respective parties.

The constitution outlines that each individual has the right to fair remuneration and the amount should not be less than the minimum wage set by law. Wages are paid in Armenian Dram. The rate of minimum, monthly and hourly pay is established by law. Particular wage conditions are provided for overtime work or night work, work carried out in hazardous conditions, during public holidays and rest days, idle time and part-time work. The labour code indicates that wages are to be paid at least once a month. The employer is obliged to provide the worker with a written statement detailing information on wages paid.

Armenia also supports maternity leave. The Armenian Constitution highlights that dismissal for reasons connected with maternity is prohibited. Every female employee during pregnancy and childbirth has the right to paid maternity leave and parental leave following the birth or adoption of a child. Women are entitled to pre- and postnatal leave while retaining whole remuneration.



Employees in Armenia are entitled to rest periods as per the government's regulations. The minimum annual paid leave in Armenia is 28 days.

According to an ARMSTAT survey in 2019, 33.5% of the employed population of Armenia is self-employed. Although decreasing, informal employment still exists and amounts to 38% of all employment (informal employment is less than 20% in urban areas and represents 64.2% in rural areas).

In 2019 the total unemployment rate among those aged 15–74 was 18.3%, with only a slightly higher unemployment rate among women (19.3%). Public services are not seen as a relevant support for finding a job for young people and young people in Armenia mainly use personal contacts, online job advertisement websites or informal channels to find a job, while only 1.2% use the State Employment Agency (SEA).

The gender pay gap is the difference between the hourly wages earned by men and women in the labor market, expressed as a percentage of men's average wage. In Armenia the gender pay gap remains an issue with the World Bank estimating that Armenian women earn 20%

less than men. ARMSTAT found that the gender employment gap is largest for the 35–44 and 55–64 age cohorts while the gender unemployment gap largely exists for the younger labor force (aged 15–34).

### Non Discrimination and Equal Opportunities

The principle of equal treatment is laid down as a fundamental right in the Armenian Constitution. According to the laws surrounding equality, everyone is equal before the law. Any discrimination based on any grounds such as sex, race, colour, ethnic or social origin, genetic features, language, religion or belief, political or any other beliefs, membership of a national minority, property, birth, disability, age or other personal or social circumstances is prohibited.

The labour code outlines and highlights the importance of equal pay, it highlights that equal pay for equal work for men and women is essential. A worker retains the right to social security whether it be in old age, for disability, loss of main wage earner, unemployment and other cases prescribed by the law.

### Forced and Child Labour

In Armenia, persons under the age of 16 are not permitted to engage in full time employment. In accordance with the labour code, it is prohibited to employ a person under the age of 14. The contract of employment may be concluded for persons between 14-16 years of age provided that written authorization is given by at least one parent or legal guardian. The working time for workers aged between 14-16 years is 24 hours per week, and 36 hours per week for workers aged between 16-18 years.

Forced labour is prohibited. It is not expected that there is a high rate of child labour in Armenia due to the law requiring schooling from the ages of six to 16.



### Worker Organisations

Article 28 of the Armenian Constitution guarantees freedom of association. This principle is reaffirmed in the labour code.

The labour code states that rights and interests of workers may be represented by trade unions. Chapter 7 of the labour code is devoted to social partnership regulation. The labour code defines this as a system of interrelations between workers (their representatives) and employers (their representatives), as well as the Government of the Republic of Armenia in some cases established by the labour code, aimed at according to workers' and employers' interests in collective labour relationship. This provision also enumerates basic principles of social partnership, namely, equality of the parties and right to collective bargaining.

In the Republic of Armenia, there are four levels of social partnership: State, branch, region and enterprise. In the latter, the social partners are the employers and the trade union of the enterprise.

In accordance with the labour code, social partnership is realized through:

- Collective bargaining aimed at preparing and signing collective agreements; and
- Exchange of information and reciprocal consultations.

**Worker Accommodation**

There is no national housing allowance scheme in Armenia, although the ministries of Urban Development and Labour and Social Affairs are considering this option.



## 20.2. Sensitive Receptors

**Table 181 Labour and Working Conditions- Sensitive Receptors**

Receptor	Receptor Sensitivity	Justification
<b>Project Workforce</b>	Medium	The Project workforce is the sensitive receptor for any worker rights violations.
<b>Local Workforce</b>	High	The local workforce may not be as familiar with industrial working conditions and labour rights.
<b>Female Workforce</b>	High	Female workers are more likely to be subjected to noncompliant working conditions and are at risk of sexual harassment.
<b>Subcontractor and Supplier Workforce</b>	High	The workforce of the subcontractors and suppliers is usually more vulnerable to worker right violations than the employees of the Project Company and the EPC, as the latter are subject to a higher degree of control.

The Project could have a negative impact on workers if all relevant Labour and Working Conditions requirements are not complied with. The range of potential non-compliances and associated impacts includes but is not limited to non-payment of wages, negotiated wages below statutory requirements, lack of written contracts with clear terms of employment, non-payment of overtime, lower pay to female employees, lack of worker welfare facilities onsite (e.g. resting areas, toilets, canteens), discrimination during

the hiring process, harassment (including sexual harassment), employment of children or forced labour, discouragement of worker organizations and collective bargaining, or the provision of worker accommodation facilities that are not compliant with the E&S framework. Labour and working conditions risks are significantly higher during the construction phase but are also applicable to the operational and decommissioning phases of the Project.

**Table 182 Labour and Working Conditions- Impact Magnitude**

Impact	Impact Magnitude	Likelihood	Justification
<b>Non-Compliance with Labour &amp; Working Conditions Requirements</b>	Major Negative	Likely	The noncompliance with the relevant requirements is relatively common during the construction projects, particularly by subcontractors and suppliers who are not fully aware of international requirements or want to minimize labour costs.





### 20.3. Impact Assessment

Table 183 Labour and Working Conditions- Impact Assessment- Construction Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>Non compliance with Labour &amp; Working Conditions</b>	Major Negative	Likely	Project Workforce (including local, female and subcontractor and supplier workforce)	High	Moderate Negative

Table 184 Labour and Working Conditions- Impact Assessment- Operational Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
<b>Non compliance with Labour &amp; Working Conditions</b>	Major Negative	Likely	Project Workforce (including local, female and subcontractor and supplier workforce)	High	Moderate Negative

The management measures for Labour and Working Conditions are the same for the construction, operational and decommissioning phases of the Project.

Table 185 Labour and Working Conditions- Management Measures- All Phases

Impact / Risk	Management Measure
<b>Non compliance with Labour &amp; Working Conditions</b>	Implement a Labour & Working Conditions Management Plan (LWCMP). The LWCMP will describe how the EPC and subcontractors will comply with IFC PS2 and EBRD PR2 including provisions on employment relationship; non-discrimination; harassment or abuse; forced labour; child labour; freedom of association and collective bargaining; hours of work; compensation; grievance mechanism; and retrenchment.





Impact / Risk	Management Measure
	Implement a Worker Accommodation Management Plan (WAMP) in compliance with ADB, IFC PS2, EBRD PR2, the IFC Guidelines on Worker Accommodation and national law and regulations.
	Adhere to rules and conditions of employment that safeguard workers' rights under national and international labour and social security laws and regulations.
	Ensure that all sub-contractor workers are engaged in line with both national legislation and applicable international (ILO) standards and recommendations.
	Implement transparent and fair recruitment procedures.
	No person shall be subject to any discrimination in employment on the basis of gender, race, religion, age, disability, sexual orientation, nationality, political opinion, social group or ethnic origin.
	No employee shall be subject to any physical, sexual, psychological or verbal harassment or abuse.
	There shall be no use of forced labour.
	There shall be no use of child labour.
	Employers shall recognize and respect the right of employees to freedom of association and collective bargaining.
	Employers shall provide a safe and healthy workplace setting to prevent accidents and injury to health.
	Employers shall provide appropriate accommodation and onsite facilities for workers (e.g. canteen, sanitary facilities, potable water).



Impact / Risk	Management Measure
	Employers shall pay at least the minimum wage.
	The Project will put in place provide a grievance mechanism for workers to raise workplace concerns with a clear non retaliation policy.
	Ensure that all the Project’s subcontractors and suppliers have a clear policy of zero tolerance towards child labour, forced labour and unsafe work conditions.
	In the event of a new strain of the pandemic causing renewed concerns, the Labour and Working Conditions Management Plan should include measures to ensure that workers are protected should they contract a communicable disease such as COVID -19, including provisions for sick leave, free accommodation and food during the quarantine and medical attention if required.
	In the event of a new strain of the pandemic causing renewed concerns, the Worker Accommodation Management Plan will include measures to manage the risk of COVID 19. This could include PCR tests for everyone entering the accommodation, quarantine dorms, enhance disinfection, increased natural ventilation for all indoor areas, and emergency procedures for increased social distancing at dorms and canteens should cases be detected. The Plan will also include provisions to minimise contact with local communities.
	As required in the chapter on economic conditions, develop a Local Recruitment Policy within the Human Resources Policy, including provisions to prioritise local recruitment whenever possible. Develop a Local Recruitment Procedure within the Labour and Working Conditions Management Plan (LWCMP).



## 20.4. Residual Impacts

Table 186 Labour and Working Conditions- Residual Impacts- Construction Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
Non compliance with Labour & Working Conditions requirements	Moderate Negative	Yes	Negligible

Table 187 Labour and Working Conditions- Residual Impacts- Operational Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
Non compliance with Labour & Working Conditions requirements	Moderate Negative	Yes	Negligible

## 20.5. Monitoring Measures

Table 188 Labour and Working Conditions- Monitoring Measures- All Phases

Impact / Risk	Monitoring Measure
Non compliance with Labour & Working Conditions requirements	Records of procurement process and employees (including subcontractors).



Impact / Risk	Monitoring Measure
	Monitoring of local recruitment procedure.
	Review and monitoring of supply chain, in particular child labour and human rights issues.
	<p>Monitoring records on the following KPI's:</p> <ul style="list-style-type: none"> <li>• Number of employees;</li> <li>• Local workers as a percentage of the total workforce;</li> <li>• Vulnerable workers (per type of vulnerability) and their respective % of the total workforce;</li> <li>• Pre-employment medical examinations and number of new hires;</li> <li>• Verbal warnings, documenting a description of the incident, evidence, worker(s) involved, root causes, and additional training provided;</li> <li>• Worker unions active in the Project (voluntary registration);</li> <li>• Number, locations, and cleaning frequency of toilets;</li> <li>• Number and locations of resting areas;</li> <li>• Number of potable water tanks, location, litres consumed per day on average, inspections;</li> <li>• Food provided to workers, adequacy of food suppliers; and</li> <li>• Grievances including type, company involved, results of the investigation, actions, and time to respond to the plaintiff.</li> </ul>

## 21 Occupational Health & Safety

Project related activities during both the construction and operation can result in increased risks to the health and safety of the construction workers and operators.

This chapter addresses the impacts relating to occupational health and safety.



### 21.1. Observations and Baseline Conditions

Occupational health and safety at work are vital components of a professional and productive work environment. Occupational accidents can have a significant human, social and economic cost, which can be eliminated by ensuring that all workplaces follow proper safety guidelines. While Armenia is a developed country and enforces the Labour Code, the main OHS legislation in Armenia, it can be violated on occasion leading to accidents, injuries and sometimes death in the workplace.

According to the ILOSTAT database, in 2018, Armenia recorded 50 non-fatal workplace injuries to employees per 100k workers.





In addition, there was 13.6 occupational fatalities recorded per 100k workers. Labour inspection is one of the main mechanisms to monitor occupational safety. In 2010 the number of inspectors per 10k employees was 1.1.

The Statistical Committee of Armenia have recorded a total of 27 industrial accidents were recorded in Armenia in 2019 due to violations

of standards on occupational safety and health. According to the statistics, last year 3 people died as a result of industrial accidents in Yerevan, Aragatsotn and Lori Provinces. Most of these accidents (66%) occurred in the mining industry due to the violation of workplace safety standards. 5 accidents were registered in the processing industry, while 4 others were electrical and gas leak accidents.

**Table 189 Occupational Health and Safety- Sensitive Receptors**

Receptor	Receptor Sensitivity	Justification
Workers	High	Workers can be exposed to increased health and safety risks due to Project related activities.

## 21.2. Sensitive Receptors

## 21.3. Impacts

### 21.3.1. Construction Phase

Construction activities can result in increased physical hazards for workers such as falls (work at height), excavations, earthworks, heavy machinery operation, hot works, vehicle movements onsite and off site, working in confined spaces, working with rotating machinery, falling objects and collection and evacuation of solid and hazardous wastes.

### 21.3.2. Operational Phase

Health and safety risks associated to Project activities during operation such as preventive and unscheduled maintenance, housekeeping, waste evacuation and office activities are significantly lower than during construction. The risks during work at height remains high.

### 21.3.3. Decommissioning Phase

The decommissioning impacts are likely to be similar to those of the construction phase but of a lower magnitude.

**Table 190 Occupational Health & Safety – Impact Magnitude**

Impact	Impact Magnitude	Likelihood	Justification
Risks to workers health and safety	Major	Likely	Project related activities can potentially threat employee’s health and safety, if not properly managed. Without adequate management, accidents are likely and can potentially have dire consequences.



## 21.4. Impact Assessment

Table 191 Occupational Health & Safety – Impact Assessment – Construction Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
Risks to workers health and safety	Major	Likely	Workers	High	Major Negative

Table 192 Occupational Health & Safety – Impact Assessment – Operational Phase

Impact / Risk	Impact Magnitude	Likelihood	Receptor(s)	Receptor Sensitivity	Impact / Risk Assessment
Risks to workers health and safety	Major	Likely	Workers	High	Minor Negative

Decommissioning phase impacts are similar to construction impacts but with a lower magnitude and duration.

## 21.5. Management Measures

Table 193 Occupational Health & Safety – Mgt. Measures – Construction Phase

Impact / Risk	Management Measure
Accidents and Incidents	Develop and Implement an Occupational Health and Safety Management Plan (OHSMP). The measures described below will be included in the OHSMP in the ESMS.
	Implement a grievance mechanism for workers.
	Provide regular OHS trainings.



Impact / Risk	Management Measure
	All workers will receive a detailed induction before being allowed to do any work onsite.
	Ensure the use of related PPEs and other protective means such as sun blockers.
	Implement limits on manual lifting/handling.
	Install guard rails and signs.
	Ensure sufficient illumination.
	Conduct regular visual checks and maintenance/clean-up of excavation debris and other potential risk sources such as cables and ropes.
	Restrict operation of heavy machinery to those that are trained and competent (licensed if required).
	Conduct regular labour audits to contractors' workforce (by independent labour auditors assigned by the Project Company).
<b>Working at Height and Falling Objects</b>	Provide specialised OHS trainings.
	As possible to the extent and as considered feasible, assemble structures and carry out other suitable work at ground.



Impact / Risk	Management Measure
	Ensure fall protection systems are in place during works at height (e.g. guard rails, fall arrest equipment, etc.).
	Consider additional safety equipment such as safety nets.
	Do not conduct related activities during heavy rain/storm and other poor/extreme weather conditions.
	Set and maintain appropriate exclusion zones below any working at height activities to the extent possible (measure for falling objects).
	Ensure all tools and equipment are attached by appropriate means to the personnel that is working at height (measure for falling objects).
	Use approved tool bags for raising and lowering equipment.
<b>Lifting Operations</b>	Ensure personnel that conduct lifting operations receive special training and are certified and competent.
	Ensure all parties involved in the lifting operations hold a meeting prior to activities, to ensure the operation is well planned, risks discussed, and communication methods provided.
	Ensure all required information regarding the load is known (e.g. attachment points and weight).
	Ensure lifting equipment is properly maintained and right for the material to be lifted (e.g. sufficient capacity to support the weight).



Impact / Risk	Management Measure
	Set and maintain appropriate exclusion zones below any working at height activities (measure for falling objects).
	Ensure weather condition limits set by the lifting equipment manufacturer are not exceeded, check prior to each lifting operation.
<b>GHG and exhaust gas emissions</b>	Implement dust suppression techniques (please refer to the air quality chapter for all relevant measures).
<b>Noise and Vibration</b>	Ensure the use of PPE is required in high noise areas.
	Consider changing equipment or implementing time limits in case of a grievance regarding vibration.
<b>Site Traffic</b>	Implement a Traffic Management Plan (TMP). The measures described below will be included in the TMP in the ESMS.
	Restrict operation of heavy vehicles to those that are trained and competent (licensed if required).
	Provide traffic trainings for all personnel and provide specialised trainings to personnel that will operate industrial vehicles.
	Include traffic issues in the scope of the trainings that site visitors will receive and limit site visitors' mobility on construction sites.
	Install and maintain signage and other traffic regulating means.





Impact / Risk	Management Measure
	Set speed limits and implement right of way practices.
	Conduct periodic vehicle maintenance.
<b>Electrocution</b>	Develop and implement a LOTO (Lock down tag out) procedure.
	Ensure live power lines and components are shut down prior to conducting work.
	Allow only trained and authorised personnel to conduct electrical works.
	Ensure related PPEs are used.
	Prohibit other workers from reaching the areas where live power lines or components exist and provide training to the ones that require to work in close proximity.
<b>Electric and Magnetic Fields</b>	Conduct additional assessments in case multiple worker grievances are received.
<b>Spread of COVID-19</b>	In the event of a new strain of the pandemic causing renewed concerns, the following measures shall be considered: Monitor the temperature of all workers daily. Train all workers on social distancing to minimise risks related to COVID 19. Ensure that groups of workers are as small and self contained as feasible and that each group of workers stays together for as many activities as possible (e.g. work onsite, canteen, dorm, ect.). Provide surgical masks to all workers as a preventative measure, and N95 measures to medical staff onsite.

Table 194 Occupational Health & Safety – Management Measures – Operational Phase

Impact / Risk	Management Measure
<b>Working at Height and Falling Objects</b>	Implement a Labour and Working Conditions Management Plan (LWCMP). The measures described below will be included in the LWCMP in the ESMS.
	Provide specialised OHS trainings.
	As possible to the extent and as considered feasible, assemble structures and carry out other suitable work at ground.
	Allow only competent and trained personnel to conduct works at height.
	Ensure fall protection systems are in place during works at height (e.g. guard rails, fall arrest equipment, etc.).
	Consider additional safety equipment such as safety nets.
	Ensure cranes and other hoisting equipment are checked and maintained regularly.
	Do not conduct related activities during heavy rain/storm and other poor/extreme weather conditions.
	Set and maintain appropriate exclusion zones below any working at height activities to the extent possible (measure for falling objects).
	Ensure all tools and equipment are attached by appropriate means to the personnel that is working at height (measure for falling objects).





Impact / Risk	Management Measure
	Use approved tool bags for raising and lowering equipment.
	Implement a grievance mechanism for workers.
	Conduct regular labour audits to contractors' workforce (by independent labour auditors assigned by the Project Company).
<b>Working in Remote Locations</b>	Ensure communications equipment are available for all personnel and maintained properly.
	Keep a suitable patient transport vehicle on site.
<b>Spread of COVID-19</b>	Please refer to the labour and working conditions chapter for all relevant management measures.

The management measures listed for the construction phase will be applied during decommissioning, as relevant.

## 21.6. Residual Impact

Table 195 Occupational Health & Safety – Residual Impacts – Construction Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
<b>Risks to workers health and safety</b>	Major Negative	Yes	Moderate Negative

Table 196 Occupational Health & Safety – Residual Impacts – Operational Phase

Impact / Risk	Impact / Risk Assessment	Management Measures	Residual Impact
Risks to workers health and safety	Moderate Negative	Yes	Minor Negative



## 21.7. Monitoring Measures

Table 197 Occupational Health & Safety – Residual Impacts – Operational Phase

Impact / Risk	Monitoring Measure
Risks to workers health and safety	Monitoring of the number of incidents related to H&S.
	Monitoring of the number of near misses related to H&S.
	Monitoring of the number of internal grievances related to H&S.
	Monitoring of the number of injuries.
	Monitoring of the records of loss time injuries.

The monitoring measures listed for the construction phase will be applied during decommissioning, as relevant.



Impact / Risk	Monitoring Measure
<b>Risks to workers health and safety</b>	Monitoring of the number of incidents related to H&S.
	Monitoring of the number of near misses related to H&S.
	Monitoring of the number of internal grievances related to H&S.
	Monitoring of the number of injuries.
	Monitoring of the records of loss time injuries.



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### 22.3. Annexes

- Annex 1. Biodiversity Survey Report
- Annex 2. Critical Habitat Assessment
- Annex 3. Social Survey Report
- Annex 4. Archaeology Inventory Report
- Annex 5. Intangible Cultural Heritage Assessment
- Annex 6. Archaeology and Cultural Heritage Assessment

