Lightsource Holdings 2 Limited (Lightsource bp)

Project Sunrise, Azerbaijan

Environmental and Social Impact Assessment Report

FEBRUARY 2024

RSK GENERAL NOTES

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ABBREVIATIONS

Term	Definition
AC	alternating current
AETC	Azerbaijan Environment and Technology Centre
AIS	alien invasive species
ALARP	as low as reasonably possible
ANAMA	Azerbaijan National Agency for Mine Action
AOI	area of influence
AZN	Azerbaijan manat (₼)
BID	background information document
BOTW	Cornell birds of the world
bp	BP Exploration (Caspian Sea) Limited
BS	British Standard
BTC	Baku-Tbilisi Ceyhan
BTK	Baku-Tbilisi-Kars
CCRA	climate change risk assessment
CCTV	closed-circuit television
CH	critical habitat
CHA	critical habitat assessment
CIA	cumulative impact assessment
CO	carbon monoxide
CO_2	carbon dioxide
CR	Critically Endangered (IUCN Red List species threat level category)
DC	direct current
DD	Data Deficient (IUCN Red List species threat level category)
DNI	direct normal irradiance
DSU	delay in start up
EaP	Eastern Partnership
EBRD	The European Bank for Reconstruction and Development
EDGE	evolutionary distinct and globally endangered
EHS	environment, health and safety
EIA	environmental impact assessment
EN	Endangered (ICUN Red List species threat level category)
EP4	Equator Principles
EPC	engineering, procurement and construction

Term	Definition
ERW	explosive remnants of war
E&S	environment and social
ES	ecosystem services
ESIA	environmental and social impact assessment
ESMP	environmental and social management plan
ESMS	environmental and social management system
ETF	European Training Foundation
EU	European Union
EW	Extinct in the Wild (ICUN Red List species threat level category)
EX	Extinct (ICUN Red List species threat level category)
EZER	East Zangezur Economic Region
FAO	Food and Agricultural Organization
FAQ	frequently asked questions
FGD	focus group discussion
GBV	gender based violence
GBVH	gender based violence and harassment
GDP	gross domestic product
GFDRR	Global Facility for Disaster Reduction and Recovery (World Bank)
GHG	greenhouse gas
GIIP	good international industry practice
GIS	geographic information system
GPH	good practice handbook
HC	hydrocarbon
HDI	human development index
HGV	heavy goods vehicle
HSE	health, safety and environment
HV	high voltage
IAQM	Institute of Air Quality Management
IBA	Important Bird and Biodiversity Area
IBAT	integrated biodiversity assessment tool
ICH	intangible cultural heritage
ICT	information and communications technology
IDP	internally displaced peoples
IEC	International Electrotechnical Commission
IFC	International Finance Corporation
IFI	International Finance Institutions

Term	Definition
IMAS	International Mine Action Standard
IPCC	Intergovernmental Panel on Climate Change
IPPC AR6	Intergovernmental Panel on Climate Change Sixth Assessment Report
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Area
KII	key informant interview
LC	Least Concern (ICUN Red List species threat level category)
LGV	light goods vehicle
Lightsource bp	Lightsource Holdings 2 Limited
LV	low voltage
LV/MV	low to medium voltage
MENR	Ministry of Ecology and Natural Resources
MERA	Ministry of Energy of the Republic of Azerbaijan
MoE	Ministry of Education
MoH	Ministry of Health
MV	medium voltage
MV/HV	medium to high voltage
NDC	Nationally Declared Contributions
NE	Not Evaluated (ICUN Red List species threat level category)
NGO	non-government organisation
NH_3	ammonia
NOx	nitrogen oxides
NT	Near-threatened (ICUN Red List species threat level category)
OHTL	overhead transmission line
O&M	operation and management
PAC	project affected communities
PCCP	Post-Conflict Construction Plan (Government of Azerbaijan)
PCS	pre-construction survey
PIIM	project induced in-migration
PM	particulate matter
PM_{10}	particulate matter of size fraction approximating to <10µm diameter
$PM_{2.5}$	particulate matter of size fraction approximating to <2.5µm diameter
PR	performance ratio
PS	(IFC) Performance Standard
PWD	persons with disability

Term	Definition
PV	photovoltaic
PVC	polyvinyl chloride
RAM	risk assessment matrix
RAMS	remote aerial minefield survey
RCP	Representative Concentration Pathway
RPS	RPS Group (Consulting and Engineering services provider)
RSK	RSK Environment Ltd.
SCADA	supervisory control and data acquisition
SCI	sources of cumulative impact
SDG	Sustainable Development Goal
SEA	State Employment Agency
SEP	stakeholder engagement plan
SGC	Southern Gas Corridor
SO_2	Sulphur Dioxide
SO_X	Sulphur Oxides
SOCAR	State Oil Company of the Republic of Azerbaijan
SSP	Shared Socioeconomic Pathway
TCFD	Task Force on Climate-Related Financial Disclosure
TCH	tangible cultural heritage
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNECE CLRTAP	United Nations Economic Commission for Europe Convention on Long-range Transboundary Air Pollution
UNEP WCMC	United Nations Environment Programme World Conservation Monitoring Centre
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UPS	uninterruptible power supply
US EPA	United States Environmental Protection Agency
VEC	valued environmental and social component
VOCs	volatile organic compounds
VU	Vulnerable (ICUN Red List species threat level category)
WDPA	World Database of Protected Areas
WHO	World Health Organization
WRI	World Resources Institute

Unit	Definition
°C	degrees Celsius
dB	decibel
dB (A)	A-weighted decibel
Gg	gigagrams
ha	hectare
kg	kilogram
km	kilometres
kV	kilovolt
kVA	kilo volt amperes
kW	kilowatt
L	litres
LAeq	A-weighted, equivalent continuous sound level (in decibels)
LAeq, T	A-weighted Leq, measured over a specified period of time (T) (in decibels)
Leq	equivalent continuous noise level (in decibels)
m	metres
m^2	square metre
m^3	cubic metre
masl	metres above sea level
mm	millimetres
MT	metric tons
MVA	megavolt-ampere
MW	megawatt
MW_{AC}	megawatt alternating current
MW_P	megawatt peak
t	tonnes
%	percentage
>	greater than
<	less than
≤	less than or equal to
$\mu g/m^3$	micrograms per cubic metre
W_P	watt peak

1 INTRODUCTION

1.1 Background

Lightsource Holdings 2 Limited (Lightsource bp) are acting as developer on behalf of BP Exploration (Caspian Sea) Limited (bp), under a cooperation agreement with the Government of Azerbaijan, to establish Project Sunrise (the project), a photovoltaic (PV) power facility in the Jabrayil district, within the East Zangezur Economic Region (EZER) of southwestern Azerbaijan.

The PV power facility will occupy an area of approximately 802 hectares (ha) and will have a capacity of 240 megawatt alternating current (MW_{AC}) (generation capacity), approximately 288 megawatt peak (MW_P).

The project comprises the design, supply, construction, installation, commissioning and operation of the 240 MW_{AC} PV power facility.

Lightsource bp will be responsible for the construction, commissioning and operation of the project. The electricity produced by the PV power facility will ultimately feed into the Azerbaijan National Grid. AzerEnerji is responsible for identifying the location of the substation and the connection to the national grid. Figure 1.1 below provides an overview of the PV power facility. A description of the project is included in Section 3.

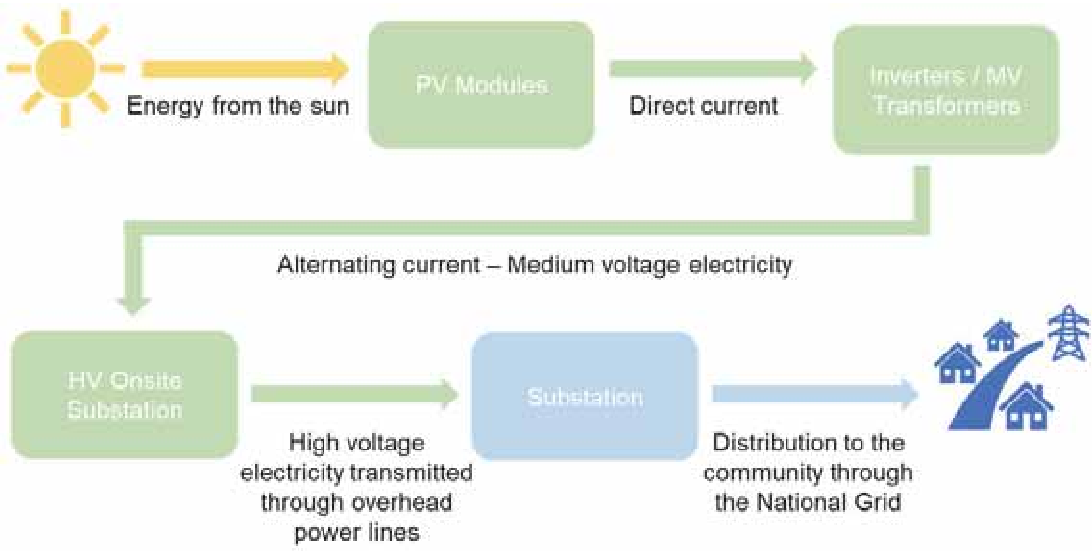


Figure 1.1: Project Sunrise PV power facility overview

Source: Lightsource bp, reproduced by RSK

1.2 Project Rationale

In the Republic of Azerbaijan, the proportion of electricity generated from renewable sources is growing rapidly. The President of the Republic of Azerbaijan set a goal to increase the share of renewable energy sources to 30% by 2030 and reduce the volume of greenhouse gas (GHG) emissions by 35% from energy sources. To achieve this goal, the State Agency for Renewable Energy Sources under the Ministry of Energy of the Republic of Azerbaijan (MERA) was established by Decree of the President of the Republic of Azerbaijan dated September 22, 2020, No. 1159, and the Charter of the Agency was approved.

The main tasks of the State Agency are to realise the goal of increasing the share of renewable energy sources in the country's energy mix, transform the EZER into the Green Energy Zone[1] and promote the participation of the private sector in the districts. In connection with these tasks a number of regulatory documents were signed and enacted by the President of Azerbaijan and the intention of these are summarised in Section 2.2 of Appendix 1.

In addition, a program of strategic importance was adopted on 2 February 2021, "National Priorities for Socio-Economic Development: Azerbaijan 2030". According to the document five national priorities should be implemented in the next decade:

- sustainable competitive economy
- dynamic, inclusive and social justice-based society
- competitive human capital and space for modern innovations
- full return to the territories
- clean environment and green growth in the country.

Project Sunrise is deemed a key piece of renewable power-generating infrastructure which will improve the provision of mains power to resettling communities within Jabrayil region and across the EZER.

The advantages and benefits of solar energy production compared to a thermal power plant include:

- diversification and security of energy supply
- reduced GHG emissions
- a non-depletable energy source
- no operating fluids or heat conversion systems that often result in discharges to air, land and water
- short installation period
- limited maintenance needs.

1.3 Environmental and Social Impact Assessment Consultant

RSK Environment Limited (RSK), a subsidiary of RSK Group, has been appointed by Lightsource bp to prepare this environmental and social impact assessment (ESIA) report for review and approval by the Ministry of Ecology and Natural Resources (MENR).

RSK has been operating in Azerbaijan since 1995. In January 1998 the company established the Azerbaijan Environment and Technology Centre (AETC) in Baku through which RSK's business in the Caspian has since been carried out.

[1] On 3 May 2021, the President of Azerbaijan signed an order on measures to establish a Green Energy Zone in the liberated territories of the Republic of Azerbaijan (Ministry of Energy of The Republic of Azerbaijan, 2023).

1.4 Scoping Stage

Azerbaijan environmental impact assessment (EIA) legislation[2] includes the requirement for preliminary consultations with the MENR to determine the content, scope and methods of the EIA assessment in advance. To facilitate this, and also meet International Financial Institution (IFI) ESIA standards, Lightsource bp commissioned RSK to conduct an ESIA scoping study prior to undertaking the ESIA study. The objectives of the scoping study were to:

- provide the MENR with a description of the construction, installation, commissioning, operation and decommissioning phase activities to be undertaken as part of the project
- present a preliminary account of potential environmental and social impacts
- propose the scope, methodology and schedule of the ESIA study.

The results of the ESIA scoping report and baseline surveys were presented to the MENR in Baku during a meeting on 25th September 2023 as part of the ESIA process. The MENR confirmed that the approach to the scoping process presented was acceptable and the study could proceed to the ESIA stage. MENR also provided feedback on the proposed process which will be addressed within this ESIA.

1.5 Report Objectives

The objectives of this ESIA report are to:

- provide an overview of planned infrastructure at the PV power facility site
- present the analysis of alternatives considered for the project
- provide information on resources consumed, emissions, discharges, and wastes
- describe the current physical, biological, and socioeconomic baseline within the project area of influence (AOI)
- identify and assess the potential environmental and social impacts, including human rights, during the various phases of the project (construction, installation, commissioning, operation, and decommissioning)
- develop suitable mitigation measures, management plans and monitoring programmes to minimise the potential impacts to as low as reasonably practicable (ALARP)
- fulfil the requirements of the environmental permitting process for the project
- seek approval of the ESIA report from the MENR.

[2] Law of the Republic of Azerbaijan on the Environmental Impact Assessment, June 12, 2018 (see Section 2.1).

1.6 Report Structure

Table 1.1 outlines the ESIA report structure.

Table 1.1: ESIA report structure

ESIA structure	
Executive summary	Presents the non-technical summary of the ESIA.
Section 1: Introduction	Introduces the background, rationale, and objective of this ESIA report.
Section 2: Regulatory Framework	Provides an overview of the applicational legislation, standards and guidelines governing Lightsource bp's activities. A detailed regulatory framework is contained within Appendix 1.
Section 3: Project Description	Provides an overview of the project location and site description, project phases (construction and commissioning, operation, and decommissioning), utilities, resource consumption, transport, workforce, security, project schedule, emissions, waste, and other environmental issues, and associated facilities.
Section 4: Project Alternatives	Provides an analysis of the technical alternatives considered for the project, and the reasons for selecting the chosen options.
Section 5: Baseline Conditions	Defines the geographical area that may be affected by the project's activities (AOI), and presents the current physical, biological, and socioeconomic baseline prevailing in the project AOI, including the findings of primary fieldwork undertaken to fill data gaps.
Section 6: Stakeholder Engagement	Details the planned engagement activities to be undertaken with stakeholders and highlights key stakeholder discussion points that have arisen during the preparation of this ESIA.
Section 7: Impact Assessment Methodology	Presents the scope and methodology for assessing potential environmental and social impacts, including human rights, from planned activities and unplanned events.
Section 8: Impact Assessment	Provides the identification and assessment of environmental and social impacts due to the project before and after the application of mitigation measures. Cumulative impact assessment included.
Section 9: Climate Change Risk Assessment	Provides a high-level analysis related to the physical risks of climate change.
Section 10: Environmental and Social Management Plan (ESMP)	Provides an overview of the project-specific plans that will be developed by Lightsource bp and their contractor(s) to facilitate implementation, tracking, and reporting of the mitigation and monitoring measures identified in this ESIA report.
Section 11: References	Lists the references used in preparation of the ESIA report.

2 REGULATORY FRAMEWORK

2.1 National Regulatory Requirements

The legal basis for ESIA in Azerbaijan is the *Law of the Republic of Azerbaijan on Environmental Impact Assessment, June 12, 2018*. The law provides the EIA procedures for projects of economic importance, projects of strategic importance, planning for the development of regions and individual economic areas in accordance with Article 39 of the Constitution of the Republic of Azerbaijan and paragraph 20, Article 94.

The law states that the main purpose of the EIA procedure is to identify the possible harmful effects of the planned activity on the environment and humans. The law comprises a list of the mandatory contents of the EIA document, including requirements for the assessment of the scale and intensity of project impacts in spatio-temporal terms as well as the implementation of measures to eliminate or mitigate them, and a list of activities requiring mandatory environmental assessment. The law requires the participation of state and municipal authorities, individuals, and legal entities, including non-governmental organisations, in the conduct of EIA and establishes the need for public hearings organised by the owner of the proposed activity. The EIA is carried out by the company during the design stage of the intended activity.

The MENR is responsible for the review and approval of the EIA report. As stated in Section 1.4 above, preliminary consultations were held with the MENR during the scoping stage with the aim of determining the content, scope and methods of the assessment in advance, and ensuring the completeness and accuracy of the information to be reflected in the ESIA report.

Legislation, standards, and guidelines applicable to project activities in Azerbaijan are provided in Appendix 1 and provides a summary of the relevant:

- renewable energy policy and legislation
- energy and planning legislation
- urban planning and building regulations
- EIA and environmental protection legislation
- the land code and legislation for the protection of historical and cultural monuments
- key health and safety legislation
- international conventions and treaties signed or ratified by Azerbaijan related to social, health, cultural heritage, and the environment
- the permits and licences considered applicable to the project.

2.2 International Standards and Guidance

2.2.1 Introduction

As well as Azerbaijani national regulations (legislation, standards, and guidelines), the ESIA will ensure compliance of the project to the applicable Equator Principles IV (EP4) (2020), the International Finance Corporation (IFC) Performance Standards (PS) 1-8 on

Environmental and Social Sustainability (2012), and the World Bank Group Environmental, Health and Safety (EHS) Guidelines ('General' EHS Guidelines) (2007).

2.2.2 IFC Performance Standards

The latest version of the IFC Performance Standards were published in 2012 and are an international benchmark for identifying and managing the environmental and social risks and impacts of projects. Since their publication, the Performance Standards have been adopted by many organisations as a key component of their environmental and social risk management. Whilst they are not intended to substitute relevant host country laws, regulations and permits concerning environmental and social issues, the Performance Standards can be used to complement national legislation and are particularly important where gaps in the national legal framework exist.

There are eight IFC Performance Standards, all of which are relevant to renewable energy development activities and/or operations, as provide in Table 2.1.

The IFC requires its clients to carry out an ESIA in accordance with PS 1 and additional requirements within PS 2-8 as applicable.

Table 2.1: IFC Performance Standards

Performance Standard[3]	Objectives
Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts	The project proponent is required to establish an effective environmental and social management system (ESMS), based on an ESIA. Detailed guidance is provided with regards to the preparation of ESMS' and ESIAs. Detailed guidance is also provided with regards to stakeholder engagement, which (under the PS 1) should be ongoing throughout the ESIA process, based on principles such as inclusivity, transparency and meaningful participation.
Performance Standard 2: Labour and Working Conditions	Covers workers directly engaged by the project proponent as well as those engaged through third parties and primary suppliers. A range of potential issues are addressed, including recruitment procedures, contracts, workers' organisations, grievance mechanisms, child and forced labour and occupational health and safety.
Performance Standard 3: Resource Efficiency and Pollution Prevention	Outlines a project-level approach to resource efficiency and pollution prevention and control in line with internationally disseminated technologies and practices. In addition, this PS promotes the ability of private sector companies to adopt such technologies and practices as far as their use is feasible in the context of a project that relies on commercially available skills and resources. PS 3 aims to avoid or minimise adverse impacts on human health and the environment by avoiding or minimising pollution from project activities, to promote more sustainable use of resources, including energy and water, and to reduce project related greenhouse gas emissions.

[3] The applicability of each PS is established during the ESIA process and is further elaborated in the respective impact assessments in Section 8

Performance Standard[3]	Objectives
Performance Standard 4: Community Health, Safety and Security	Recognises the impacts that project activities can have on local community health, safety and security. Project proponents are required to implement measures to minimise such impacts, including with regards to infrastructure and equipment design and safety, the management of hazardous materials, accidental events/emergencies and security personnel.
Performance Standard 5: Land Acquisition and Involuntary Resettlement	Seeks to address the adverse impacts on communities and persons that can result from project-related land acquisition and land use restrictions. It requires involuntary resettlement to be avoided as far as possible; where this is not possible, it should be minimised and appropriate mitigation measures should be implemented to address the adverse impacts of displacement. Detailed guidance is provided with regards to compensation and benefits, stakeholder engagement, grievance mechanisms and resettlement and livelihood restoration planning and implementation.
Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	Recognises 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 have been guided by the Convention on Biological Diversity. The implementation of the actions necessary to meet the requirements of this performance standard is managed through the project proponent's ESMS, the elements of which are outlined in PS 1.
Performance Standard 7: Indigenous Peoples	Recognises that indigenous peoples may be particularly vulnerable to adverse project impacts. It aims to ensure that business activities minimise any such impacts and also respects the human rights, dignity and culture of indigenous peoples, whilst promoting development benefits in culturally appropriate ways. Informed consultation and participation with indigenous peoples is a core requirement of PS 7 which should be maintained throughout the project lifecycle.
Performance Standard 8: Cultural Heritage	Aims to guide project proponents in protecting cultural heritage from the adverse impacts of project development and supporting its preservation. Requirements are established for both tangible and intangible forms of cultural heritage and the performance standard applies to all cultural heritage, regardless of whether or not it has been legally protected or previously disturbed.

2.2.3 Equator Principles – EP4

The Equator Principles are a risk management framework followed by financial institutions for identifying, assessing, and managing environmental and social risks in projects. They apply globally, to all industry sectors, and have evolved over time. The fourth version (EP4) came into effect on 1 October 2020. Compared to its predecessor, EP4 places greater emphasis on consideration of issues such as climate change and human rights in the context of environmental and social risk management. EP4 requires compliance with other international standards, namely the IFC Performance Standards (2012) and World Bank Group EHS Guidelines (2007) and which are discussed in Sections 2.2.2 and 2.2.4 respectively.

Principles within EP4 of particular relevance to renewable energy development activities and/or operations are shown in Table 2.2.

Table 2.2: EP4

Principle	Objective
Equator Principle 1: Review and Categorisation	Requires projects proposed for financing to be categorised based on the magnitude of potential environmental and social risks and impacts, including those related to human rights, climate change and biodiversity.
Equator Principle 2: Environmental and Social Assessment	Requires project proponents to conduct an appropriate assessment to address the relevant environmental and social risks and scale of impacts of proposed projects. Assessments of potential adverse human rights impacts and climate change risks should be included as part of the assessment or assessed separately.
Equator Principle 3: Applicable Environmental and Social Standards	Requires project proponents to comply with relevant host country laws, regulations and permits pertaining to environmental and social issues, alongside leading international standards (namely the 2007 World Bank Group EHS Guidelines and 2012 IFC Performance Standards).
Equator Principle 4: Environmental and Social Management	Requires project proponents to develop and maintain an ESMS, including an environmental and social management plan, to address issues raised during the assessment of project risks and impacts in line with the applicable standards.
Equator Principle 5: Stakeholder Engagement	Requires project proponents to undertake and demonstrate effective stakeholder engagement with affected communities, workers, and other stakeholders (as appropriate) in a structured, ongoing and culturally appropriate manner. The process must be tailored for vulnerable groups, including indigenous peoples.
Equator Principle 6: Grievance Mechanism	Requires project proponents to establish effective grievance mechanisms for use by affected communities and worker to receive and facilitate resolution of concerns and grievances about a project's environmental and social performance.
Equator Principle 10: Reporting and Transparency	Requires project proponents to ensure that the ESIA (or at least an ESIA summary) is accessible and published online, including a summary of human rights and climate change risks and impacts where relevant.

Equator Principle 1 requires a project proposed for financing to be categorised on the basis of its potential environmental and social risks and impacts. The categorisation is based on the IFC environmental and social categorisation process:

- Category A: projects with potential significant adverse environmental and social risks and/or impacts which are diverse, irreversible, or unprecedented.
- Category B: projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible, and readily addressed through mitigation measures.
- Category C: projects with minimal or no adverse environmental and social impacts/risks.

The proposed project is considered a **Category B** project under IFCs environmental and social categorisation as the potential environmental and social impacts associated with the project (as identified during the scoping stage and described in the scoping report) are considered to be limited, generally project-specific and can be addressed through the implementation of good international industry practices. The environmental and social risks have been assessed in this ESIA, with engineering and management measures developed to minimise the potential impacts to ALARP during construction and operation. The residual impacts (i.e., those that remain after the implementation of mitigation measures) will be managed during the life of the project through various environmental and social management and monitoring plans.

2.2.4 EHS Guidelines

The World Bank Group EHS Guidelines were published in 2007 and contain the performance measures and levels that are generally acceptable to the World Bank and its subsidiary organisations (e.g., the IFC). They are sub-divided into General EHS Guidelines and Industry Sector EHS Guidelines.

The General EHS Guidelines provide information on cross-cutting environmental, health and safety issues which are applicable to all industry sectors (IFC, 2020a). They consist of four technical guidance documents designed to address the four areas, as shown in Table 2.3. No Industry Sector EHS Guidelines have been published for renewable energy at the time of writing this ESIA.

Table 2.3: General EHS guidelines

Guideline	Description
General EHS Guideline	
Environmental	• Technical guidance document outlines a series of necessary precautions for managing impacts on the environment. • Specific guidance is provided on the following aspects to avoid, minimise, and control adverse impacts to the environment: o air emissions and ambient air quality o energy conservation o wastewater and ambient water quality o water conservation o hazardous material management o waste management o noise management o contaminated land • Guidance for designing and implementing monitoring programs is also provided for air emissions and ambient air quality, wastewater and ambient water quality, waste management, and noise management.
Occupational health and safety	• Technical guidance document outlines a series of precautions for managing key risks to workers' health and safety. • The main focus is on the operational phase of projects but much of the content is also applicable to construction and decommissioning activities. • Priority is given to the elimination of hazards in the workplace; where this is not possible, steps should be taken to control, minimise and protect workers from the hazard.
Community health and safety	• Technical guidance document complements the information provided in the equivalent documents on the environment and occupational health and safety but specifically addresses aspects of project activities which may take place outside of traditional project boundaries and impact upon local communities. • Specific guidance is provided on protecting local water quality and availability, ensuring the structural safety of projects, minimising traffic risks and developing emergency preparedness and response procedures.
Construction and decommissioning	• Technical guidance document provides additional, specific guidance on prevention and control of impacts on community health and safety and the environment that may occur during new project development or at the end of the project lifecycle. • Specific guidance is provided on construction and decommissioning activities for occupational and community health and safety and for all aspects given within the environmental guidelines.

3 PROJECT DESCRIPTION

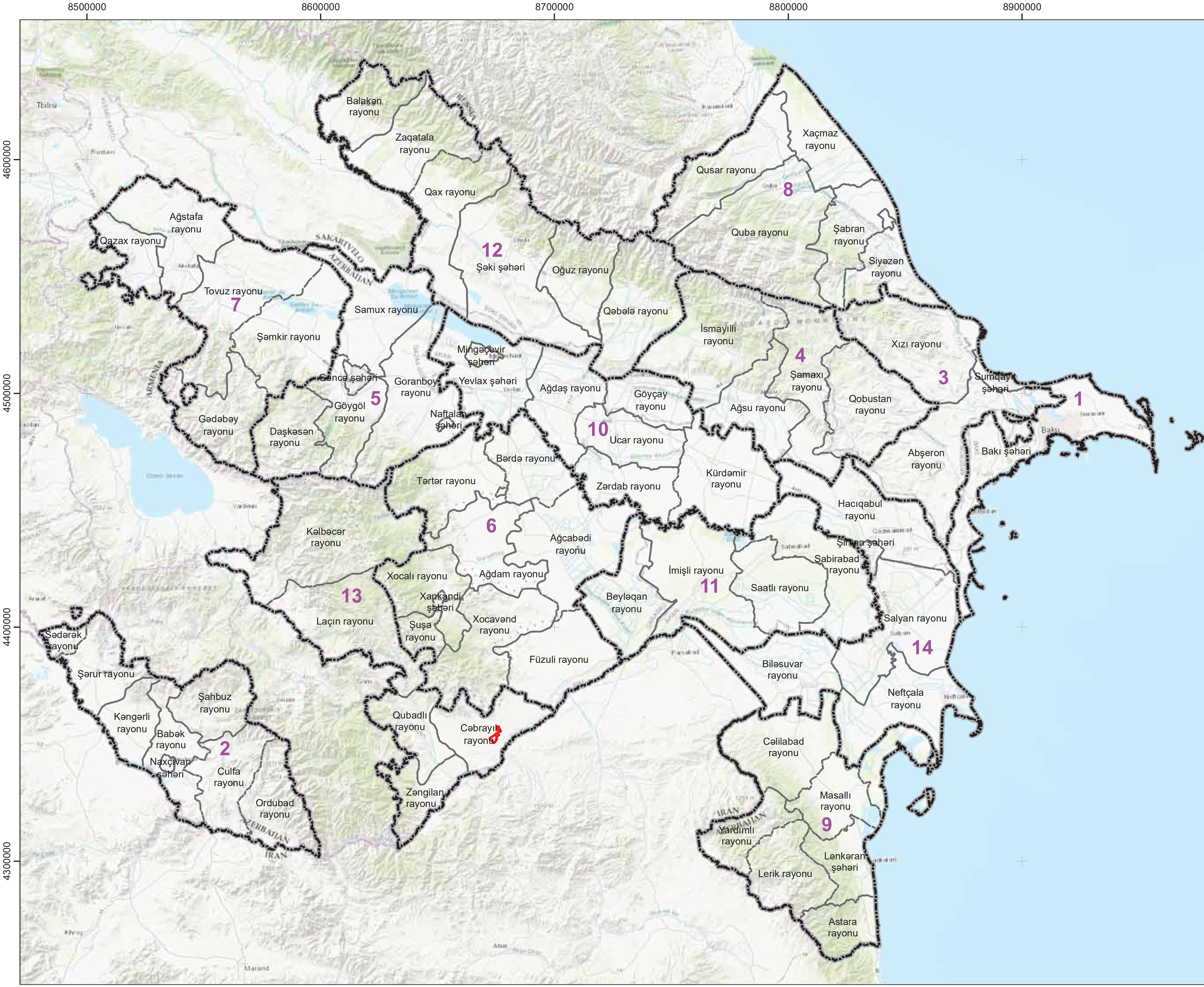
3.1 Project Location and Site Description

3.1.1 Location

The project will be developed within two selected sites located near Hajili settlement, approximately 6 kilometres (km) south of Jabrayil City, northwest of the Araz River in Jabrayil district. Figure 3.1 shows the location of the project within Azerbaijan and Figure 3.2 the project location within Jabrayil district. The two selected sites for the installation of PV modules are identified as the northern and southern clusters. The boundary coordinates of each cluster are presented in Table 3.1.

Table 3.1: Project Sunrise site boundary coordinates

Point	Coordinates (WGS 1984 UTM Zone 38N)	
	Easting	Northing
Northern cluster		
NC_1	675226.6698	4355714.9821
NC_2	675300.4476	4354659.5560
NC_3	676411.7361	4354851.5795
NC_4	676029.8551	4353475.2824
NC_5	676507.7285	4353334.1688
NC_6	676703.4992	4353771.0977
NC_7	677031.8039	4353666.0642
NC_8	675988.5379	4355761.8152
NC_9	675693.3547	4354250.0833
NC_10	676835.1185	4354309.6937
Southern cluster		
SC_1	675184.6709	4352922.2878
SC_2	672249.2026	4350634.7122
SC_3	674110.3889	4348665.5616
SC_4	674982.0211	4349749.0081
SC_5	675347.5455	4350300.6913
SC_6	675168.1968	4351494.4600
SC_7	676231.8050	4352140.2526
SC_8	675599.9904	4352442.8084
SC_9	675801.1192	4351749.0265
SC_10	674616.4670	4352305.2660



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Projection: Gauss Kruger
Datum: Pulkovo 1942
Units: Meter

Rev	Date	Description	Drn	Chk	App
01	01/02/2024	Final	USeid	RB	FG
00	10/11/2023	Draft A	USeid	RB	FG

Project Sunrise

RSK

Figure 3.1:

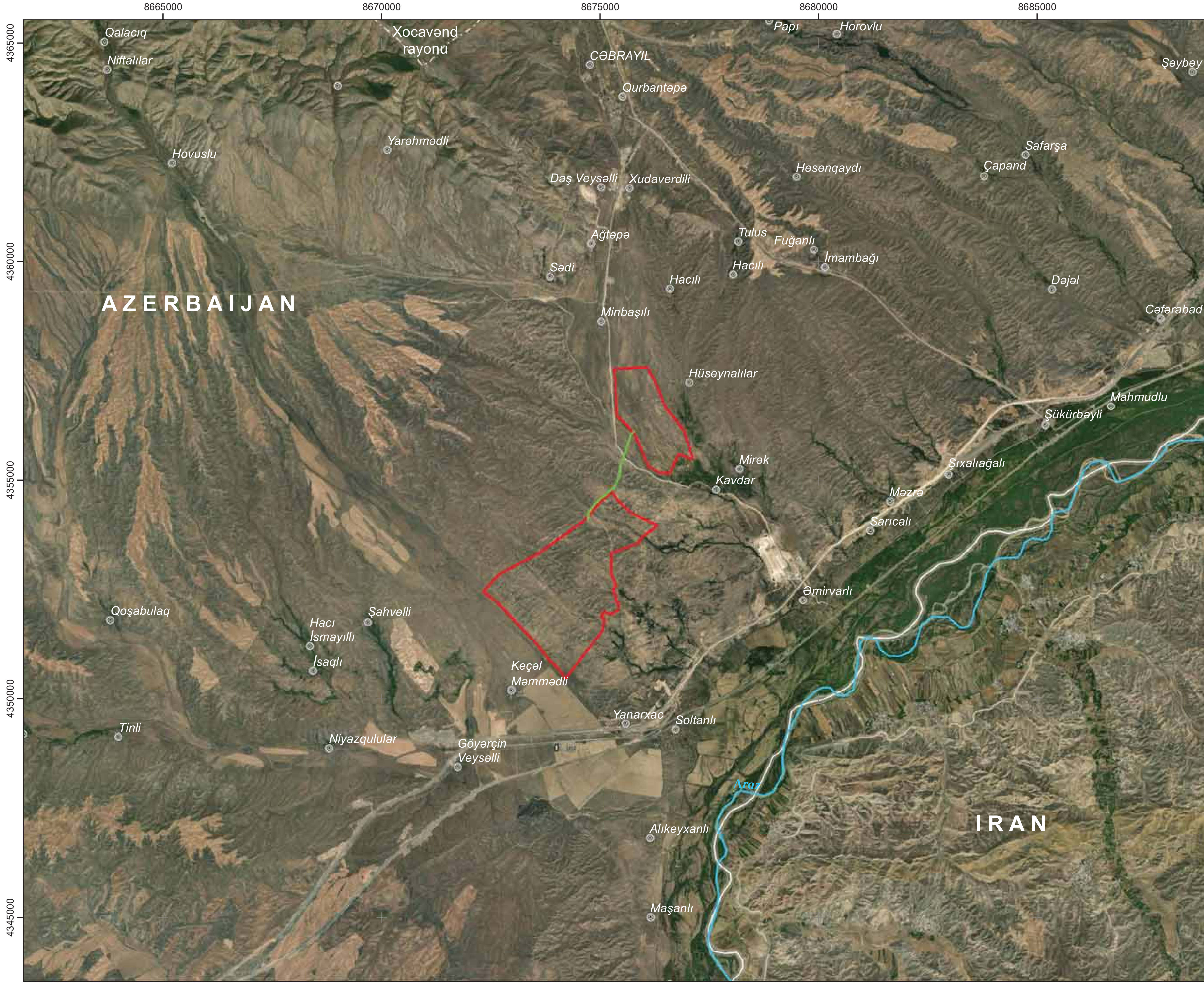
Project location within Azerbaijan

0 25 50
Kilometers
SCALE: 1:1,500,000 @ A3

REV 01

Document Path: P81137\P81137 - Figure 3.1.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community



Legend:

- Towns and villages
- Cable route
- State border
- Major rivers
- Project Area

Notes:
This map contains data from the following sources:
DATA SOURCE (DATE)

Coordinate System: Pulkovo 1942 GK Zone 8
Projection: Gauss Kruger
Datum: Pulkovo 1942
Units: Meter

Rev	Date	Description	Drn	Chk	App
01	01/02/2024	Final	USeid	LS	FG
00	10/11/2023	Draft A	USeid	LS	FG

Project Sunrise

RSK

Figure 3.2:
Location and overview of the project site

0 1,000 2,000
Meters

SCALE: 1:80,000 @ A3

N W E S

REV 01

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3.1.2 Site Description

The study area is geographically located in the southern part of Garabagh, in the Goyan steppe. The Goyan steppe, a plain in Jabrayil district of Azerbaijan, covers the territory between the Garabagh ridge and the Araz River. The northern cluster is located on the river plain on the bank of the Chaylag River (a tributary of the Araz River), between the former settlements of Minbashili and Mirak. The southern cluster is located 1 km to the southwest of the northern cluster on rolling hills southwest of the Chaylag River, with the northern site boundary adjacent to the rural road between Minbashili and Shavelli (Figure 3.2).

The project will be constructed on government owned land provided for the development of the project. Prior to the Armenian occupation of the land in 1993, the northern cluster was cultivated with vineyards (grape vines are still present on site, (see Figure 3.3)) and the southern cluster was used for livestock grazing and other agricultural activities (see Figure 3.4). Both sites are currently vacant and devoid of infrastructure apart from unpaved tracks crossing the sites. Due to the decades of occupation of the land, explosive remnants of war (ERW) can be found in areas which have not been cleared by the Azerbaijan National Agency for Mine Action (ANAMA).

Figure 3.3: Views across the northern cluster

Source: RSK (taken in May 2023)

Figure 3.4: Views across the southern cluster

Source: RSK (taken in May 2023)

3.1.3 Pre-survey Site Preparation and ERW Clearance

Due to the recent history of the site and its location within the formerly occupied territories, ERW surveys and clearance were required prior to any physical works on site by engineering and ESIA survey teams.

ANAMA commissioned RPS to conduct a drone survey and a remote aerial minefield survey (RAMS), to identify the presence of minefields (by detecting any metal/plastics present on site). The data from this survey was used to plan the operational resources and clearance methods. The project area was divided into three sections:

- to be cleared visually
- to be cleared as a battlefield
- to be cleared as a minefield.

ANAMA complied with the International Mine Action Standards (IMAS) 08-30 Post clearance documentation (edition 2, amendment 5, 1 June 2013) to conduct the ERW clearance. Handheld metal and magnetic locators were used for ERW clearance down to 30 centimetres (cm) and Foerster Ferex 4.032 magnetometers for ERW clearance down to 4 metres (m) depth.

The clearance is achieved and demonstrated in two stages.

- Stage 1 involves the monitoring of the demining organisation's management systems and operational procedures before and during the clearance process.

- Stage 2 involves the inspection of the cleared land by sampling. IMAS 07.40 provides guidance on the monitoring requirements and IMAS 09.20 provides guidance on the procedures to be adopted for post clearance inspections.

All 900 ha of the project site and buffer zones were cleared to 20-30 cm depth (shown in green as “cleaned” in Figure 3.5 below) and 12 ha was cleared down to 4 m depth along transects (shown as blue lines and “cleared” in Figure 3.5 below, see also Figure 3.6). The road connecting the northern and southern clusters was also cleared to allow safe passage.

Area clearance certificates were issued for the areas cleared by ANAMA.

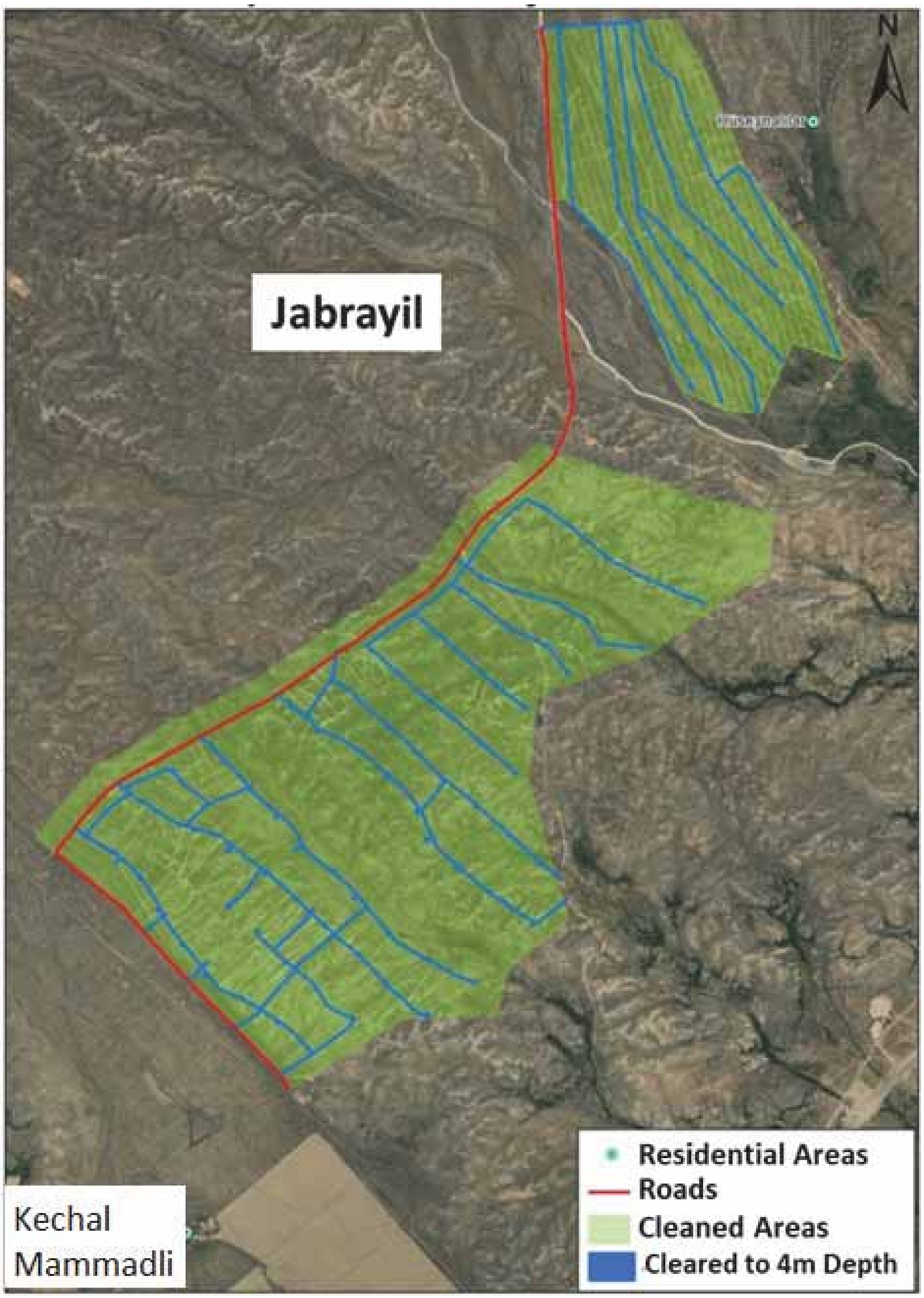


Figure 3.5: Project Sunrise ERW clearance status (April 2023)

Source: Lightsource bp

Figure 3.6: Cleared transects visible in the southern cluster, photo taken from vantage point at northeastern corner of project site

Source: RSK (taken in May 2023)

3.2 Description of the Project

3.2.1 Overview

Lightsource bp is acting as developer on an exclusive basis to install PV modules and associated infrastructure on the project site. The solar installation will comprise the following components:

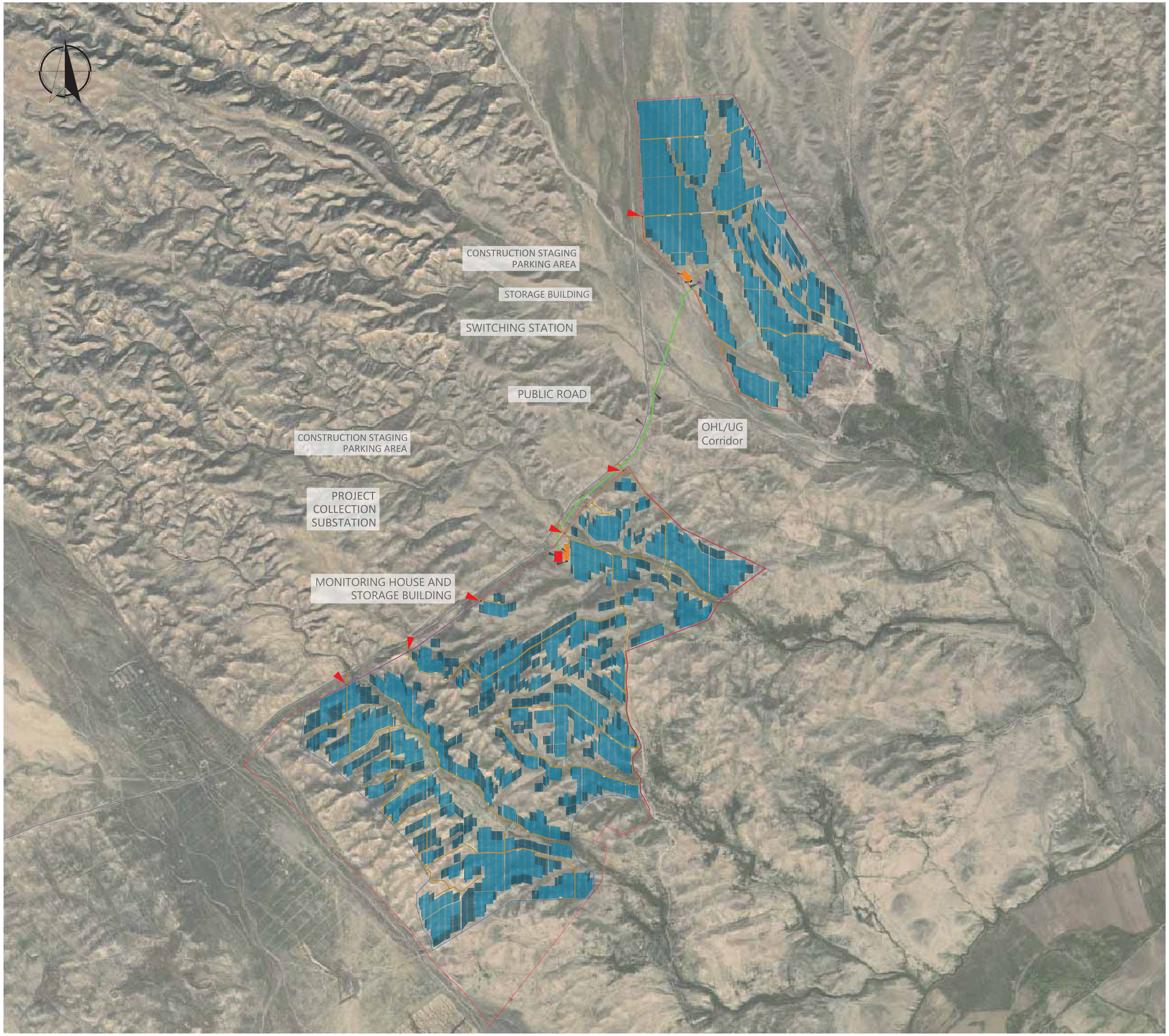
- PV modules attached to mounting frames (made of either galvanised aluminium or steel) to form tables (“arrays”) (the current base case uses a single axis tracking system to mount the solar PV modules)
- low to medium voltage (LV/MV) substations which will house electrical equipment, including a transformer, switches and circuit breakers, used to control and distribute electrical power in a localised area or grid
- inverters, adjacent to the LV/MV substations which will convert direct current (DC) electricity to alternating current (AC) electricity for the grid
- storage containers materials and portacabins for welfare/office areas
- a control house, with an associated weather station and communications equipment
- underground cables and a cable (underground or an overhead transmission line (OHTL)) connecting the two sites
- security fencing around the site perimeter, with access gates included
- internal access tracks within the site
- closed-circuit television (CCTV) and site security systems.

The connection of the PV power facility to the national grid is outside the scope of this project. AzerEnerji is responsible for the development of the step-up medium to high voltage (MV/HV) substation and the connection of the PV power facility to the national grid. The proposed location for the onsite substation is presented in Figure 3.7. Details on the specification and components of the substation are presented in Section 3.2.9.

The project will be connected at the medium voltage (MV) busbar of the step-up MV/HV substation via MV underground lines. This will be located within the project area. From this point, AzerEnerji will be responsible for the construction/commissioning of this step-up MV/HV substation including all the main equipment such as the power transformers.

Figure 3.7 below shows the proposed design for the PV panel array within the northern and southern clusters and this has been prepared to maximise energy production within the available area while taking into account known site-specific constraints and features. Figure 3.8 provides a schematic overview of the main components.

The project elements described in the sections below have been provided by Lightsource bp.



	Site Boundary
	Site Access
	Security Fence
	Single Axis Tracker 78 x 1
	Single Axis Tracker 52 x 1
	Transformer
	Access Gates
	Access Road
	Bridge and culvert crossing
	Flood zone crossing
	Monitoring house / storage building
	Construction staging / parking area

NORTH PLOT	
Capacity - DC	99.66 MW$_p$
SOUTH PLOT	
Capacity - DC	188.33 MW$_p$

PV SYSTEM SPECIFICATIONS	
Capacity - DC	288.00 MW$_p$
Capacity - AC	322.245 MW$_{AC}$
DC/AC Ratio	0.89
Modules	(496548) 580 W Bifacial
Mods. per string	26
Pitch	6.50 m
GCR	37.10 %
Mounting structure	(7243) SAT
• Full	4612
• Partial	2631
• Half	-
MV Stations	46
• Nominal Power	323.472 MVA
Access roads	28181 m
Fenced area	(8021273 m^2) 1982 Acres
• Perimeter	18620 m

Revisions:

Rev	Date	Comments	Dwn	Chkd
00	07.11.23	BDL (Basic Design Layout)	MV	

DRAWN	CHECKED	APPROVED	DATE
MV			09.10.2023

PROJECT NAME & ADDRESS:
Location:
AZERBAIJAN

NOTES:
- 580 Wp Bifacial modules
-
-
-

Paper Size:	Scale:	Sheet:
A3	1:30000	1

CAPACITY:
496548 Modules 288.00 MWp

DRAWING TITLE:
AZE_Project Sunrise_LP3-BDL_00

DRAWING NUMBER:	STATUS:
LP3-BDL	Preliminary

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Figure 3.7: Project Sunrise – 288 MW$_P$/240 MW$_{AC}$ base case

Source: Lightsource bp

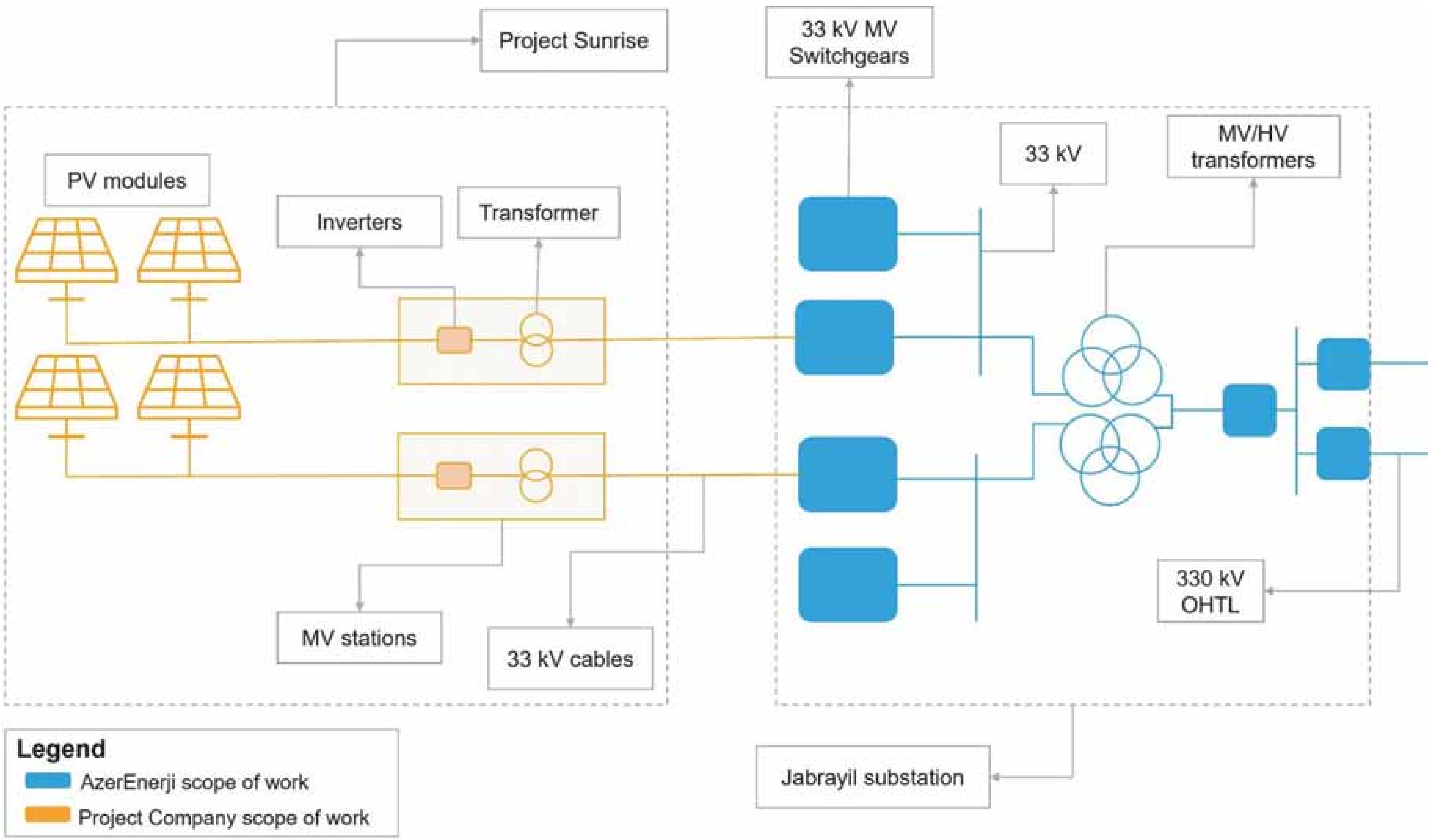


Figure 3.8: Schematic of main project components

Source: Lightsource bp, reproduced by RSK

3.2.2 PV Modules

The primary component of a PV system is the solar cell. This is the element that converts solar radiation (the sun's energy) into DC electricity using semiconductors that exhibit the PV effect. A PV plant contains many cells connected in modules which are then connected in strings to produce the required output. The PV module technology proposed for this project will be mono-crystalline silicon (mono-c-Si), with a watt range between 560-600 W_P (watt peak) N-type bifacial. Approximately 500,000 PV modules will be installed across both clusters. Each module will be approximately 2.2 m x 1.3 m with a 30 mm thick frame. The alternative technologies considered are summarised in Section 4.4.

The performance of a PV panel will decrease over time due to a process known as degradation. The degradation rate depends on the environmental conditions and the technology of the panel. The performance ratio (PR) of a well-designed PV power plant will typically be in the region of 77% to 86% (with an annual average PR of 82%), degrading over the lifetime of the plant. In general, good quality PV modules may be expected to have a useful life of 35 to 40 years.

The project will use PV modules that are certified by the International Electrotechnical Commission (IEC), ISO9001:2015: Quality Management System, ISO14001:2015: Environment Management System and ISO45001:2018 Occupational health and safety management systems.

3.2.3 Foundations

Foundation options for the PV module racks include galvanised driven pile profiles (directly rammed type or pre-drilled type), ground screw, or concrete foundations (see Figure 3.9).

- Galvanised driven pile profiles use precast steel profiles and are either driven directly into the soil or into pre-drilled ground. If piles are used, approximately 98,000 will be required.
- Ground screw foundations securely anchor the solar array underground by applying a screw to pre-drilled ground.
- Concrete foundations are not driven into the ground but instead use a man-made footing partially embedded in the ground and steel reinforced to hold the rack and panel in place.

The choice of one option over the other depends on substrate characteristics (i.e., whether the ground is soft, rocky or accessible by rigs). The final choice for the foundations will depend on the outcome of the detailed geotechnical survey and may comprise a combination of these foundation types.

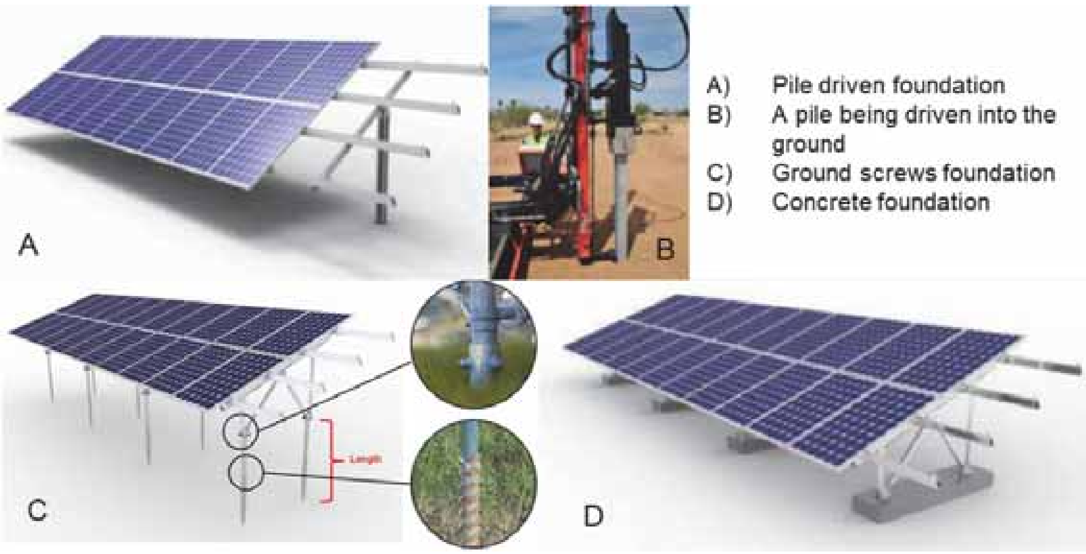


Figure 3.9: Illustration of typical panel rack foundation options (note – fixed tilt racks are shown in this figure, not single axis tracker systems)

Source: Lightsource bp

The foundations of the transformer substations shall consist of a foundation slab. The loads, plans, requirements and recommendations provided by the manufacturer of the transformer substations shall be taken into consideration for both the design and execution of the transformer substations.

3.2.4 Single Axis Horizontal Tracker System

PV modules are securely mounted on sun-tracking frames, thus increasing yield by up to 20%. Tracking, particularly for areas with a high direct/diffuse irradiation ratio also enables a smoother power output. PV modules attached to a tracking system allow the PV tables to move in relation to the sun, allowing for optimal performance throughout the day. The project proposed to utilise a single-axis tracking system that tilts the PV table around a horizontal axis tracking the sun from east to west (see Figure 3.10). Data collection on position and weather conditions and communication with the trackers will be via a supervisory control and data acquisition (SCADA) system. The proposed tracking system parameters are as follows:

- pitch: 6.5 m
- ground coverage ratio: 37.1%
- estimated no. of trackers: 7,243.

The maximum row length will be 300 m with a 4 m break between row ends for maintenance purposes.

Figure 3.10: PV modules installed on a single axis tracking system

Source: Lightsource bp

3.2.5 Inverters

The primary function of the inverter is to convert the DC produced by the PV modules into an AC. It is not yet determined if either central or string inverters will be used on the project. A central inverter has a footprint of approximately 1–2 m by 2–3 m and is typically up to 3 m tall.

String inverters can offer several advantages over central inverters including primarily ease of serviceability and greater redundancy in event of failures or underperforming plant sections. A string is a group of PV modules, wired together in series and connected to an inverter (a string inverter). String inverters are approximately 1 m x 0.5 m and up to 1 m high. The number of string inverters is estimated at approximately 1,000 however this is subject to ongoing design and will be refined prior to construction. Figure 3.11 presents an example of a string inverter and a central inverter.

Figure 3.11: Example of a string and central inverter

Source: Lightsource bp

3.2.6 Low Voltage Cables

DC string cables, connecting several strings to a monitor box will run along the backside of the PV module substructure avoiding loops and will be stabilised by special clamps or ultraviolet-resistant cable conduits. DC main cables, connecting each monitor box with the inverter, will be placed underground within a pipe or in a directly buried DC cable trench, typically buried up to 0.8 m below ground and in a 0.3 m to 0.75 m wide trench.

3.2.7 MV Transformer Stations

Inverters are connected to the so-called "MV power/transformer station" which comprises an LV/MV transformer, electrical panels and MV switchgear. If central inverters are used, they will be integrated into the MV Station. MV stations are most commonly packaged into a 5 to 8 m long, 2 to 3 m deep and 3 m tall container (see Figure 3.12). The rated power of the transformer within the MV power station is predefined according to the connected inverters power rating.

MV stations are interconnected by MV cables laid underground in polyvinyl chloride (PVC) ducts or directly buried. Circuits are typically directly buried in an MV trench, which varies from 1 m deep x 0.4 m wide to 1.2 m deep x 0.8 m wide, depending on the number of circuits and cables per phase. The total length of the MV cables is expected to be approximately 340 km. The PV site has several MV stations (approximately 46) that will connect the PV site to the step-up MV/HV substation via medium voltage circuits. These circuits end at the MV busbar of the step-up MV/HV substation where the Point of Connection has been established.

The electricity generated in the PV modules is fed up to the inputs of the inverters, where the power is converted from DC to AC power at low voltage and then increased to medium voltage via the MV stations.

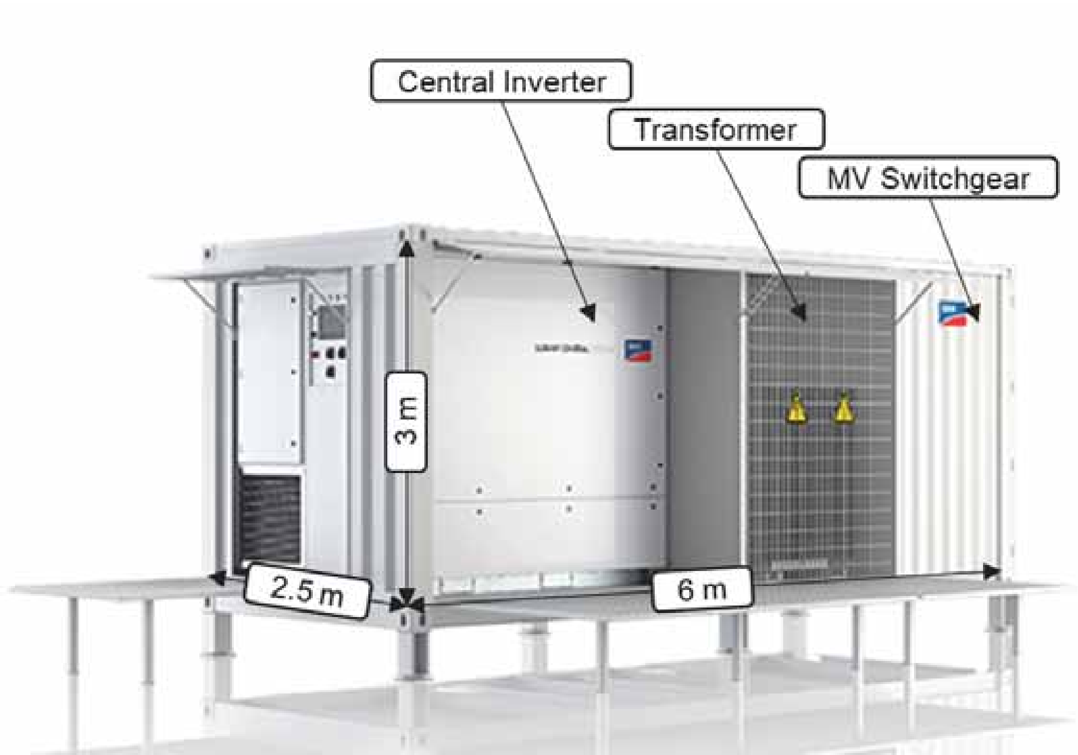


Figure 3.12: Example of an MV transformer station with an integrated central inverter

Source: Lightsource bp

3.2.8 Interconnecting Cable

An approximately 3 km long 33 kV OHTL or underground cable will be installed to connect the northern and southern clusters as shown in Figure 3.7.

3.2.9 Onsite Substation

AzerEnerji is responsible for the construction, maintenance, and operation of the MV/HV substation. The MV/HV step-up substation will be designed to collect the energy produced at 33 kV by the PV site and step up to 330 kV. The substation will be built three months in advance of the PV plant commissioning date and will be located within the boundary of the southern site. A schematic of the Lightsource bp and AzerEnerji scope of work in relation to the MV/HV substation is shown in Figure 3.13.

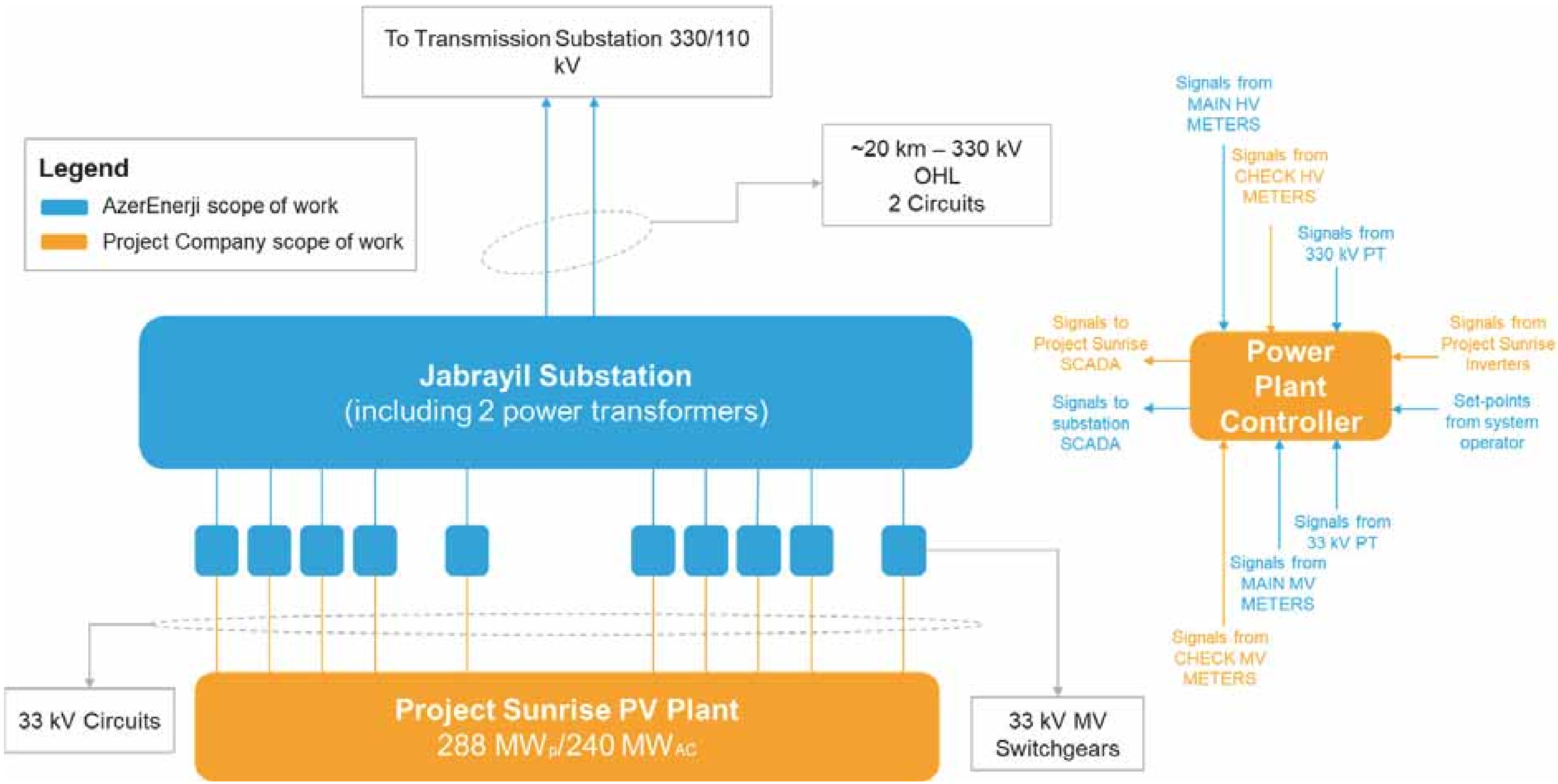


Figure 3.13: Schematic showing Lightsource bp and AzerEnerji scopes in relation to the step-up MV/HV substation

Source: Lightsource bp, reproduced by RSK

3.2.10 Administration and Control Buildings

Amenity (operations and maintenance building, communications equipment building, spares warehouse, water tanks) and main control buildings will be modularised as far as possible (see Figure 3.14), with a view to minimising site construction work. The buildings will be placed on a concrete base surrounding gravel fill. On site the approximate sizes of the control house will be 2 x 6 m containers, storage containers will be 4 x 12 m containers, two 45,000 litre water tank capacity and two portacabins for workforce office, rest and welfare areas.

A parking area with sufficient space for approximately 10-15 vehicles will be developed near to the administration and control buildings. The parking area will be gravel on top of a geotextile membrane.

The proposed locations of storage buildings and the monitoring house are shown in Figure 3.7.

Figure 3.14: Example of a communications building

Source: Lightsource bp

3.2.11 Access Roads

The details of site access and routes will be determined at engineering, procurement and construction (EPC) contractor selection phase. For the purpose of the ESIA, there are two options for accessing the project site by road. The site can be accessed by travelling southwest from Horadiz towards Şükürbəyl and then either continuing southwest towards Yanarxac and then northwest towards the southern cluster, or by travelling northwest from Şükürbəyl towards Jabrayil on an upgraded section of highway and then south towards the northern cluster. The location of access gates to the northern and southern clusters are also shown in Figure 3.7.

Sections of the existing paved access road will need upgrading to accommodate heavy construction vehicles. The upgrades are expected to comprise levelling, cutting up to 300 millimetres (mm) depth and filling using sub-base and base gravel material. Exact details of road upgrades required are currently unknown and will be determined prior to construction.

New access roads (6 m wide with 0.5 m shoulder each side) will be constructed in order to facilitate the transportation of materials, equipment and personnel to the sites during the construction and operations phase.

Within the site boundary, an internal road network (4 m wide with 0.5 m shoulder on either side and a gravel or crushed rock surface) will be constructed between the panel arrays and inside the perimeter fence-line to facilitate access during construction and for operational maintenance.

3.2.12 Fencing and Security

Entry to the site areas will be restricted to authorised personnel only. A perimeter fence (including pedestrian emergency egress gates) and a main vehicle gate will be installed around the PV power facility northern and southern clusters to prevent unauthorised access and in accordance with relevant laws and applicable standards. A typical perimeter fence is illustrated in Figure 3.15. The approx. 19 km of perimeter fence will include the following specifications, as a minimum:

- 2-2.5 m height
- 3 m base distance
- a braced pile will be placed at corners every 30 m
- metal components of the fence will be earthed and will comply with the requirements from the earthing studies
- materials for all fencing will be galvanised
- poles and foundations will be designed to support environmental conditions and will be adapted to the ground conditions
- barbed wire (2 x 1.6 mm thickness) will be placed above piles for security.

An intrusion detection system and CCTV will also be installed to provide coverage of the perimeter fence, main access, building areas and any other vulnerable points around the PV power facility, without impinging on local communities.

Figure 3.15: Example of typical security fencing and CCTV

Source: Lightsource bp

3.2.13 Surface Water Drainage

A detailed operational drainage design will be carried out pre-construction with the objective of ensuring that drainage of the land is maintained without affecting areas outside of the project boundary. The design of the drainage systems will take account of the site topography and seasonal fluctuations in surface water runoff. Bridges or culverts may be installed in some locations over existing drainage channels. A full flood risk assessment and hydrological assessment will be carried out as part of the surveys and these will consider any implications.

3.3 Project Phases

3.3.1 Construction and Commissioning

At the time of writing this ESIA report, the mobilisation, site preparation, construction and commissioning programme is expected to last approximately 18 months between July 2024 and December 2025 (see Section 3.11).

The main activities to be undertaken within the PV power facility will include:

- site preparation
    - perimeter fencing of the site
    - fencing any biodiversity and cultural heritage reserve areas
    - vegetation clearance
    - construction of site welfare facilities (and construction workers accommodation if required)
    - earthworks, including ground levelling, installation of drainage ditches, trenching for cables and construction of internal site roads

- PV power facility installation
    - import of components to site
    - installation of foundations and mounting structures
    - installation of PV modules
    - installation of cables
    - installation of other equipment such as inverters and transformers
    - construction of main control room
    - installation of CCTV and intrusion detection system
- commissioning of the PV power facility
    - mechanical and visual inspection
    - electrical and equipment testing
    - commencement of electricity supply into the grid
- site clean-up and reinstatement of temporary construction areas.

The construction activities are described in further detail within the following sections. However, it should be noted that the design has not yet been completed and the EPC contractor has not yet been appointed. Lightsource bp may award the construction contract to a single contractor as one package (the construction contractor may then divide the scope into separate work packages and use other suitably qualified and experienced sub-contractors to achieve the works).

3.3.1.1 Site preparation and earthworks

Topographic survey crews will survey the PV power facility site and set out the site boundaries, elevations, orientation, and infrastructure layouts. Due to the hilly nature of the PV power facility southern cluster site (see Figure 3.4), approx. 1.5 million cubic metres (m^3) of earthworks are expected to be required to create a suitable surface. The northern cluster is relatively flat and located on a river plain in the valley floor (see Figure 3.3).

Site preparation works will typically involve ground levelling (cut and fill), installation of drainage ditches and trenching for cables so that rainwater flows away from the work areas, and compaction of the loose surface soil, to provide firm ground for the placement of infrastructure (buildings, panel racks and the PV modules) and construction of internal roads. Bulldozers and/or excavators will be used for earth excavation, whilst dump trucks and/or front-end loaders will be used to load and stack the soil to designated locations.

The uncontaminated excavated soil will be used for backfilling, thus minimising the waste generated. Excess uncontaminated topsoil and subsoil will be stockpiled at the edge of the worksites, in accordance with good international industry practice, for future use for backfilling after completion of the work to aid in restoration of the area to its original state. If any visibly contaminated soil is encountered, it will be stored in a dedicated area (suitable for temporary storage of hazardous waste) prior to offsite transport to a licensed treatment or disposal facility.

3.3.1.2 Development of temporary compound areas

It is anticipated that multiple ‘compound areas’ will be built within the southern and northern clusters, with the size and location dependant on final layout design and EPC requirements. This area could occupy up to 20-30,000 square metres (m^2) and will include:

- typical production areas such as parking areas for vehicles and machinery
- warehouse(s)
- centralised laydown and material storage areas that are close to offloading facilities within the northern and southern clusters
- temporary waste collection points/storage areas (for hazardous and non-hazardous waste streams)
- welfare facilities (i.e., toilets and rest areas)
- small workshops etc.

The proposed locations of construction staging and parking areas are shown inFigure 3.7.

3.3.1.3 Worker accommodation

The need for temporary accommodation to be constructed is dependent on whether the workforce can be employed from the surrounding area or if adequate accommodation is available locally (i.e., in Horadiz) for any employees from other parts of Azerbaijan. This will be decided at EPC contractor selection stage.

Should accommodation be required for a national workforce and/or expatriates it will be provided for workers during the construction phase. It will be the responsibility of the EPC contractor to arrange for temporary workers accommodation.

This is expected to include a combination of temporary construction workforce accommodation within the project area and local accommodation in Horadiz (i.e., existing hotels or guesthouses) during construction, with the workforce transported to and from the project site by bus.

Should temporary worker accommodation be required to be constructed, the following factors will be considered during site selection.

- Existing environmental and social constraints – the worker accommodation will be situated in an area that does not impact identified environmental or social receptors.
- Safety, security and worker welfare – the worker accommodation will be situated in a secure area which have been cleared of ERW and free from any existing contamination.

Worker accommodation will typically comprise:

- accommodation, kitchen, dining, food storage, laundry, recreation, ablution, office and meeting rooms, medical clinic buildings (portable cabins)
- generators for power supply and associated diesel storage tanks
- potable and non-potable water tanks and/or water treatment plant (mobile containerised)
- septic tanks with the capacity to store 5-days worth of wastewater generated
- waste, fuel and hazardous materials storage areas
- firefighting equipment
- parking area.

The infrastructure will be modularised as far as possible, with a view to minimising site construction work. Flatbed trailers will transport the camp infrastructure to the sites.

The activities associated with temporary worker accommodation construction will be subject to change following the site selection process. However, the following activities are likely to be required prior to construction commencing:

- vegetation clearance, grading and compacting of the ground surface
- fencing the worker accommodation site and setting up appropriate security measures including lighting (including lightning rods if needed) and security gatehouses
- construction of designated areas for waste and wastewater management (i.e., septic tanks) and waste storage/collection
- laying temporary foundation blocks and skids for the construction of portacabins
- installing temporary utility lines including electricity, water and sewerage
- installation of lighting in key areas around the camp.

The worker accommodation will be designed in a manner that is fully compliant with project specifications, relevant national regulations and IFC PS 2 on workers' accommodation.

3.4 Operation

The operation of the PV power facility will be restricted to daylight hours. With automated functions of inverter and switchyard controllers, the maintenance will be mostly oriented towards better upkeep and monitoring of overall performance of the system. The PV system requires the least maintenance among all power generation facilities due to the absence of fuel, intense heat, rotating machinery, waste disposal, etc. However, keeping the PV modules in good condition, monitoring and correcting faults in the connected equipment and cabling are still required to get maximum energy from the facility.

Maintenance during the operation phase is likely to include the following activities:

- servicing of equipment
- cleaning of the solar PV modules (from dust and dirt during the dry season)
- general upkeep of the site territory (e.g., grass cutting and removal of vegetation to prevent shading).

The cleaning and maintenance arrangements will be defined in the operation and maintenance contract prior to commissioning.

3.5 Decommissioning

Decommissioning of the PV power facility is expected to require 12-18 months to complete and will be based on regulatory and industry standards at the time. The land will not be reprofiled but will be restored to its current state. No extensive remediation is expected to be required, apart from topsoil reinstatement and re-seeding to encourage natural vegetation.

PV modules are currently manufactured with performance warranties of up to 35 years plus, which guarantees the performance of the PV modules to a certain minimum level at 35 years of operation. With appropriate proactive monitoring and maintenance regimes in place, the PV modules are expected to work efficiently and economically well beyond the 35-year performance warranty period. Premature decommissioning could therefore represent an inefficient use of resources and a loss of the potential renewable energy generation benefits.

The decommissioning activities are likely to include:

- electrical disconnection and removal of electrical circuits
- site preparation and temporary storage – confirming the integrity of access to the sites to accommodate the required decommissioning equipment, mobilisation of decommissioning equipment, planning for temporary storage of waste
- dismantling of project infrastructure (PV modules, racks, cables etc.), and removing built structures and paved surfaces
- dismantling of security, communications, surveillance and lighting systems
- transportation of segregated waste materials suitable for re-use, recycling, and disposal.

Essentially decommissioning will follow the construction process but in reverse.

The decommissioning or upgrading of the infrastructure has not been discussed in this ESIA report but will be addressed before decommissioning is required in the form of a decommissioning management plan. Post closure monitoring will be carried out before transferring the land to the next landowner.

3.6 Utilities

3.6.1 Power Supply

3.6.1.1 Construction and commissioning phase

Energy supply for construction needs will be either from the national grid, or from a diesel generator. A diesel generator will be used in the absence of a point of connection in low voltage (LV) with enough capacity. Energy from the AzerEnerji substation (point of connection) will be required for hot commissioning.

3.6.1.2 Operation phase

The operational facility's power supply will be provided by an auxiliary transformer which will be powered by the development itself. There will be no energy storage facilities on site except for small uninterruptible power supply (UPS) units for the SCADA system, perimeter security system and other auxiliary services. A 150 kilo volt amperes (kVA) diesel generator (approximately equivalent to 150 kW) may also be installed for emergency power supply in case of a power outage.

3.6.2 Water Supply

3.6.2.1 Construction and commissioning

During construction, water will be sourced offsite from an existing source that has adequate capacity to accommodate the project's water needs. Average daily water consumption is estimated at 105 m^3/day. This is the equivalent to 150 litres (L) per worker, which includes the water for flushing toilets, cleaning hands and equipment, and concrete mixing, for example.

3.6.2.2 Operation phase

Water will be brought to the site in tankers and stored on site in a storage tank. Water consumption during the operation phase is estimated at 0.02 m^3 (equivalent to 20 L) per day. The frequency of water deliveries will depend on consumption but is expected to occur once every 3-6 months. The intention is that water will be sourced from an existing source/supplier with the necessary permits/authorisations to supply water.

3.7 Resource Consumption

The estimated quantity of resources anticipated to be used during the peak construction and commissioning phase (approx. 2-3 month period) and operation phase are presented in Table 3.2 and Table 3.3 respectively.

Contracting and procurement procedures for resources will be fair and equitable. The project will give preferential treatment to the procurement of resources (along with other goods and services) originating from Azerbaijan, when such resources are internationally competitive with respect to quality, availability, price, and performance.

Table 3.2: Indicative quantities of resources to be used during the construction and commissioning phase

Resources	Use	Quantity
Diesel	Diesel generators and construction vehicles	approximately 450 L/day (diesel generators during peak construction period) approximately 1,500 L/day (construction vehicles as listed in Table 3.4 during peak construction period)
Lubricating oils	Maintenance of plant, equipment, and vehicles	Minimal 5-10 L
Hydraulic oils		Minimal 5-10L
Paint	Protect, colour, or provide texture to objects	Minimal 5 L
Cleaning agent	Remove dirt	Minimal 0-5 L
Cement Sand Gravel	Concrete (mix of sand/gravel/cement) for the cast-in-place pile and equipment foundations	TBC at EPC selection phase
Steel	Structures and frames	10,000 metric tons (MT)
Fencing	Site security	18,650 m
Water (peak)	Potable drinking water, potable domestic water, non-potable water	105 m^3/day at peak construction (700 worker)

Table 3.3: Indicative quantities of resources to be used during the operation phase

Resources	Use	Quantity
Diesel	Emergency diesel generators	Very minimal <5 kg/month combined
Lubricating oil	Maintenance of plant, equipment, and vehicles	
Insulating oil (inverter/ transformers)	Replenishment of oil from leakage of main and box transformers or replacement after major repairs.	
Decontamination powder	Remove contaminants	
Coolant	Reduce or regulate the temperature of a system	
Thread glue	Prevent self-loosening, leakage, and corrosion	
Paint	Protect, colour, or provide texture to objects	
Degreasing agent (alcohol)	Removing grease, oil, fats, or other contaminants	<5 kg/year
Pesticides	Hygiene and maintenance activities	<10 kg/year
Herbicides		
Water (peak)	Potable drinking water, potable domestic water, non-potable water	0.02 m^3/day

3.8 Transport

Materials, equipment, and personnel will be transported to/from the project sites during the construction and commissioning phase and operation phase of the project. A logistics assessment will be undertaken as part of the project to define the vehicle type and number, and transport routes for the various project requirements will be surveyed. The outcome of the logistics assessment will be communicated to the MENR in due course.

Construction of the PV power facility will require various types of machinery and equipment but the exact types and numbers will be subject to EPC contractor selection and in accordance with Lightsource bp's construction standards and requirements. The typical range of vehicle and equipment and numbers anticipated to be used are provided in Table 3.4.

Table 3.4: Vehicle type and number expected to be used during the construction and commissioning phase

Type	Quantity	Sound power level dB(A)*
Backhoe	2	107
Excavator	5	110
Ramming machine	10	117
Telehandler	8	99
Cable pulling machine	2	102
Dumper	10	97
Pick-up	10	108
Buses	2	108
Piling rig	8	108
* Source of dB(A): https://www.transport.gov.scot/media/42094/appendix-a171-typical-construction-plant-and-noise-levels.pdf		

Transport during operation is likely to be limited to pick-ups for the transportation of people and light machinery (i.e., hand tools, vegetation strimmers, mowers etc. for maintenance and vegetation control), and limited heavy vehicle movements for the supply of water and other resources to site and the removal of waste and wastewater prior to treatment/disposal at an approved facility.

3.9 Workforce

The workforce is expected to consist of a combination of Azerbaijani nationals and expatriate workers and both groups are expected to be used during the construction and commissioning, operation and demobilisation phases.

The construction workforce is expected to be 300 persons on average across 6-8 months, reaching 700 persons at peak times. Lightsource bp aims to maximise the employment of construction workforce from the local population, subject to final technology selection and skills availability.

Construction activities are planned to take place in one shift, during day-light hours only (07:00-19:00), Monday to Saturday. Night-time working may be required to optimise the construction schedule; however, this is not deemed to be the base case. Working hours may vary depending on the season, with adjustments made where appropriate.

Temporary construction offices and site welfare facilities will be available on site during the construction and commissioning phase.

The operation of the PV power facility will be restricted to daylight hours. The exact workforce requirements will be determined prior to commissioning and will be defined in the operations and maintenance contract.

Various levels of training and skills development opportunities will be provided to the workforce throughout the project lifecycle to ensure they are able to fulfil their roles and promote ongoing learning and capacity building. This includes basic training on health, safety, and environment (HSE), labour management and, where required for specific job profiles, vocational training.

All workers will be provided with local employment contracts in accordance with Azerbaijan labour law based on the duration of their positions, i.e., limited term contracts for construction personnel.

3.10 Security

The EPC contractor will be responsible for security during the construction and commissioning phase, and Lightsource bp will have its own security personnel during the operation phase (either in-house or subcontracted).

3.11 Schedule

An indicative development schedule, outlining the sequence of major activities and the time required for mobilisation and site preparation, is outlined in Table 3.5.

Table 3.5: Project development schedule

Key milestone	Dates
Mobilisation and site preparation	July 2024 – October 2024
Construction	October 2024 – November 2025
Pre-commissioning and testing	November 2025 – March 2026
Commercial operation	December 2025 onwards

3.12 Emissions, Waste and Other Environmental Issues

3.12.1 Air Emissions

3.12.1.1 Construction and commissioning phase

During the construction and commissioning phase, plant and equipment will be used for site preparation, earthworks, installation of foundations and piling activities; diesel generators will be used for supply power; and heavy and light vehicles will be used to transport workers, materials, and equipment - all of which are powered by diesel/gasoline combustion engines. The use of combustion engines will result in emissions of exhaust gases containing air pollutants such as nitrous oxides (NO_x), particulate matter smaller than 10 microns (PM_{10}), volatile organic compounds (VOCs) and carbon monoxide (CO). The quantities of exhaust gases emitted will depend on factors such as engine type, service history, pattern of usage and fuel composition.

Fugitive dust emissions arising from this phase are likely to be variable in nature and will depend upon the type and extent of the activity, soil type and moisture, road surface conditions and weather conditions. For example, periods of dry weather combined with higher-than-average wind speeds have the potential to generate more dust. The project construction activities considered to be the most significant potential sources of fugitive dust emissions are:

- clearing, levelling, grading, backfilling, and other earth moving activities – due to handling, storage and disposal of topsoil and subsoil materials

- construction aggregate usage - due to the transport, unloading, storage and use of dry and dusty materials (such as cement and sand)
- movement of heavy and light vehicles on dry or unpaved access roads.

3.12.1.2 Operation phase

Operation of the PV power facility is not expected to generate any air emissions. However, heavy and light vehicles used to transport workers, materials and equipment will all be powered by diesel/gasoline combustion engines resulting in emissions of exhaust gases as described in Section 3.12.1.1. above.

As with the construction and commissioning phase, fugitive dust emissions are likely to be variable in nature and the most significant potential sources of these emissions are heavy and light vehicle movements on dry or unpaved access roads.

3.12.2 Noise Emissions

3.12.2.1 Construction and commissioning phase

Elevated noise levels are expected from plant and equipment used for site preparation, earthworks, installation of foundations and piling activities; diesel generators used to supply power; and heavy and light vehicles used to transport workers, materials, and equipment. A high-level overview of the type and number of plant and equipment expected to be used for construction activities and the associated sound power levels are presented in Section 3.8.

Diesel generators will be used for power generation during the construction and commissioning phase.

- One x 150 kVA diesel generator for temporary office and welfare facilities at each of the northern and southern clusters (two total). Should a national grid connection be available during this phase the generators will be used for emergency power supply only.
- Worker accommodation will require a bank of generators for power supply with up to eight x 150 kVA generators installed to supply the up to 700 person workforce accommodated.

All these noise sources are temporary and mobile with activities occurring within the limits of the project site.

The assumed noise levels typically vary depending on the machinery used and activities carried out simultaneously.

- Heavy machinery and construction equipment will generate noise levels in the range of 80-85 (equivalent continuous noise level (Leq) in decibels (dB)) at 15 m distance.
- Diesel generators in operation will generate noise levels in the range of 70-75 (Leq, dB) at 15 m.
- Piling activity (if required for panel rack foundation construction) typically generates higher noise levels compared to other construction works, and it mainly depends on the soil conditions (hard soil generates higher levels than soft soil) and the type of piling machinery used. It is assumed piling can generate noise levels in the range of 90-95 (Leq, dB) at 15 m from the piling activity.

3.12.2.2 *Operation phase*

Operation of the PV power facility is not expected to generate significant noise. The key source of noise during operation is the humming or buzzing noise produced by the substation and transformers but this is not anticipated to be significant. Noise will also be generated by heavy and light vehicles used to transport workers, materials and equipment to/from the project site during normal operation and maintenance activities.

3.12.3 Waste

All waste will be managed in accordance with Lightsource bp's Waste Management Plan and the EPC contractor's Waste Management Plan; both documents will be developed for the project. Lightsource bp will ensure, through contractual arrangements and the auditing process, that waste is segregated at source/sorted onsite prior to transportation offsite for reuse, recycling, treatment and/or disposal.

3.12.3.1 *Construction and commissioning phase*

The majority of waste generated throughout the project will be generated during the construction phase, originating from packaging materials (wood pellets and cartons) that can be recycled or reused. Some waste will also be generated from the kitchens and offices associated with the workforce on site.

Table 3.6 below provides details of the estimated quantities and management techniques for each waste stream generated by the project.

Table 3.6: Estimated quantity and management of waste streams during construction

Waste stream	Estimated quantity	Management
Hazardous waste e.g., paints, solvents and chemicals, chemical cans and containers, oily rags, spill response equipment, batteries	Negligible, less than 5-10 kg per month	Collected on site in specialised containers. Removed by an appropriately licenced third-party waste management company.
Non-hazardous solid waste (excluding recyclables/reusables) e.g., general (domestic) waste, kitchen waste, plastic, cardboard, paper, glass, scrap metal, wood	Assuming 700 people maximum workforce: Average generation per person: 26.4 kg/month (0.82 kg/person/day) = 17,220 kg/month (574 kg/day) (comprised of: – 5,160 kg/month organic – 10,320 kg/month recyclables – 1,710 kg/month to landfill).[4]	Segregated collection on site. Removed and transported to licenced third-party waste and recycling management facilities.

[4] Breakdown based on 30% organic waste, 60% recyclables and 10% to landfill

Waste stream	Estimated quantity	Management
Sewage and grey water	Estimated 1,950 m^3/month (65 m^3/day) from workforce accommodation Estimated 150 m^3/month (5 m^3/day) from welfare facilities on site	Estimated approx. 100 L/person/day for a peak workforce of 700 persons. Most will be generated at accommodation (from bathrooms/kitchens). Wastewater generated on site will be collected and periodically transported to a treatment facility by road tanker. No on-site treatment and waste discharge are planned.
Soil	Negligible	Stored onsite in designated areas away from any sensitive receptors/habitats. Reused for cut/fill and reinstatement.

3.12.3.2 Operation phase

Waste generation will be minimal during the operation phase; primarily associated with the main control room, amenity building activities, maintenance and repair work. There will also be a toilet facility and kitchen on site during operations.

Minimal sewage and grey water streams (from welfare facilities only) will be generated during the operational phase and the volumes of hazardous and non-hazardous waste generated will be less than those generates during the construction phase as shown in Table 3.6.

3.13 Associated Facilities

According to IFC PS 1, the definition of associated facilities is *'facilities that are not funded as part of the project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable'* (IFC, 2012).

To identify associated facilities, the following activities related to the project have been considered.

- Contractors used throughout the project phases for the provision of equipment, machinery, and resources, as well as for the removal of waste prior to treatment and/or disposal.
- The infrastructure required to construct and maintain Project Sunrise such as the expansion or creation of access roads, concrete batch plants, borrow pits or spoil disposal sites.
- Substations that will collect, convert and distribute the electricity generated by Project Sunrise and feed it into the national grid.

For the project the only associated facility identified is the step-up MV/HV substation that will be constructed within the southern cluster. As discussed in Section 3.2.9 above this substation will be constructed and operated by AzerEnerji, but would not be constructed if Project Sunrise was not realised.

Construction, operation and decommissioning activities associated with the step-up MV/HV substation are therefore assessed within this ESIA to the extent possible with the level of information available. Risks and potential impacts identified will be addressed in accordance with Lightsource bp’s and AzerEnerji information provided.

4 PROJECT ALTERNATIVES

4.1 Introduction

In this section, the critical technical alternatives selected for the project are identified and the justification for their selection discussed.

4.2 Site Selection

Lightsource bp conducted a site selection exercise comprising both desktop review and site visits of Government proposed sites, considering the following criteria:

- technical suitability criteria
  - site availability, size and the area of total usable land
  - irradiation (daylight) levels and potential energy yield
  - orientation and topography to be considered acceptable and conducive to the generation level required
  - access to the site could be achieved with ease without impacting on third-parties
- grid connection feasibility
  - availability of grid capacity
  - likely ease/difficulty of accessing the point of connection
- planning considerations - site not subject to ecological or landscape designations, no significant heritage assets identified, flood risk issues, neighbouring land use and potential visual receptors
- site considerations
  - setting, nature and land use of the site and immediate surroundings
  - shading considerations affecting energy yield
  - topography
  - access
  - external shading
  - construction obstacles (i.e., trees, ravines, watercourses etc.)
  - contaminative land use on site or immediate surroundings
  - any apparent environmental or social impacts.

Table 4.1 presents a summary of the results of the site selection process which was conducted using desktop analysis.

Of the several potential sites assessed, Lightsource bp proceeded with the current Jabrayil locations. This aligns with Lightsource bp's international development experience, where hundreds of sites are assessed every year, and less than 10% of these eventually go ahead, with the other 90% either unviable technically, unable to achieve grid connection, or considered inappropriate from a planning policy and an environmental and social impact point of view.

Table 4.1: Summary of site selection desktop analysis

Site for review	Results of desktop analysis	
	Positive results	Negative results
Confidential location (1,470 ha)	• Sufficient acreage and on plateau • Topography from Google Earth review • Likely not issues with hydro/ flooding	-
Confidential location (564 ha)	• Relatively flat from Google Earth review • Irradiance	• Not sufficient acreage if trackers are used • Valley – possible shading issues • River – possible flooding issues
Confidential Location (3,989 ha)	• Sufficient acreage • Closer to likely substation • Better transport links	• Residential areas within site boundary • Valley – possible shading issues • River – possible flooding issues
Qubadli Jabrayil (900 ha) – **Selected site.**	• Sufficient acreage • Access and transport links from google earth review • No sensitive E&S receptors found during desktop analysis • Potential for trackers • Irradiance	• Hydrological constraints (seasonal) • Topography

4.3 E&S Screening Study 2022

Following the site selection assessment as described in Section 4.2, further environmental and social screening was applied to the Jabrayil site. The key findings of this screening study are detailed in Table 4.2.

Table 4.2: Summary of 2022 screening study results

Aspect	Key features
Biodiversity	
Protected areas, sensitive habitats, flora and fauna	• No protected areas within or close to the project site • Topsoil to be preserved and site will be reinstated following construction to facilitate habitat recovery • Project has the potential to impact two priority faunal species identified • Large priority tree species to be avoided where possible

Aspect	Key features
Physical environment	
Climate and topography	• Within the Jabrayil region there is no evidence of extreme weather events such as droughts, fires or floods in the available literature online
Air quality	• The project area is within a rural, non-developed area, air quality is therefore assumed to be good
Noise	• The project area is within a rural, non-developed area, the background noise levels are therefore assumed to be typical for rural areas
Geology, soils and geohazards (landslides, faults, earthquakes, sinkholes)	• The ThinkHazard (GFDRR) earthquake hazard classification for Jabrayil is medium, meaning there is a 10% chance of potentially damaging earthquakes (0.1 PGA-g3) in the next 50 years
Groundwater, surface water bodies and flood risks	• Rivers (Injechay, Chakhmagchay, etc.) are short and seasonal
Extractive industries (minerals, hydrocarbons)	• Project site does not overlie any known mineral or hydrocarbon reserves
Socioeconomic	
Historical conditions	• As a recently liberated territory currently there is no resident civilian population, regular commercial or agricultural activities carried out in Jabrayil • Internally displaced people (IDP) will be able to resettle in the district following the ongoing restoration • Construction of the Araz Valley Economic Zone is ongoing in Jabrayil district
Administrative structure and governance	
Socioeconomic conditions	
Economy, livelihoods and land use	
Traffic, infrastructure and services	• Baku-Nakhchivan railway (52 km) and Ali-Bayramli - Zangilan highways (60 km) pass through the region • There is an existing road (minor road) running along the south-west and north-west boundary of the southern cluster and the western border of the northern cluster
Tangible and intangible cultural heritage	• There are no known historical architecture, religious or archaeological monuments within or close to the project site

4.4 Technology Selection

4.4.1 PV Module Technology

A technological alternative that was discarded was the installation of east-west facing panels. The project will comprise tracking systems (that move with the orientation of the sun).

East-west panels are stacked in a triangular formation and are usually prominent in countries where there is an uneven distribution of energy throughout the day, due to large scale south facing PV power facilities creating an energy peak during the middle of the day. East-west PV power facilities supplement traditional PV power facilities by generating more energy in the morning and evening hours. They typically produce less energy in a given day than south facing panels and are therefore incentivised through elevated generation payments by governments as a solution to the aforementioned problem.

Commercially, the east-west panels were not considered viable. With a similar footprint, the east-west configuration typically involves more panels and leads to a noticeably higher number of heavy goods vehicle (HGV) road deliveries, which in turn leads to greater nuisance, safety risks, and air pollution and noise. The choice to deliver a traditional south facing PV power facility is therefore preferable.

PV cell technologies are broadly categorised as either crystalline or thin-film. Crystalline silicon (c-Si) cells provide high efficiency modules. They are sub-divided into mono-crystalline silicon (mono-c-Si) or multi-crystalline silicon (multi-c-Si). Mono-c-Si cells are generally the most efficient but are also more costly than multi-c-Si. Thin-film cells provide a cheaper alternative but are less efficient. There are three main types of thin-film cells: Cadmium Telluride (CdTe), Copper Indium (Gallium) Di-Selenide (CIGS/CIS), and Amorphous Silicon (a-Si). The PV module technology proposed for this project will be mono-c-Si, with a watt range between 560-600 W_P N-type bifacial, which is designed to deliver high efficiency under harsh conditions, provide more power output in weak light and have a lower operating temperature thus increasing power output. Furthermore, they are more tolerant of impurities, making them more durable and reliable in the long term.

Lightsource bp have phased out the use of cadmium modules due to the hazardous and toxic nature of cadmium.

4.4.2 PV Module Racks

The chosen panel technology will be single tracker systems. Tracking systems can either be single-axis or dual-axis with the former rotating around the horizontal axis which follows the sun as it moves east to west, and the latter moving around both the horizontal and vertical axes. The dual tracker system was discarded for this site due to a mix of commercial and technical reasons; they can also be taller to allow best manoeuvrability and therefore can sometimes increase the visual impacts associated with the solar panels.

Fixed-angle frames are simpler to install, cheaper and require less maintenance than sun-tracking frames. However, tracking systems can increase yield by up to 20%. Tracking, particularly for areas with a high direct/diffuse irradiation ratio also enables a smoother power output. Single axis horizontal tracker structures are proposed for this project.

4.5 Plant and Equipment

A high-level overview of the type and number of plant and equipment expected to be used for the project is presented in Table 3.4. The EPC contractor may propose alternative plant and equipment to deliver the scope of work. The specification and number of plant and equipment will be outlined in the contract document, and further detailed in the contractor's method statement which will be reviewed and approved by Lightsource bp prior to mobilisation to the project site.

4.6 Provision of Concrete

The base case is for the project to use third-party concrete batching plants for the supply of concrete. If third-party facilities cannot provide sufficient volume of concrete, then a centralised, small volume concrete batching plant will be established within the construction zone.

4.7 ‘Do Nothing’ Scenario

The ‘do nothing’ scenario is a hypothetical alternative conventionally considered in ESIA as a basis for comparing the development proposal under consideration. In this situation, the do-nothing scenario would comprise not developing the PV power facility.

Should the project not move forward, then the significant and crucial positive economic, environmental, and social benefits of the project would not be realised. Such benefits include the following:

- The development shows the commitment of the Government of Azerbaijan to realising its goal of increasing the share of renewable energy sources to 30% by 2030, transforming the regions into the Green Energy Zone and meeting the objectives of the “National Priorities for Socio-Economic Development: Azerbaijan 2030”.
- Generating electricity through solar has benefits over conventional thermal power production, including the use of non-depletable energy source (the sun), no need for operating fluids and heat conversion system that often involves discharges to air, land and water, short installation periods, limited maintenance, and reduced GHG emissions, thus contributing to the Government’s goal of reducing national GHG emissions by 35% by 2030.
- The project will develop power-generating infrastructure which will improve the provision of mains power to the resettling communities across Jabrayil district and beyond to other areas in Azerbaijan. The project will have a capacity of 240 MW_{AC} and is expected to generate electricity for at least 35 years.

5 BASELINE CONDITIONS

5.1 Introduction

This section of the ESIA presents the results of both desk-based studies and field surveys carried out to identify the conditions in the project area and develop appropriate mitigation measures.

5.1.1 Overall Approach

Very little historic data is available for the region and project site. Therefore, a large portion of the baseline data presented has been collected as part of this ESIA. The work was carried out by a team of local experts, comprising:

- geology/hydrology specialist
- soils specialist
- botanist
- zoologist (field)
- zoologist (reporting)
- social specialist
- archaeologist
- legislation specialist.

Various other UK-based RSK experts were responsible for supervising the desk- and field-based studies. Secondary data from freely available, reliable online sources has also been used to support the baseline development.

5.1.2 Area of Influence

The impact of the project and project activities on a particular resource or receptor will have spatial (distance) and temporal (time) dimensions, the scale of which is dependent on several factors. These factors are incorporated in the definition of the project AOI.

The AOI defined for construction phase activities will be different from the area that may be affected during operation phase activities.

The PV power facility AOIs for each topic were defined based upon the definitions given in the IFC PS1 and represent the geographical area expected to be affected by:

- direct impacts arising from planned project activities and facilities
- direct impacts from unplanned, non-routine events
- indirect impacts on biodiversity or on ecosystem services that are linked to the livelihoods of affected communities
- cumulative impacts.

5.1.2.1 Environmental AOI

The environmental AOI for the project is presented in Table 5.1.

Table 5.1: Environment AOI for the PV power facility (construction phase and operation phase)

Topic	Phase	Consideration	AOI
Environment AOI (physical and biological)			
Air quality	Construction	The use of construction plant, equipment and machinery during clearing, levelling, grading, backfilling, and other earth moving activities at the PV solar facility and new access roads leading to the generation of fugitive dust* and gaseous exhaust emissions (i.e., SO_x, NO_x, PM_{10}, VOCs and CO).	1 km radius from source
		Unloading, storage and use of construction aggregate materials (such as cement and sand) at the concrete batching plant (if third-party not used) leading to the generation of fugitive dust.	500 m radius from source
		The potential use of diesel generators to supply power at the PV power facility site leading to the generation of gaseous exhaust emissions (i.e., SO_x, NO_x, PM_{10}, VOCs and CO).	250 m radius from source
		The use of dry or unpaved haul roads by heavy and light vehicles for the transportation of workers, materials and equipment to the PV power facility leading to the generation of fugitive dust and gaseous exhaust emissions (i.e., SO_x, NO_x, PM_{10}, VOCs and CO).	250 m either side of the transport route
	Operation	The use of roads by heavy and light vehicles for the transportation of workers, materials and equipment to the PV power facility site leading to the generation of fugitive dust and gaseous exhaust emissions (i.e., SO_x, NO_x, PM_{10}, VOCs and CO).	250 m either side of the transport route
Noise	Construction	The use of construction plant, equipment and machinery during clearing, levelling, grading, backfilling, and other earth moving activities at the PV power facility and new access roads leading to the generation of noise**.	500 m radius from source
		The use of piling rigs for the piling of foundations leading to the generation of noise.	500 m radius from source
		The use of diesel generators to supply power at the PV power facility leading to the generation of noise.	250 m radius from source
		The use of dry or unpaved haul roads by heavy and light vehicles for the transportation of workers, materials and equipment to the PV power facility leading to the generation of noise.	250 m either side of the transport route
	Operation	The use of roads used by heavy and light vehicles for the transportation of workers, materials and equipment to the PV power facility leading to the generation of noise.	250 m either side of the transport route
		Operation of the substation (associated facility) and PV power facility MV transformers and inverters generating noise.	500 m radius from source
Soil	Construction	Clearing, levelling, grading, backfilling, and other earth moving activities at the PV power facility and new access roads leading to the disturbance of soil.	Physical footprint of the PV power facility and new access roads
	Operation	Not applicable as there will be no interaction with soil during the operation phase.	Not applicable

Topic	Phase	Consideration	AOI
Groundwater	Construction	Localised dewatering may be required in areas with a high-water table during excavation to prevent unstable slopes. Dewatering may occur uninterrupted or intermittently depending on the flow rate of the groundwater in the area during early stages of construction.	Downstream users within 500 m of the site
	Operation	Not applicable as there will be no interaction with groundwater during the operation phase.	Not applicable
Surface water	Construction	Erosion and sedimentation may impact local surface water bodies within the project area.	Surface water bodies that cross the project area
	Operation	Not applicable as there will be no interaction with surface water during the operation phase.	Not applicable
Biodiversity	Construction	Vegetation clearance within the newly developed areas of the PV power facility and new access roads as a result of site preparation and earthworks leading to direct permanent loss of natural or modified habitats.	Physical footprint of the PV power facility and new access roads
		Installation of perimeter fencing around the PV power facility leading to permanent habitat fragmentation.	Physical footprint of the PV power facility
		Noise, vibration, and air emissions (from the activities outlined above) and the use of artificial perimeter lighting leading to reduced fitness of flora and fauna.	1 km radius from source
		Sedimentation in local surface water bodies leading to the Araz River may impact aquatic flora and fauna.	Surface water bodies crossing the project area that lead to the Araz River
	Operations	Continued use of perimeter fencing around the PV power facility leading to permanent habitat fragmentation.	Physical footprint of the PV power facility
		Glare from the PV panels leading to the reduced fitness of birds.	5 km radius around the PV power facility
		Noise, vibration, and air emissions (from the activities outlined above), the use of artificial perimeter lighting and shading from the PV panels leading to reduced fitness of flora and fauna.	1 km radius from source
		Sedimentation in local surface water bodies leading to the Araz River may impact aquatic flora and fauna following storm events.	Surface water bodies crossing the project area that lead to the Araz River

* Fugitive dust emissions arising from the construction phase are likely to be variable in nature and will depend upon the type and extent of the activity, soil type and moisture, road surface conditions and weather conditions. For example, periods of dry weather combined with higher-than-average wind speeds have the potential to generate more dust.

** The extent of the AOI depends on plant/equipment/vehicle numbers, hours of work and the ambient noise conditions.

5.1.2.2 *Social study area and AOI*

The study area for the socioeconomic baseline has been determined taking into consideration the IFC definition of a project's AOI[5]. It has been defined based on project aspects and the identification of potential socioeconomic and cultural heritage impact receptors. A primary and a secondary area of influence has been identified.

The primary AOI, which considers direct impacts from planned events covers a radius of approximately 10 km around the project site up to the Khojavend district boundary and the national boundary with Iran, plus a buffer of 2 km on either side of the road from the project site to Horadiz[6] as shown in Figure 5.1.

The secondary AOI includes Azerbaijan as a whole.

The study area should encompass the AOI but may be larger to help in understanding the context in which the social receptors covered in the AOI exist, including any trends and pressures on the condition of the receptor. The study area for the baseline therefore includes the entire country of Azerbaijan: information is provided at a national level to give context and to support the assessment of any regional/national impacts (often indirect).

5.1.2.3 *Tangible cultural heritage AOI*

The tangible cultural heritage (TCH) AOI for the construction phase includes all construction areas:

- the project areas
- access roads.

The area affected visually or by noise, dust and vibration beyond the physical footprint is also included in the AOI.

During the operational phase, the TCH AOI includes:

- the project areas.

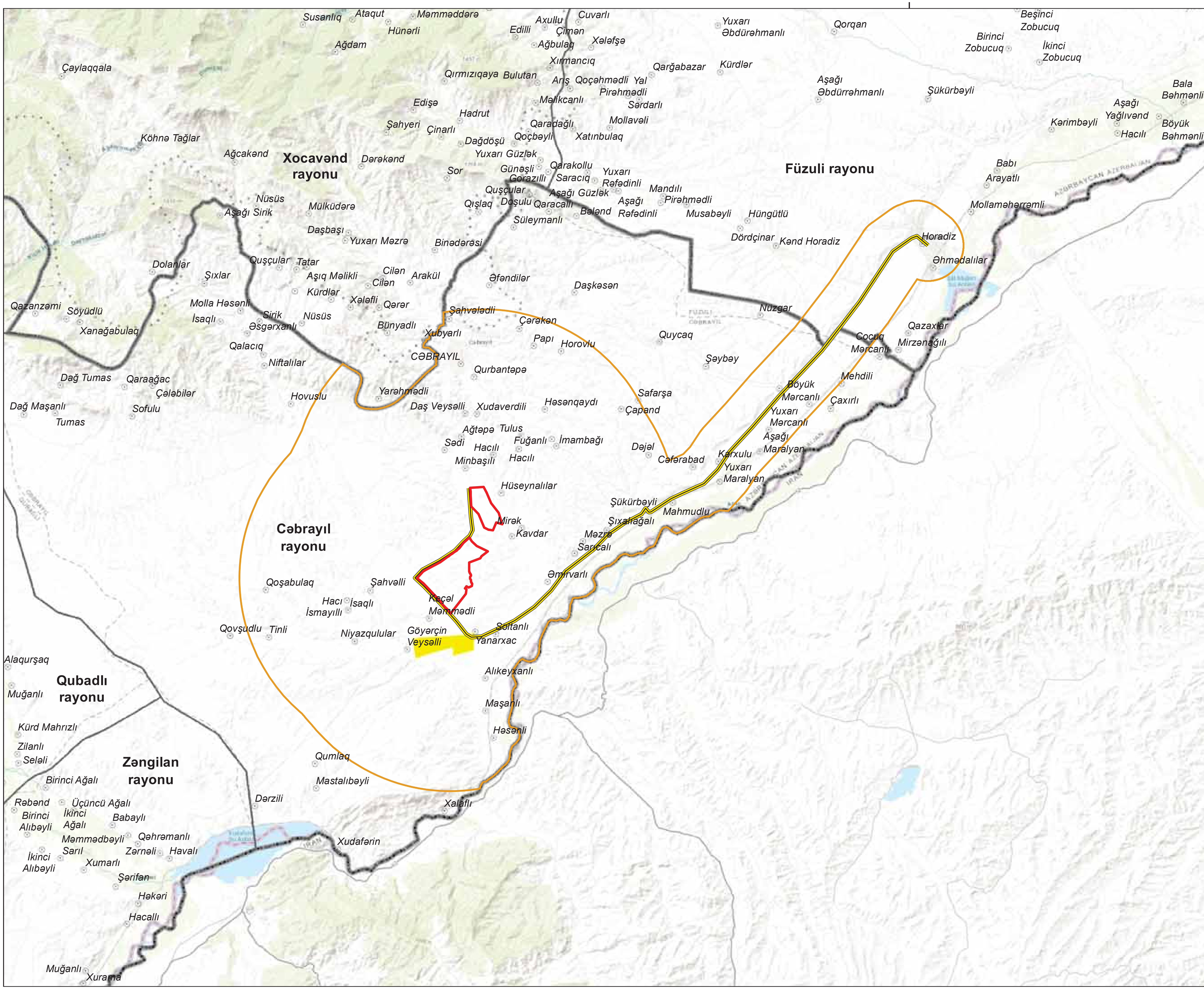
Visual and noise impact on receptors beyond the physical footprint is also included in the operation AOI.

The location of each site was categorised as:

- **inside** - the project footprint resulting in a direct physical impact
- **close** - within 100 m of the project footprint with associated potential noise, dust, vibration or visual impacts
- **outside** - over 100 m from the project footprint and not expected to be affected.

[5] Project area of influence defined in IFC Performance Standard 1.

[6] Horadiz is the closest settlement to the project site understood to have a civilian population.



Legend:

- Towns and settlements (unoccupied)
- Road to Horadiz
- Districts
- Economic Regions
- Project Area
- Social Study Area
- Araz Valley Economic Zone Industrial Park

Notes:
This map contains data from the following sources:
DATA SOURCE (DATE)

Coordinate System: Pulkovo 1942 GK Zone 8
Projection: Gauss Kruger
Datum: Pulkovo 1942
Units: Meter

Rev	Date	Description	Drn	Chk	App
01	01/02/2024	Final	USeid	RB	FG
00	12/02/2024	Draft A	USeid	RB	FG

Project Sunrise

RSK

Figure 5.1:

Primary social AOI

0 3 6
Kilometers

SCALE: 1:200,000 @ A3

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Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

5.2 Physical Environment Baseline

The physical environment baseline addresses the following topics:

- climate
- air quality
- noise
- landscape
- topography and geomorphology
- soils
- geology
- hydrogeology (including groundwater)
- surface water.

5.2.1 Sources of Data

Primary data collection for the physical baseline (e.g., air and noise baseline surveys) was scoped out of the project due to the nature of the environment and the project area being within the territories recently liberated following a three decades long occupation, meaning there are few receptors. Secondary data was therefore used to inform the physical baseline section including data collected for this project and from other studies where available.

Specialist desktop studies were conducted for geomorphology, geology, hydrogeology and geology (see Appendix 2) which have been used to inform the physical baseline. Additionally, secondary data from freely available online sources including previous ESIAs for similar projects, the Azerbaijan National Academy of Science, the World Bank and the United Nations Environment Programme were used to inform the physical baseline.

5.2.2 GHG Emissions

There is currently no existing infrastructure within the site boundary. The project will be developed within two selected sites (identified as the northern and southern clusters) located approximately 6 km south of Jabrayil City, northwest of the Araz River in the Jabrayil district. The project will be constructed on government owned land provided for the development of the project.

The northern cluster was previously cultivated with vineyards, with some grape vines still present on the site. The southern cluster was previously used for livestock grazing and other agricultural activities.

In line with the Institute of Environmental Management and Assessment’s Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance (2022), if a site currently has no development or significant activity, the baseline can be considered to have zero GHG emissions, to ensure a reasonable worst-case approach to establishing the net GHG effect.

No change is expected for the future baseline when compared to the current baseline. It is unlikely that under a future ‘business-as-usual’ scenario there would be any significant changes to the amount of GHG emissions from the site, either positive or negative.

5.2.3 Climate

Azerbaijan has a highly varied climate which includes nine of the world's eleven climate zones e.g., semi-arid, temperate, continental and tundra. The following sub-sections provide information on the temperature, precipitation, wind, humidity and solar irradiance in the Jabrayil region of Azerbaijan, where the proposed PV power facility will be located.

5.2.3.1 Temperature

In Jabrayil, the summers are hot, dry, and clear and the winters are very cold, snowy, and partly cloudy. As shown in Figure 5.2, over the course of the year, the temperature typically varies from -3°C to 32°C and is rarely below -7°C or above 36°C.

The hot season lasts for 3.5 months, from May to September, with an average daily high temperature above 26°C. The hottest month of the year is July, with an average high of 31°C and a low of 19°C.

The cold season lasts for 3.5 months, from November to March, with an average daily high temperature below 11°C. The coldest month of the year is January, with an average low of -3°C and a high of 5°C (CE Renewables, 2023; Weather Spark, 2023).

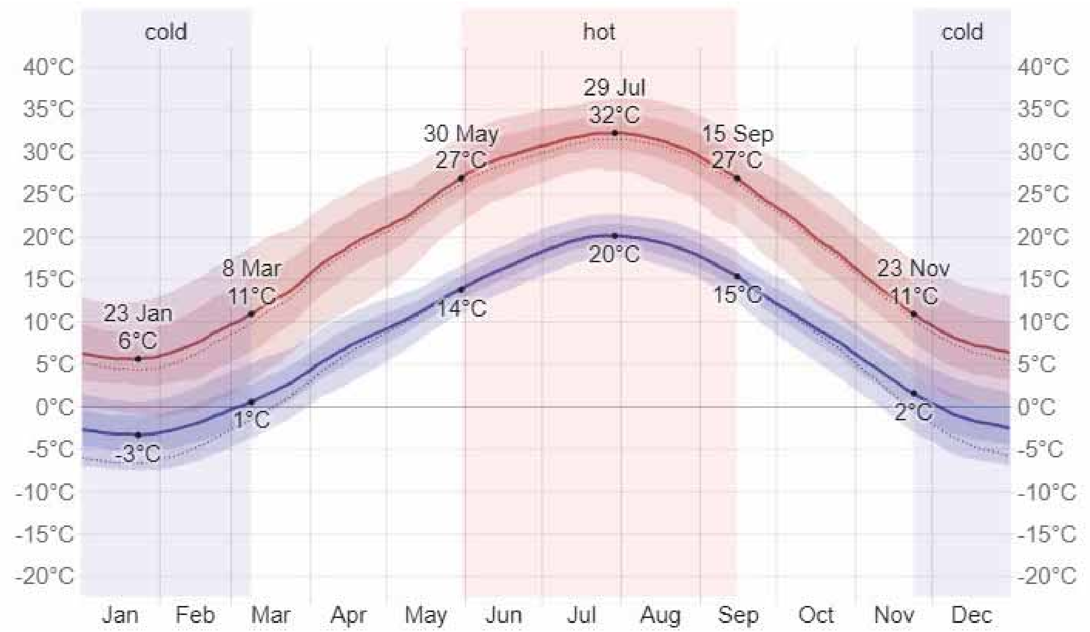

Figure 5.2: Jabrayil average temperature (high and low)

Source: Weather Spark (2023)

Figure 5.3 illustrates the daily mean temperature recorded at a weather station in the Jabrayil region between November 2021 and November 2023. During this period, the highest daily mean temperature was recorded at 30.3°C on 9 August 2023 and the lowest daily mean temperature was recorded at -1.1 °C on 18 January 2022. The data is provided in Appendix 2i.

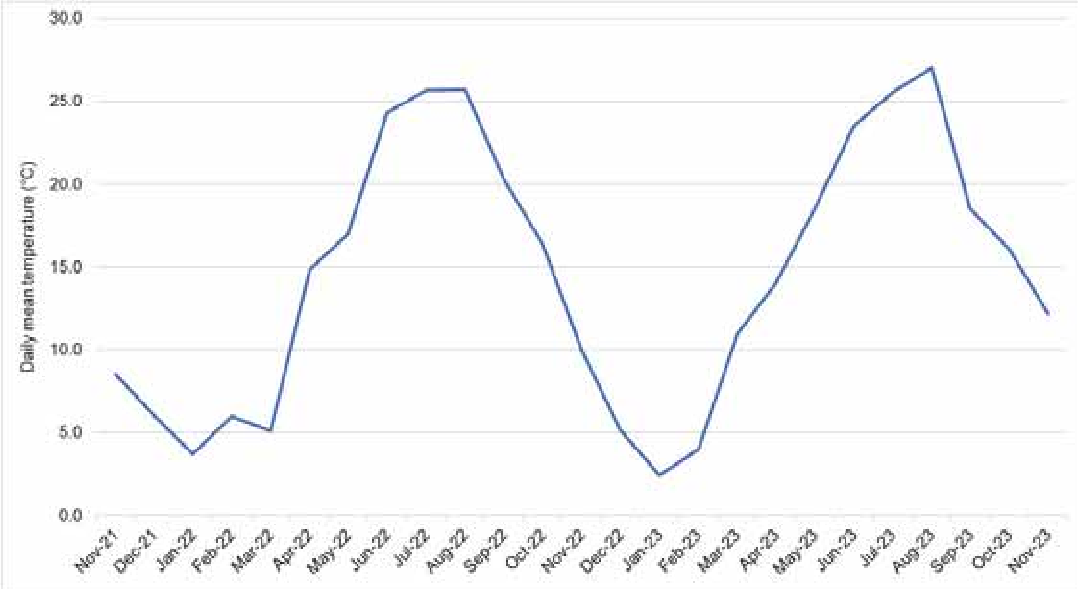

Figure 5.3: Daily mean temperature in Jabrayil region (2021-2023)

Source: National Hydrometeorological Service under the MENR of Azerbaijan Republic (2024)

5.2.3.2 *Precipitation*

Table 5.2 and Figure 5.4 present the average monthly rainfall in Jabrayil, which is calculated over a sliding 31-day period and shown centred around each day of the year. As shown in Figure 5.4, Jabrayil experiences some seasonal variability in monthly rainfall.

The wet season lasts 8.5 months, from September to June, with a greater than 10% chance of a given day being a wet day. The month with the most wet days is May, with an average of 4.3 days with at least 1.02 mm of precipitation. The month with the most rain in the project area is April, with an average rainfall of 17.78 mm. The dry season lasts 3.5 months, from June to September. The month with the fewest wet days in the project area is July, with an average of 1.0 days with at least 1.02 mm of precipitation. The month with the least rain is January, with an average rainfall of 2.54 mm (CE Renewables, 2023; Weather Spark, 2023).

Table 5.2: Jabrayil average monthly rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rain (mm)	2.5	4.2	10.4	18.8	18.8	10.6	6.1	6.1	14.5	17.5	15.7	5.3

Source: Weather Spark (2023)

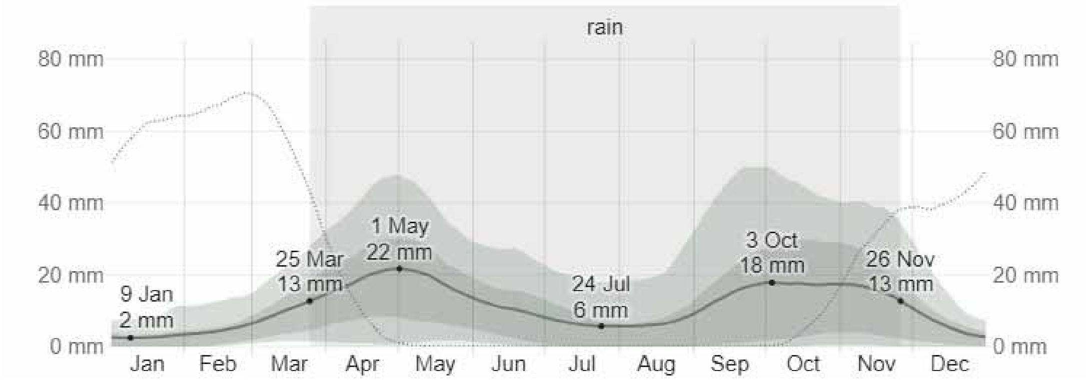

Figure 5.4: Jabrayil average monthly rainfall

Source: Weather Spark (2023)

In Azerbaijan the average annual amount of atmospheric precipitation is 700-1,400 mm at 2,700 metres above sea level (masl), more than 900 mm at 1,500-2,700 masl, and 500-800 mm at 1,000-2,000 masl. In the Araz (Jabrayil) plain, the average annual amount of atmospheric sediments is 285-595 mm (see Appendix 2c). Figure 5.5 illustrates the daily precipitation recorded at a weather station in the Jabrayil region between November 2021 and November 2023. During this period, the maximum daily precipitation was recorded at 21.6 mm on 19 March 2022. The data is provided in Appendix 2i.

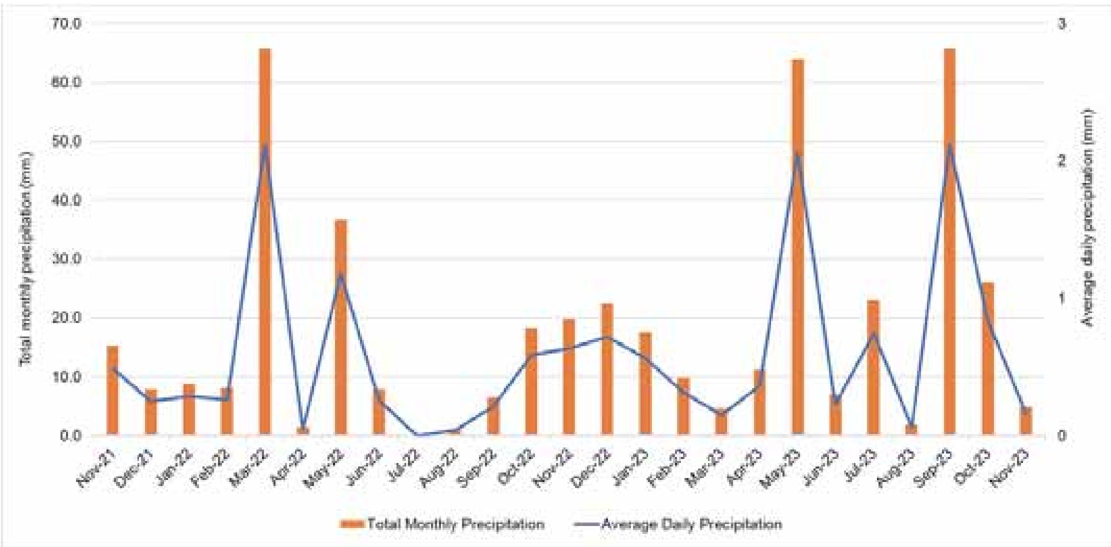

Figure 5.5: Daily amount of precipitation in Jabrayil region (2021-2023)

Source: National Hydrometeorological Service under the MENR of Azerbaijan Republic (2024)

5.2.3.3 *Hail*

The European Severe Weather Database (ESWD), managed by the European Severe Storms Laboratory, records information on important weather events that can endanger people or result in significant damage to property.

An isolated large hail event was recorded about 75 km north of the Project site in 2018 with increased incidences of large hail events recorded about 100 km north of the Project. Based on this data, the potential risk of large hail events appears to be lower than in the northern and central parts of the country (European Severe Storms Laboratory, 2023).

5.2.3.4 *Wind*

Modelled historical data indicates the wind is generally strongest between June and September and the windiest month of the year is July, with an average hourly wind speed of 11.5 kph (Weather Spark, 2023).

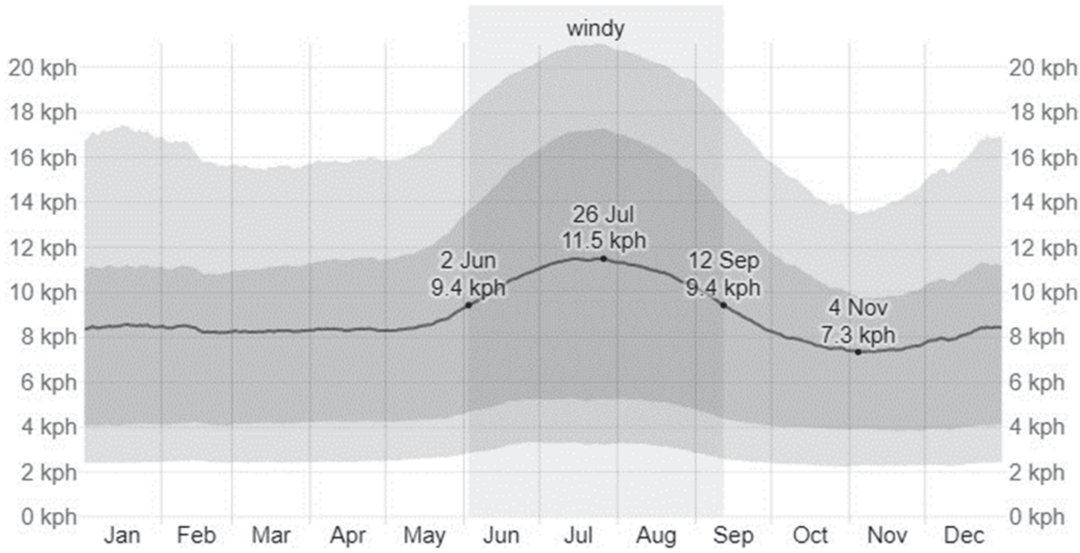

Figure 5.6: Average wind speed in Jabrayil (hourly wind vector at 10 m above ground)

Source: Weather Spark (2023)

Figure 5.7 illustrates the daily maximum wind speed and wind direction recorded at a weather station in the Jabrayil region between 2021 and 2023 respectively. During this period, the maximum wind speed was recorded at 20 m/s on 14 February 2022. The predominant daily wind directions were recorded to be northwesterly, northerly and westerly during this period. The data is provided in Appendix 2i.

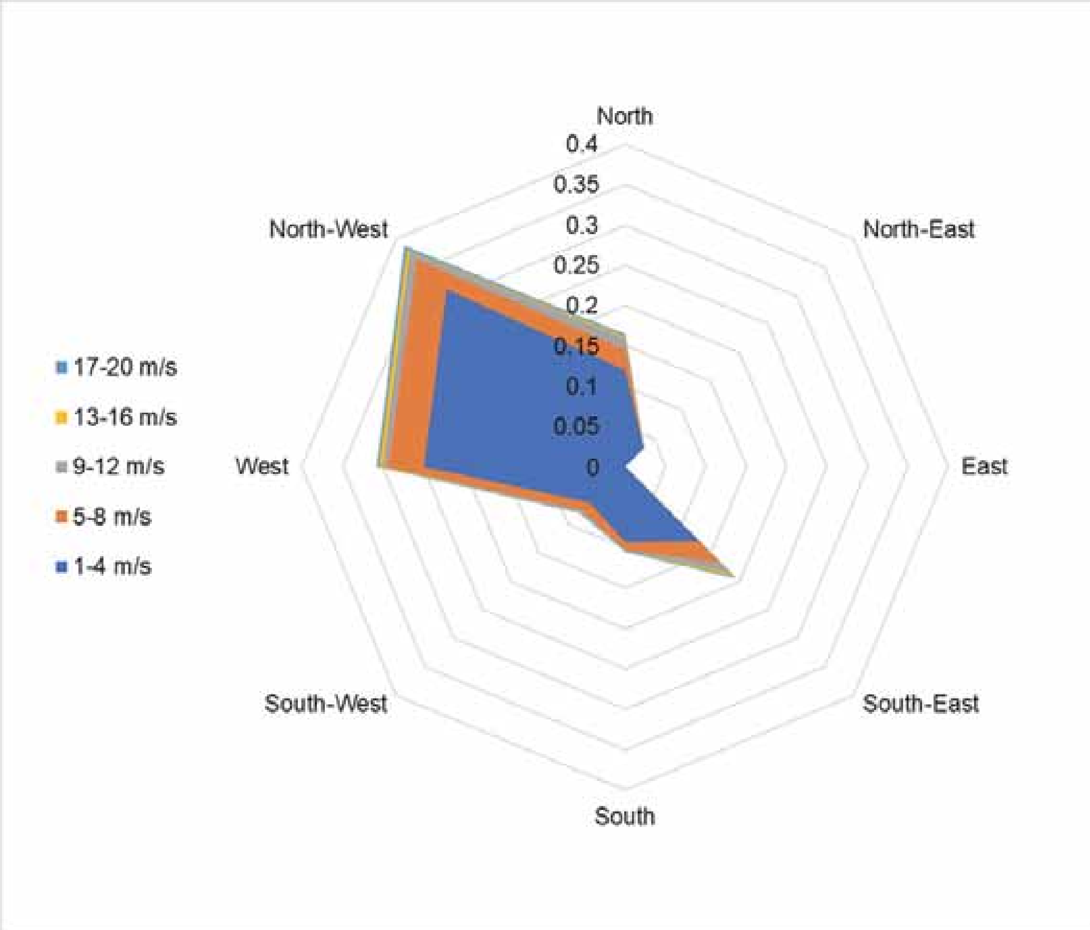

Figure 5.7: Wind speed and direction in the Jabrayil region (2021-2023)

Source: National Hydrometeorological Service under the MENR of Azerbaijan Republic (2024)

5.2.3.5 Humidity

There is limited air quality data for Azerbaijan, particularly for the Garabagh region where the project area is located. Therefore, the humidity comfort level[7] in Jabrayil has been used as a source of information for the baseline to inform the understanding of the seasonal variation in humidity in the project area (see Figure 5.8).

The humidity comfort level, calculated using dew point, in Jabrayil is primarily dry (blue in Figure 5.8) for the majority of the year. Between October and the beginning of June, muggy[8] conditions (orange in Figure 5.8) are not present. Comfortable or humid conditions are expected between April and November.

[7] Humidity comfort levels are calculated based on dew point, as it determines whether perspiration will evaporate from the skin, thereby cooling the body. Lower dew points feel drier and higher dew points feel more humid.

[8] Colloquially descriptive of warm and especially humid weather

Figure 5.8: Humidity comfort levels in Jabrayil (percentage of time spent at various humidity comfort levels, categorised by dew point)

Source: Weather Spark (2023)

5.2.3.6 Solar irradiance

Figure 5.9 presents the estimated direct normal irradiation (DNI) across Azerbaijan (World Bank Group, 2020a). The map represents the average daily and yearly sum of DNI covering the 20-year period of 1999-2018. As shown in Figure 5.9, the estimated annual DNI in Azerbaijan ranges between 900 and 1,800 kWh/m^2 and is approximately 1,450 kWh/m^2 within the project area.

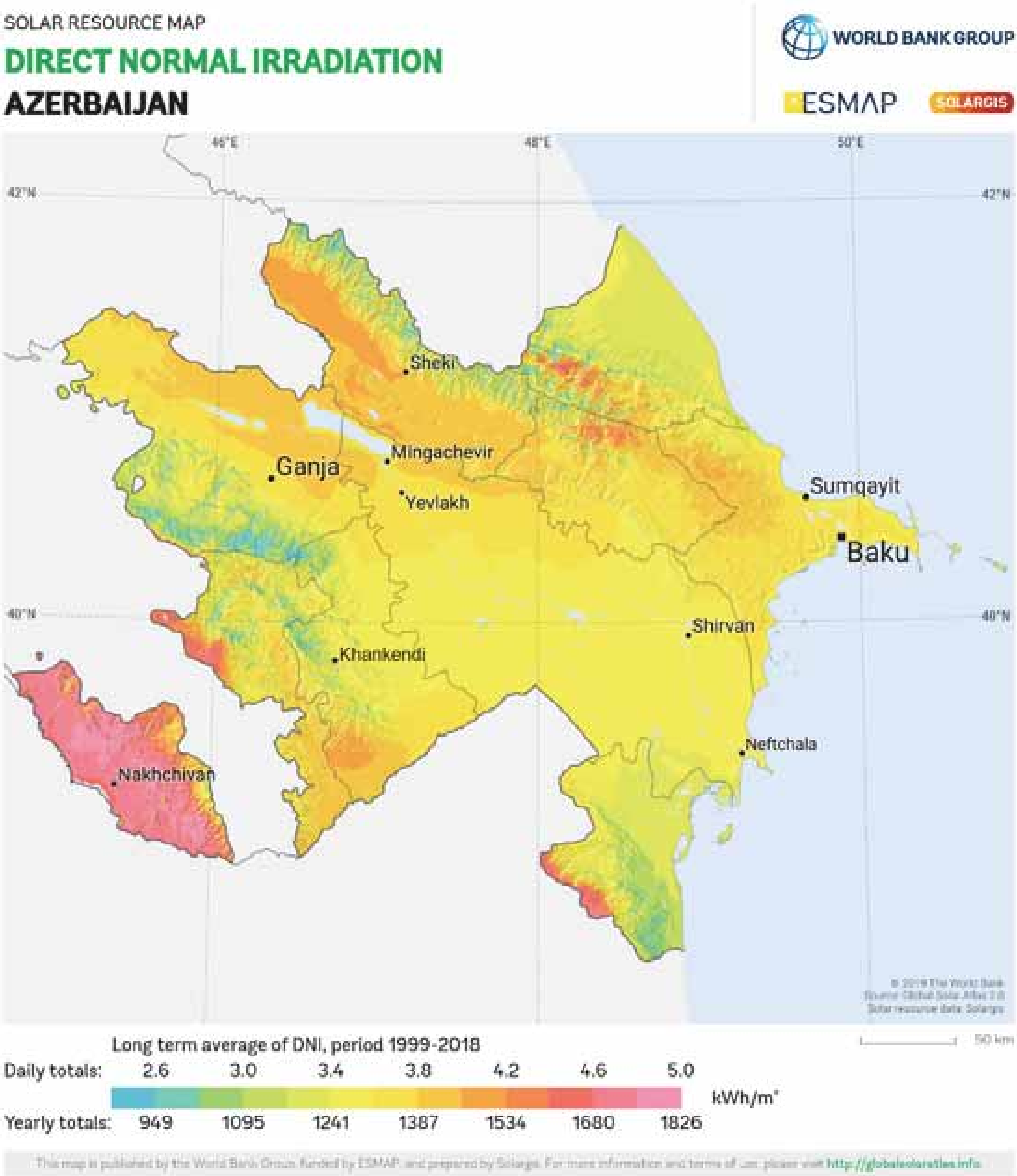

Figure 5.9: Map showing estimated direct normal irradiation in Azerbaijan (kWh/m^2)

Source: World Bank Group (2020)

5.2.4 Air Quality

The project area is within a rural, non-developed area with limited receptors to air quality. It is assumed that pollutant levels would be typical for this environment. Furthermore, the impacts to air quality from the project are only expected during the construction phase. There is limited air quality data for Azerbaijan, particularly for the Garabagh region where the project area is located. Therefore, national-level data has been used to inform the air quality baseline for the project.

The Norwegian Meteorological Institute (2011) reviewed emissions of nitrogen oxides (NO_x), sulphur oxides (SO_x), ammonia (NH_3), carbon monoxide (CO), ground level ozone and PM in Azerbaijan for the 2000–2009 period (see Table 5.3). This data was in turn derived from data submitted to the United Nations Economic Commission for Europe Convention on Long-range Transboundary Air Pollution (UNECE CLRTAP) in May 2011.

Table 5.3: Emissions from Azerbaijan (in Gg (Gigagrams, equal to 1,000,000 grams))

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
SO_x	162	154	146	138	130	129	105	99	91	85
NO_x	104	91	100	80	118	97	81	80	91	91
NH_3	37	36	35	41	48	48	50	53	53	53
CO	306	419	422	361	463	361	401	447	496	530
$PM_{2.5}$	6	6	5	5	5	5	4	4	4	4
PM_{10}	7	6	6	6	5	5	5	4	4	4

Source: Norwegian Meteorological Institute (2011)

The data above indicates that, within Azerbaijan as a whole, there has been an overall decrease in SO_x, $PM_{2.5}$ and PM_{10} emissions and an increase in NH3 and CO emissions between 2000 and 2009, while NOx emissions have remained relatively constant. While this data is not specific to the Sunrise solar project site, it can provide an indication of emission levels and likely trends.

More recently, data from the World Bank (2021) indicates that in Azerbaijan, $PM_{2.5}$ air pollution, as mean annual exposure (micrograms/m^3), has been increasing since 2016 (data up until 2019) following a decline from 2012, see Figure 5.10 below.

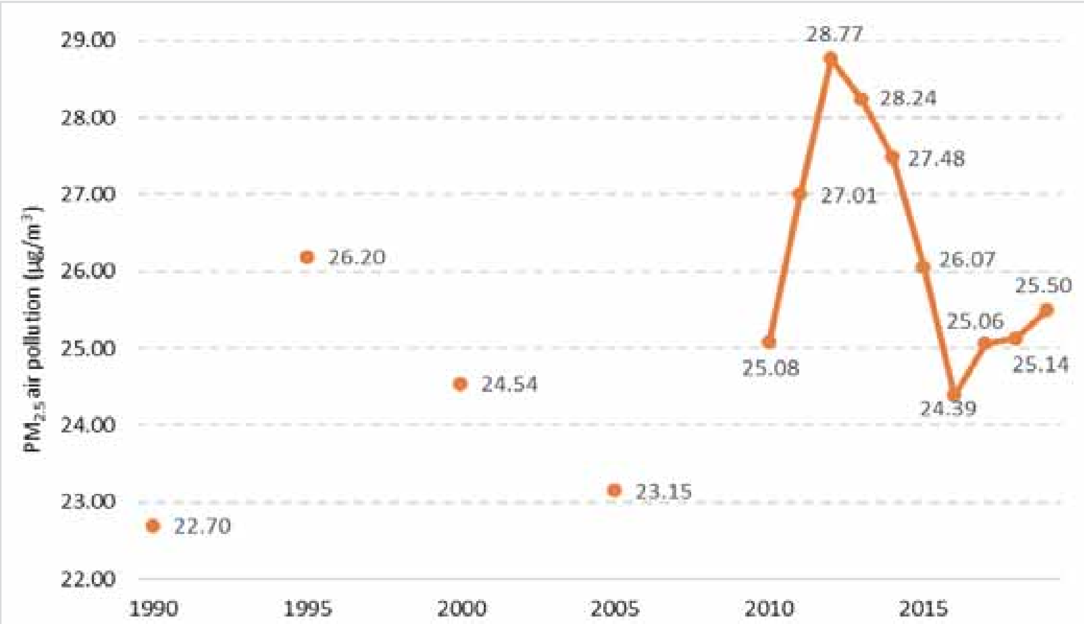

Figure 5.10: $PM_{2.5}$ air pollution, mean annual exposure (micrograms/m^3) – Azerbaijan

Source: Reproduced using data from the World Bank Group website (2021)

The project area is within a rural, non-developed area with limited receptors to air quality. It is assumed that pollutant levels would be typical for this environment.

5.2.5 Noise

There is limited noise data for Azerbaijan and no noise data has been identified for the Garabagh region where the project area is located. The project area is within a rural, non-developed area with limited noise receptors. The background noise levels are therefore assumed to be typical for rural areas, with the main noise sources expected to be wind, wildlife, and possibly traffic and/or noise from the quarry.

5.2.6 Traffic and Transport

The project area benefits from existing highway links, connecting the Garabagh region to the project area. Review of on-site video footage and photographic copies indicates that HGV and light goods vehicle (LGV) traffic currently utilise the highway network in this location.

The project area is limited in its existing traffic data sources, however strategic routes including interconnecting links to the north and east of the proposed site boundaries are present.

The existing network is generally hard-standing/gravel surfaces which appear suitable for HGV use during construction.

5.2.7 Landscape

The project area is located within a zone of subtropical semi-arid plain, in a remote rural and non-developed setting. The local geomorphology is characterised by a sloping plain (southwest Araz plain) and low mountains in the north (southeastern foothills of the Garabagh range). The northern cluster is located on the Chaylag river plain, with its western boundary adjacent to the rural road between Minbashili and Shahvelli. The southern cluster is located on a sloping terrain characterised by hills and a low mountain massif. Both sites are relatively open. Further information on the geomorphology of the area is available in Section 5.2.8.

Significant human modifications to the landscape related to previous military activities can be observed in the project site and surrounding region, these are due to decades occupation of the region by Armenia. The project site has recently undergone demining by ANAMA. The site was previously used for agricultural activities (vineyards and pasture). Both sites are currently unoccupied and devoid of infrastructure apart from unpaved tracks crossing the sites.

Figure 5.11 shows the vantage points at which photographs were taken around the northern and southern clusters. The oriented VP photographs have been included in Appendix 2h.

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01	01/02/2024	Final	BC	FG	KC
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Project Sunrise

Figure 5.11:

Vantage points around the project area

0 600 1,200

Meters

SCALE: 1:37,000 @ A3

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Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

5.2.8 Topography and Geomorphology

The surface is mainly a sloping plain (Injegol, Gayan steppe) with low mountains in the north (southeastern foothills of the Garabagh range) and a subtropical semi-arid plain. Figure 5.12 and Figure 5.13 present sketch plans of the southern and northern clusters respectively. The site is located at an elevation of between 285 and 370 masl.

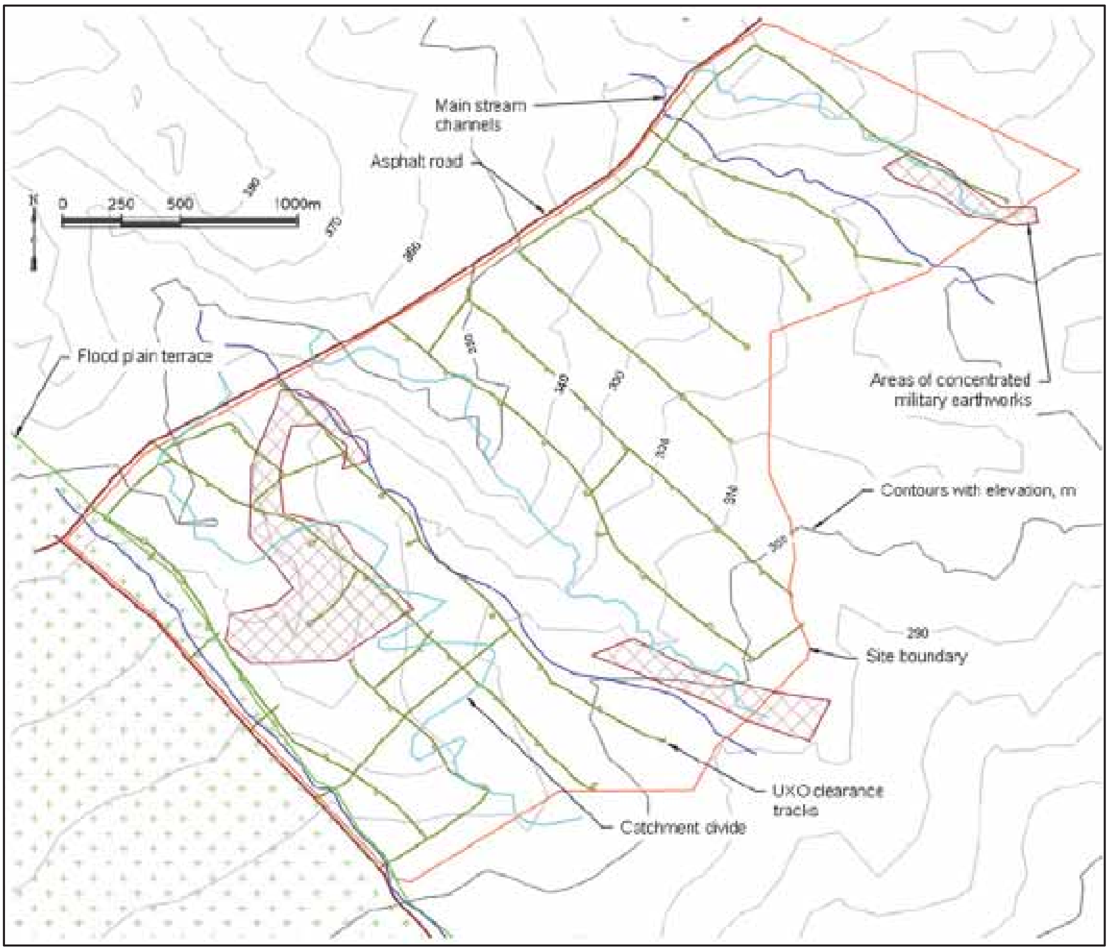


Figure 5.12: Sketch plan of the southern cluster with elevations (masl)

Source: CQA (2023)

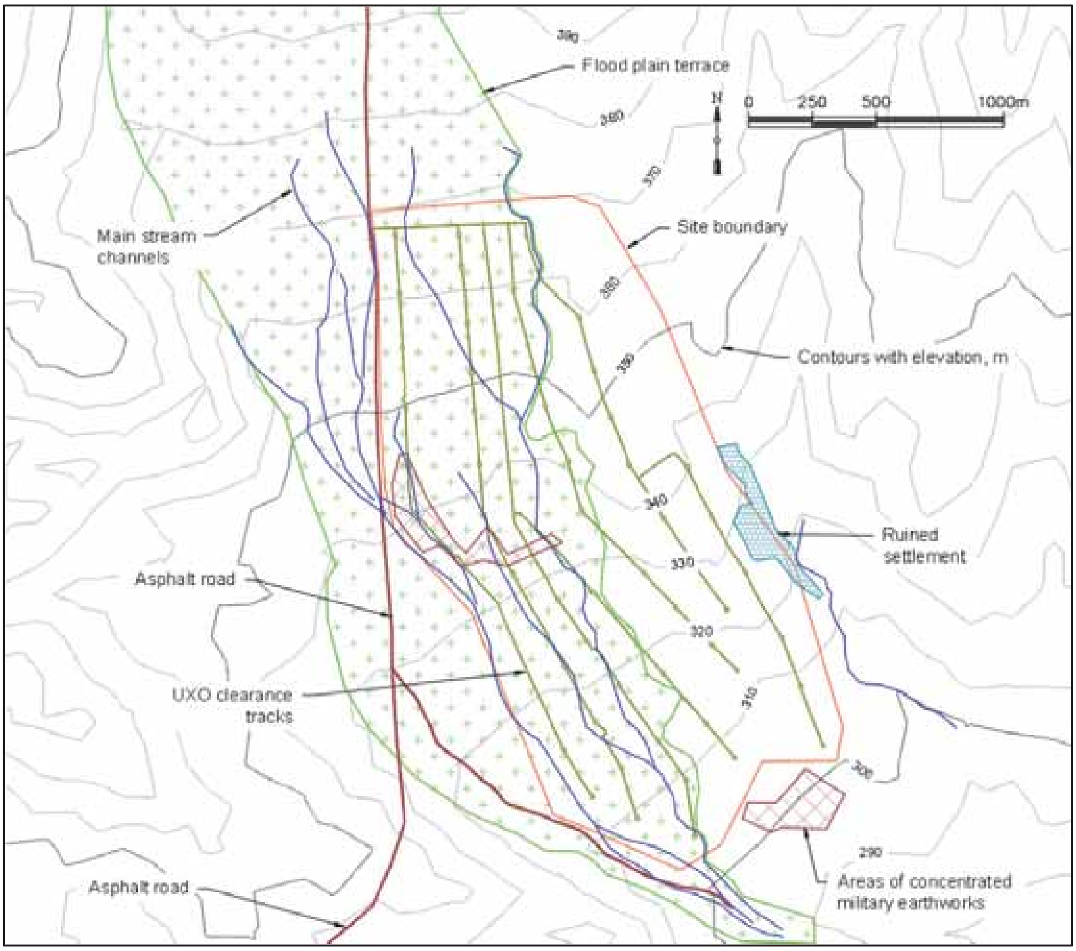


Figure 5.13: Sketch plan of the northern cluster with elevations (masl)

Source: CQA (2023)

A network of streams and rivers has developed extensively in the region since the Holocene. In the west, the surface of the plain rises to an elevation of 400 masl. The valleys stretch in the south-eastern direction towards the Araz River. The north-western part of the plain is covered with proluvial-diluvial sediments formed as a result of the erosion of the rocks that formed the branches separated from the Garabagh range. In the south-eastern part, the surface of the plain reaches the 80-100 masl terrace of the Araz River and descends 60 m into the valley of the Araz River (see Appendix 2a).

The project site is located in a lowland basin, which is an extension of the central Azerbaijan lowlands (and Kur river valley). This basin cuts across the main axis of the Lesser Caucasus Mountain chain and extends from Bahramtepe in a south westerly direction. The lowlands extend southwards to the Alburz Mountains, which rise within a few kilometres of the Iranian border, and northwards to the Lesser Caucasus Mountains, which rise around 20 km from the site (CQA, 2023).

5.2.9 Soils

The soil of Azerbaijan is represented by all major soil types and is distributed by horizontal and vertical zonation (Aliyev, 2018). The Government of Azerbaijan estimates that approximately 42% of the country's land is negatively impacted by soil erosion and approximately 7% of the land area is affected by salinisation, which, in addition to further issues such as swamping and chemical pollution, contribute to low agricultural productivity (World Bank Group and Asian Development Bank, 2021).

There are five main soil types in the project area, as shown in Figure 5.14. These are consolidated mountain grey-brown soil, mountain light grey-brown, undeveloped mountain grey-brown, colluvial sand sediments of the slopes and fine riverbed sediments. Soil forming rocks in the Jabrayil region consist of andesite, andesite-basalt, eroded alluvial, diluvial of the main rocks and loess-like alluvial, and sandy, gravelly and clay sediments (Mammadova et al., 2023).

Soil erosion is a prominent issue in Azerbaijan, particularly in the Araz River floodplain, and in the Jabrayil region where surface and ravine erosion are caused by water, wind and the reduction of vegetation cover (Mammadova et al., 2023; United Nations Environment Programme, 2022).

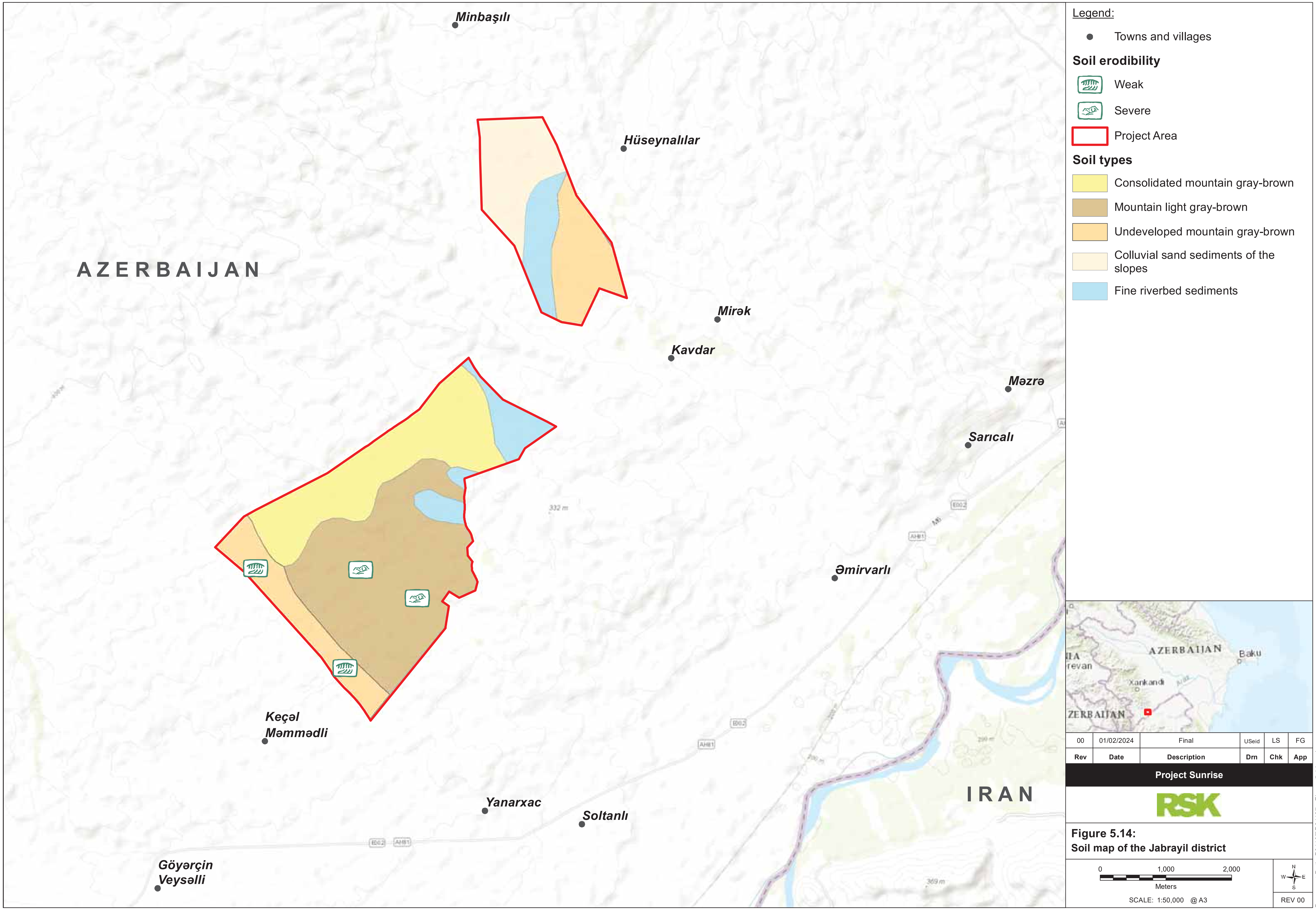


Figure 5.14:
Soil map of the Jabrayil district

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Mountain gray-brown (chestnut) soils are spread over large areas (200-400 m) in the dry steppe foothills and low mountain areas of the Lesser Caucasus and Garabagh; these soils are formed on hard limestones, limestone conglomerates, marls or diluvium of pebbly-clay carbonates in mid-mountain zones (see Appendix 2b). Trial pit logs from a geotechnical investigation conducted by AT-Geotech (2023) for the project show that the depth of topsoil (organic and humus layers) ranges from 0-0.3 m with some trial pits showing no topsoil. Interspersed layers of clay, sand, silt, and gravel are evident below the topsoil, often extending to the bottom of the trial pit at 3 m. The soil types across the project site are undeveloped mountain gray-brown (chestnut), consolidated mountain gray-brown (chestnut), mountain gray-brown (chestnut) and colluvial sand sediments of the slopes and riverbed sediments.

5.2.9.1 Soil contamination

As identified during the Scoping phase, soil sampling was carried out to identify any pre-existing pesticide contamination was conducted within the project areas in October 2023 by CQA International. Ten soil samples (eight in the northern cluster and two in the southern cluster) were collected adjacent to the trial pits excavated for the previous geotechnical survey. Sample locations were concentrated within the northern cluster to provide representative samples across the area, which was previously used for intensive agricultural purposes (i.e., crop cultivation and orchards/vineyards) and therefore potentially contaminated.

The soil sample was taken at approximately 10 cm depth, from the topsoil layer, after a thin layer of surface material was removed. Once collected, the samples were delivered to an accredited laboratory (Azecolab, Baku) and analysed with liquid-liquid extraction, gas chromatography electron capture detector (LLE-GC-ECD). The results for all samples show very low levels of pesticide contamination for the analytes selected, when compared to the values for permissible concentrations for direct contact provided by the Food and Agriculture Organisation of the United Nations (FAO, 2000) as shown in Table 5.4.

Table 5.4: Soil contamination survey results

Parameter	Unit	Sample number (trial pit (TP))										FAO
		19A	11A	14A	17A	3A	24A	32A	30A	12	24	Permissible Concentration for direct contact (soil)
Aldrin	µg/kg dm	<0.1	<0.1	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	50,000
Alpha-BHC	µg/kg dm	01.3	<0.12	<0.12	<0.12	0.2	0.19	0.17	0.62	0.15	0.17	4,000,000
Beta-BHC	µg/kg dm	0.9	1.01	0.78	0.59	0.9	0.46	1	0.75	0.63	<0.35	4,000,000
Delta-BHC	µg/kg dm	0.14	0.21	0.29	0.28	0.32	0.21	0.17	0.22	0.24	0.22	4,000,000
Gamma-BHC (Lindane)	µg/kg dm	2.11	1.26	2.47	2.38	1.98	1.38	1.95	1.23	4.76	1.28	4,000,000
4,4'-DDD	µg/kg dm	0.21	0.19	0.2	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	<0.12	10,000,000
4,4'-DDE	µg/kg dm	0.26	0.23	0.19	0.29	<0.12	0.35	<0.12	0.76	1.09	0.64	10,000,000
4,4'-DDT	µg/kg dm	<0.91	<0.91	<0.91	<0.91	<0.91	<0.91	<0.91	<0.91	<0.91	<0.91	10,000,000
Dieldrin	µg/kg dm	0.12	0.17	0.17	0.07	0.08	0.14	<0.06	<0.06	<0.06	<0.06	50,000
Endosulfan I (Alpha)	µg/kg dm	0.2	0.14	0.17	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	<0.13	3,000,000
Endosulfan II (Beta)	µg/kg dm	0.22	0.16	0.31	<0.09	0.1	0.13	<0.09	<0.09	<0.09	<0.09	3,000,000
Endosulfan Sulfate	µg/kg dm	0.19	<0.06	<0.06	<0.06	<0.06	0.07	<0.06	<0.06	0.18	<0.06	3,000,000
Endrin	µg/kg dm	1.33	1.44	1.01	0.6	0.77	0.86	0.27	0.21	0.35	0.21	100,000
Endrin Aldehyde	µg/kg dm	<0.09	<0.09	0.13	<0.09	0.2	<0.09	<0.09	<0.09	<0.09	<0.09	100,000
Heptachlor	µg/kg dm	1.07	1.02	1.04	0.83	2.86	0.68	0.54	1.11	0.46	0.41	50,000
Heptachlor Epoxide Isomer B	µg/kg dm	0.22	0.22	0.18	<0.15	0.33	<0.15	<0.15	<0.15	0.21	<0.15	50,000

5.2.10 Geology

Located between the Black Sea to the west and the Caspian Sea to the east, the Caucasus region links Asia with Europe. The region is geographically subdivided into the North Caucasus (i.e., the area north of the Greater Caucasus), and the South Caucasus (i.e., the area south of the Greater Caucasus). The Caucasus region is a part of an ongoing continent-continent collision of the Arabian and Eurasian plates.

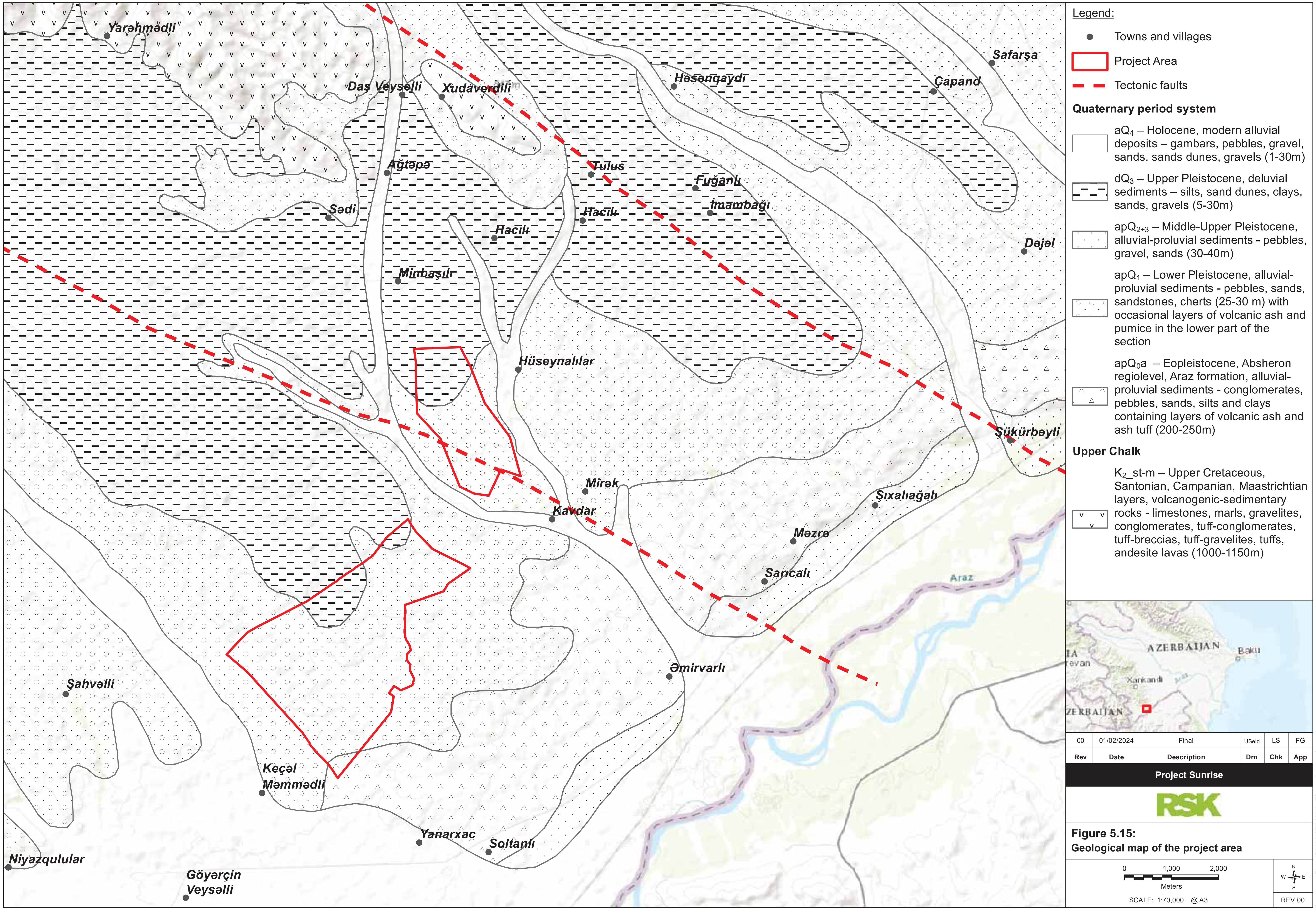
The project area is located within the southeastern part of the Atrvin-Garabakh megazone (Lower Araz structural zone), which covers the centre of the Lesser Caucasus mountain range and the northeastern and southeastern slopes in Azerbaijan (Alizadeh et al., 2016).

The bedrock in the region comprises the range of lithologies which are indicative of accretionary arcs on destructive continental margins: volcanic intrusions and lavas, igneous plutons, oceanic sediments and some ophiolites (i.e., fragments of oceanic crust) (Middle Jurassic age to Cretaceous, Paleogene and Neogene)). On site, the bedrock is buried beneath relatively young sedimentary deposits and is not exposed within 20 km of the site.

The structural geology of the site area has two major geological lineaments. The straight line of the Araz valley, running NE-SW, is a major geological boundary, separating the older accretionary arc of the Alburz Mountains from the younger arc of the Lesser Caucasus. In addition, the Lachyn-Bashlybel fault can be traced from the town of Jabrayil to Bashlybel village; westward, it plunges under the levelling Middle Eocene sedimentary–volcanogenic mass of the Kalbajar trough (Alizadeh et al., 2016). The southern end of the Lesser Caucasus Mountains is offset by approximately 40 km along this feature (CQA, 2023). See Appendix 2c for additional baseline information on geology.

5.2.10.1 Surface Geology

As presented in Figure 5.15 below, the geological strata on the southern site are Pleistocene alluvial deposits, laid down by braided rivers and detrital fans from erosion of the Lesser Caucasus during the recent ice ages. The predominant lithology is silty clay, with some thin beds of gravel. Strata on the northern cluster are mostly Holocene alluvial deposits, largely comprising gravel with subordinate silts and clay layers. The global climate at this time was cooler and drier and is referred to as the recent Ice Age. The climate became temporarily warmer on several occasions, leading to periods of melting ice sheets and glaciers. The resulting large, energetic, rivers deposited large extents of alluvium during these periods.



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00	01/02/2024	Final	USeid	LS	FG

Project Sunrise

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Figure 5.15:
Geological map of the project area

REV 00

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

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5.2.10.2 Geohazards

Seismic activity is mainly observed in the northern part of the Garabagh region. An earthquake of magnitude 7 in 1868 is reported to have occurred. Several earthquakes were observed between 1900 and 1960 with magnitudes ranging between 5 and 7. The last relatively powerful earthquake occurred in Zangezur in 1968 and was felt in the region with a magnitude of 6. The earthquake hazard within the Jabrayil region is classified as medium according to currently available information (Global Facility for Disaster Reduction and Recovery, 2020). This means that there is a 10% chance of a potentially damaging earthquake occurring within Jabrayil in the next 50 years.

The two geological lineaments described above define the extension of the lowlands in the site area. These two lineaments appear to be relatively inactive structures at present and do not appear to be associated with significant seismic events. The incidence of major earthquakes is currently greatest in the thrust zones of the Greater Caucasus Mountains, to the north, and in the Zagros mountains, to the south. However, the entire area is still seismically active.

No information or data on landslides and sinkholes for the project area are available.

5.2.10.3 Mines and quarries

A sand and gravel quarry is located approximately 3 km to the east of the project site. No mining activities occur within the boundaries of the project site.

5.2.11 Hydrogeology

Based on the above geological data, it is likely that the shallow aquifers in the project areas comprise alluvial deposits such as gravel, silt and clay.

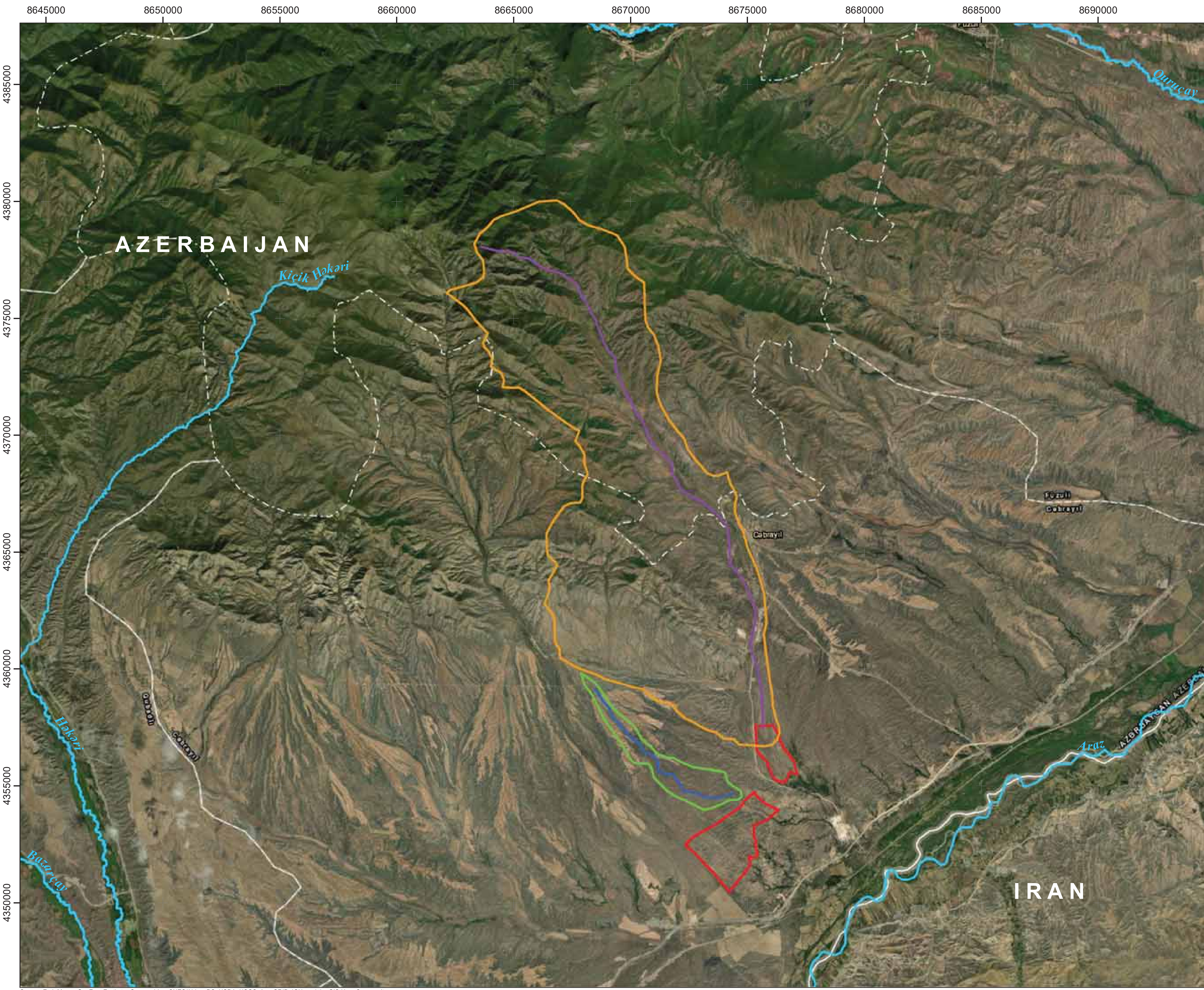
There are no groundwater monitoring wells or abstraction boreholes within the project areas. It is understood from the hydrogeology baseline report (Appendix 2d) that in general, groundwater is of potable quality in the area around the project sites (see Appendix 2d).

The geotechnical site investigation (CQA, 2023) stated that no groundwater was encountered in any of the trial pits at depths of up to 3 m. The resistivity data indicated that groundwater was not present at depths down to approximately 16 m.

5.2.12 Surface Water

The site is located in a lowland basin, which is an extension of the central Azerbaijan lowlands (and Kur River valley). This basin cuts across the main axis of the Lesser Caucasus Mountain chain.

Two major rivers drain the southern slopes of the Lesser Caucasus, and both flow through these lowlands: the Araz (defining the Iranian border) and the Bazarchay (which joins the Araz upstream from the site). The site is located in the catchment of the left bank tributary of the Araz. The catchments of small streams that flow through the site areas are shown in Figure 5.16 (CE Renewables, 2023).



Legend:

- Major rivers
- Ephemeral river
- Ephemeral river catchment
- Large stream channel
- Large stream channel catchment
- Project Area

Notes:
This map contains data from the following sources:
DATA SOURCE (DATE)

Coordinate System: Pulkovo 1942 GK Zone 8
Projection: Gauss Kruger
Datum: Pulkovo 1942
Units: Meter

Rev	Date	Description	Drn	Chk	App
01	01/02/2024	Final	USeid	LS	FG
00	05/11/2023	Draft A	USeid	LS	FG

Project Sunrise

RSK

Figure 5.16:
Main water catchments affecting the project site

0 2,500 5,000
Meters
SCALE: 1:150,000 @ A3

N W E S

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Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Two main valleys are present within the site (and extending outside the site), which trend from northwest to southeast. The channels and ridges of the many smaller tributary valleys are approximately perpendicular, producing a “trellis” effect in the landform. The two main valleys contain stream channels and localised alluvial deposits of sand and gravel, although most do not contain eroded channels.

The largest stream channel that flows onto the southern area of the site has a catchment area of 850 ha (stream shown in blue and catchment outlined in green in Figure 5.16) and a main channel length of approximately 12 km. Most of the northern area lies in the flood plain terrace of a small ephemeral river that flows southwards from the foothills of the Lesser Caucasus and through Jabrayil City to join the Araz River as a left bank tributary. The area of the catchment above the site is 14,600 ha (ephemeral river shown in purple and catchment outlined in orange in Figure 5.16), with a main channel length exceeding 26 km. The channel is wide and braided until several kilometres beyond Jabrayil City becoming a more defined channel in a narrower valley into the hills (CE Renewables, 2023).

The river channels are shallow, with rounded gravel beds, suggesting that water can flow occasionally. Only the larger stream channels appear to host ephemeral streams from time to time. Infiltration into the ground seems to be the dominant response to normal levels of rainfall, with run-off being very low. In most cases this is likely to increase the water content of the soil, reducing the soil moisture deficit, rather than representing a significant recharge of groundwater. Short-lived flash-flooding of the small stream valleys may occur very rarely, after particularly heavy rainfall. More commonly, the lower-elevation land may become soft and boggy in wet periods (CE Renewables, 2023).

5.3 Biological Baseline

The baseline conditions of the biological environment have been determined using a combination of desk-based assessments and field survey data. Literature review, field surveys and data collections were conducted for flora and fauna by local subject matter experts. Two survey efforts were undertaken as part of this baseline assessment, one in May 2023 and a second seasonal survey in October 2023.

In addition, a Critical Habitat (CH) screening study was completed by RSK which identifies potential features of biodiversity importance which may occur or exist within the wider project area. Data for this exercise were acquired from the Integrated Biodiversity Assessment Tool (IBAT) which draws from the International Union for Conservation of Nature (IUCN), BirdLife International and other leading conservation authority databases.

5.3.1 Ecological Context and Protected Areas

5.3.1.1 Ecology

The proposed Project Sunrise site lies in the Azerbaijan shrub desert and steppe ecoregion. This ecoregion comprises 64,090 km^2 (UNEP-WCMC, 2023) of semi-arid lowlands, bound on the northern and western edges by the Caucasus and Lesser Caucasus mountain ranges respectively, with the Caspian Sea to the east. The wider ecoregion hosts primarily shrub deserts, steppe, open woodlands, riparian forests in river floodplains, and wetland plant communities. The project site itself is on the southern edge of this ecoregion, which generally comprises grassy steppe habitats with remnant patches of oak forest, although no such patches exist within the site itself.

The wider ecoregion hosts fragmented populations of charismatic megafauna such as Striped Hyena (*Hyaena hyaena*), Goitered Gazelle (*Gazella subgutturosa*), Eurasian Lynx (*Lynx lynx*), Wild Boar (*Sus scrofa*), Brown Bear (*Ursus arctos*), Grey Wolf (*Canis lupus*), Caucasian Badger (*Meles canescens*)[9] and European Wildcat (*Felis silvestris*). In general, this ecoregion exhibits high levels of biodiversity and endemism and currently falls behind its protected area goal of 16% of the terrestrial area (UNEP-WCMC, 2023).

A detailed literature review of fauna records for the project area was conducted (Ibrahimov & Mustafayev, 2023), highlighting the presence of 106 species of animals, including 2 amphibians, 23 reptiles, 54 birds and 27 mammals which have been historically recorded in the area. Of these, a total of 12 species, including: 1 species of reptile, 8 birds and 3 mammals, were included in the Third Edition of the Red Book of the Republic of Azerbaijan (nəşr, 2023). The Red Book listed species are detailed in Table 5.5 below, highlighting the potential presence of sensitive species which may not have necessarily been captures during the survey activities.

Table 5.5: Red Book species historically recorded in the project area (nəşr, 2023)

Taxa	Species Name	Common Name	IUCN[10]
Reptilia	*Testudo graeca*	Spur-thighed Tortoise (also known as Common Tortoise)	VU
Aves	*Haliaeetus albicilla*	White-tailed Sea-eagle	LC
	Aquila heliaca	Eastern Imperial Eagle	VU
	Gypaetus barbatus	Bearded Vulture	NT
	Neophron percnopterus	Egyptian Vulture	EN
	Gyps fulvus	Griffon Vulture	LC
	Francolinus francolinus	Black Francolin	LC
	Perdix perdix	Grey Partridge	LC
	Tetrax tetrax	Little Bustard	NT

[9] Note that IUCN refer to Caucasian badger (*Meles canescens*) as a subspecies of Eurasian Badger (*Meles meles canescens*) while other sources elevate the Caucasian badger to its own species level. For the purposes of this assessment, Caucasian Badger (*Meles canescens*) is treated as a separate species.

[10] IUCN Red List categories for species include: EX = Extinct, EW = Extinct in the Wild, CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near-threatened, LC = Least Concern, DD = Data deficient and NE = Not evaluated.

Taxa	Species Name	Common Name	IUCN[10]
Mammalia	*Barbastelle capsica*	Eastern Barbastelle	VU[11]
	Lutra lutra	Eurasian Otter	VU[12]
	Rhinolophus hipposideros	Lesser Horseshoe Bat	LC
	Rhinolophus mehelyi	Mehely's Horseshoe Bat	VU
	Vormela peregusna	Marbled Polecat	VU

In addition, the nearby Araz River is expected to host as many as 31 species of fish, 1 amphibian, 3 reptiles and 27 species of waterfowl. Of these, 2 species of fish are also included in the Red Book of the Republic of Azerbaijan (nəşr, 2023) (see Table 5.6). It is noted that the project site does not directly abut or impact the Araz River, however there is a limited potential for unplanned impacts to affect the ecology of the river and as such it is included in the assessment of sensitivities.

Table 5.6: Red Book species historically recorded in the Araz River (nəşr, 2023)

Taxa	Species Name	Common Name	IUCN
Actinopterygii	*Salmo trutta fario*	Brown Trout	LC
	Luciobarbus capito	Bulatmai barbel	VU

5.3.1.2 Protected areas

While the site does not directly overlap with any protected areas, there are a number of such features in the surrounding area, designated at both a national level and as Key Biodiversity Areas (KBA). Of particular note is the Basitchay State Nature Reserve, which is a Category 1a designated site in accordance with the IUCN management criteria and hosts important and diverse populations of flora and fauna. Similarly, in neighbouring Iran, the Arasbaran Protected Area is both an Important Bird and Biodiversity Area (IBA) and KBA and lies in close proximity (approximately 5 km) to the Project Sunrise development site, on the opposite banks of the Araz River.

5.3.2 Baseline Studies

The project is divided into two sites, referred to as the northern and southern clusters. Surveys for both flora and fauna were conducted by the subject matter experts in May and October 2023, capturing the Spring/Summer and Autumn/Winter seasonality.

The site survey was limited to demarcated transects which have been cleared of ERW. The orientation and coordinates for each transect start and endpoint are provided in Appendix 2f. Key findings of the surveys themselves are provided in Section 5.3.2.1 and 5.3.2.2, as well as provided in full in Appendix 2e and Appendix 2f.

[11] Listed in 2nd/3rd editions of Republic of Azerbaijan Red Book as VU. LC as per IUCN category (see also Rakhmatulina (2005) and Hasanov (2021)).

[12] Listed in 3rd edition of Republic of Azerbaijan Red Book as VU. NT as per IUCN category.

5.3.2.1 Fauna

Field studies were conducted in May and October 2023 with a total of 40 species identified within the project area (see Table 5.7).

Table 5.7: Summary of species identified during the May and October 2023 surveys

Species Name	Common Name	IUCN	May 2023	Oct 2023
Amphibians				
Pelophylax ridibundus	Eurasian Marsh Frog	LC	●	●
Reptiles				
Testudo graeca *	Spur-thighed Tortoise	VU	●	●
Emys orbicularis	European Pond Turtle	NT	●	●
Pseudopus apodus	European Glass Lizard	LC	●	●
Lacerta strigata	Caucasus Emerald Lizard	LC	●	●
Macrovipera lebetinus	Lebetine Viper	LC	●	
Aves				
Buteo rufinus	Long-legged Buzzard	LC	●	●
Aquila nipalensis	Steppe Eagle	EN	●	●
Falco tinnunculus	Common Kestrel	LC		●
Francolinus francolinus *	Black Francolin	LC	●	●
Phasianus colchicus	Common Pheasant	LC	●	●
Coturnix coturnix	Common Quail	LC	●	
Columba livia	Rock Dove	LC	●	●
Streptopelia turtur	European Turtledove	VU	●	●
Caprimulgus europaeus	European Nightjar	LC	●	
Athene noctua	Little Owl	LC		●
Apus apus	Common Swift	LC	●	●
Apus affinis	Little Swift	LC	●	●
Merops apiaster	European Bee-eater	LC	●	
Merops persicus	Blue-cheeked Bee-eater	LC	●	
Upupa epops	Common Hoopoe	LC	●	●
Hirundo rustica	Barn Swallow	LC	●	
Galerida cristata	Crested Lark	LC	●	●
Melanocorypha calandra	Calandra Lark	LC	●	●
Alauda arvensis	Eurasian Skylark	LC	●	●
Motacilla flava	Western Yellow Wagtail	LC	●	●

Species Name	Common Name	IUCN	May 2023	Oct 2023
Motacilla alba	White Wagtail	LC	●	●
Sturnus roseus	Rosy Starling	LC	●	
Pica pica	Eurasian Magpie	LC	●	●
Corvus corone	Carrion Crow	LC	●	
Corvus cornix	Hooded Crow	NA	●	●
Oenanthe isabelline	Isabelline Wheatear	LC	●	●
Oenanthe pleschanka	Pied Wheatear	LC	●	
Oenanthe oenanthe	Northern Wheatear	LC	●	●
Passer montanus	Eurasian Tree Sparrow	LC	●	●
Mammalia				
Hemiechinus auratus	Long-eared Hedgehog	LC	●	
Microtus arvalis	Common Vole	LC	●	●
Canis aureus	Golden Jackal	LC		●
Canis lupus	Grey Wolf	LC	●	●
Vulpes vulpes	Red Fox	LC	●	●
Notes: Species marked with an asterisk are listed in Edition III of the Red Book of Fauna for Azerbaijan (nəşr, 2023)				

Herpetofauna

A total of six herpetofauna species were identified during the survey activities in May and October. These consisted of one amphibian (Marsh Frog *(Pelophylax ridibundus)* – LC, see Figure 5.17) and five reptiles (Spur-thighed Tortoise *(Testudo graeca)* – VU, European Pond Turtle *(Emys orbicularis)* – NT, European Glass Lizard (*Pseudopus apodus)* – LC, Caucasus Emerald Lizard *(Lacerta strigata)* – LC (see Figure 5.19) and Blunt-nosed Viper *(Macrovipera lebetinus)* – LC).

Of these species, the Spur-thighed Tortoise (*Testudo graeca*) (see Figure 5.18), sometimes referred to as Common Tortoise, is listed by IUCN as Vulnerable and was identified as many as 16 times in the May surveys, and 19 times during the October surveys and is seemingly common throughout the area. One instance of unseasonal mating was also recorded in October, expectedly due to milder than normal weather at this time of year.

Similarly, the European Pond Turtle (*Emys orbicularis*, NT) was identified four times during May and twice during October. All other herpetofauna which were identified are common and widespread.

No herpetofauna were identified as potential CH triggers by the screening exercise.

Figure 5.17: Eurasian Marsh Frog (*Pelophylax ridibundus*)

Source: Ibrahimov & Mustafayev (May 2023)

Figure 5.18: Spur-thighed Tortoise (*Testudo graeca*)

Source: Ibrahimov & Mustafayev (May 2023)

Figure 5.19: Caucasus Emerald Lizard (*Laserta strigata*)

Source: Ibrahimov & Mustafayev (October 2023)

Birds

A total of 29 avifauna species were identified during the efforts across both May and October survey periods. The identified avian community was relatively homogenous across both seasons, with only two species added in the October surveys. The majority of species are common and widespread, with only European Turtle Dove (*Streptopelia Turtur*) and Steppe Eagle (*Aquila nipalensis*) listed as VU and EN respectively, but both recorded during both seasonal surveys. Several of the known migrant taxa such as Bee-eaters (*Merops apiaster* and *Merops persicus*), Barn Swallow (*Hirundo rustica*) and European Nightjar (*Caprimulgus europaeus*) were predictably absent by October, having migrated towards their over-wintering grounds.

Only one species of avifauna identified during the survey efforts are listed in the Red Book of Azerbaijan (nəşr, 2023), namely the Black Francolin (*Francolinus francolinus*) (see Figure 5.20) which has seen significant decline in population since the 1950s (Cornell BOTW, 2023). This species was recorded during the May and October surveys and is listed globally as LC by IUCN.

Figure 5.20: Black Francolin *(Francolinus francolinus)*

Source: Ibrahimov & Mustafayev (May 2023)

It is noted that the CH Screening exercise identified a large number of primarily migratory bird CH candidate species which may occur in the project area, however on review, these have been screened out as none are expected to place particular significance on the habitats or geography of the project area. Of those species which potentially trigger other criteria, an abridged assessment is provided in Table 5.8.

Table 5.8: Summary of species assessments for potential avifauna CH trigger species

Scientific Name	Common name	IUCN Status	Potential Trigger Criteria	Assessment
Vanellus gregarius	Sociable Lapwing	CR	C1, C3, C5	This species occurs in Azerbaijan primarily as a passage migrant between breeding and wintering grounds (Cornell BOTW, 2023) and as such the population here is expectedly fragmented and transient, with relatively few records. This species is not expected to make frequent or significant use of the habitats or area of the project site and as such is not expected to trigger CH under either C1 or C3 (IUCN, 2023). Its status as an evolutionary distinct and globally endangered (EDGE) species results in this species being identified as a priority biodiversity feature and, when / where encountered, it should be considered protected.
Aquila nipalensis	Steppe Eagle	EN	C1, C3, C5	While listed as CR in Europe (IUCN, 2023), the global status of this species is determined largely by trends in its Asian heartland, especially in Kazakhstan, Mongolia and China (Cornell BOTW, 2023). This species occurs in Azerbaijan primarily as a passage migrant and is not expected to rely significantly on the habitats or area of the project site although it was seen frequently during the surveys. Its status as an EDGE species results in this species being identified as a priority biodiversity feature and, when / where encountered, it should be considered protected.
Oxyura leucocephala	White-headed Duck	EN	C1, C3	Occurring primarily in shallow open water (IUCN, 2023), this species is not expected to make significant use of any habitats occurring within the project area. It is not considered to trigger CH for this project area.
Neophron percnopterus	Egyptian Vulture	EN	C1, C3, C5	A widely ranging species of open and cliff habitats (IUCN, 2023), this species likely occurs in the project area in low numbers but is unlikely to meet the threshold for CH under either C1 or C3. Its status as an EDGE species results in this species being identified as a priority biodiversity feature and, when / where encountered, it should be considered protected.
Falco cherrug	Saker Falcon	EN	C1, C3	Patchily distributed over a large area, this species occurs in Azerbaijan in the non-breeding season only and is rarely reported within the country (Cornell BOTW, 2023). While the habitats of the project area are suitable hunting grounds for this species, it is not expected to rely on them to the point of triggering CH.

Scientific Name	Common name	IUCN Status	Potential Trigger Criteria	Assessment
Anser erythropus	Lesser White-fronted Goose	VU	C1, C3	This species is known to occur in Azerbaijan in relatively small numbers of over-wintering visitors. It is unlikely to significantly utilise the habitats of the project area. It is not considered to trigger CH for this project.
Branta ruficollis	Red-breasted Goose	VU	C1, C3	This species is known to occur in Azerbaijan as a small number of over-wintering visitors. It is unlikely to significantly utilise the habitats of the project area. It is not considered to trigger CH for this project.
Clanga clanga	Greater Spotted Eagle	VU	C1, C3	Although listed by IUCN as resident in Azerbaijan, this species is relatively infrequently recorded in the country. This species exhibits a preference for forests and wetland habitats (IUCN, 2023) and is thus unlikely to rely significantly on the grassland and steppe of the project area. It is not considered a trigger for CH.
Aquila heliaca	Eastern Imperial Eagle	VU	C1, C3	Commonly occurring in Azerbaijan with the majority of records occurring in the NW of the country. This species is very widespread and is not known to breed in the country. While suitable, it is not expected that the population supported by the habitats of the project area would reach the threshold for C3 and it is not considered to trigger CH for this project.
Streptopelia turtur	European Turtle dove	VU	C1, C3	A widely distributed species with a large population, this species is listed as vulnerable due to a rapid decline in its global population over a relatively short period. It is estimated that 200,000-400,000 pairs of this species breed in Azerbaijan, utilising a range of habitats including the steppe and shrubland of the project site (Cornell BOTW, 2023). This species was recorded during both survey periods and is still relatively common throughout this portion of its range. It is not however expected that the breeding population within the project area reaches the threshold for C3, and it is therefore not considered to trigger CH.
Otis tarda	Great Bustard	VU	C1, C3, C5	This species has suffered significant range declines in recent years and is possibly extinct in Azerbaijan according to IUCN. Cornell BOTW lists this species has having few records in Azerbaijan in recent years, with zero confirmed sightings listed on eBird. While the habitats of the project area are considered suitable for this species, it has seemingly been largely extirpated and the current status is not expected to hinge significantly on the project area. This species is not considered to trigger CH.

Mammalia

Only five mammal species were identified across the survey periods, namely Long-eared Hedgehog (*Hemiechinus auritus* – LC), Common Vole (*Microtus arvalis* – LC), Golden Jackal (*Canis aureus* – LC), Wolf (*Canis lupus* – LC), and Red Fox (*Vulpes vulpes* – LC). All of the identified species are widespread and common across much of Europe and Western Asia and would not be considered to be of conservation concern.

The CH screening further identified a number of potential mammalian sensitivities, half of which are various species of bats. A high-level assessment of potential mammalian CH trigger species is provided in Table 5.9. Following individual species-by-species assessment, none of the mammalian taxa identified by IBAT are considered likely to trigger CH for the project.

Invertebrates

While the surveys of the project site itself did not record or enumerate any invertebrate species, the CH screening exercise identified 8 potential CH trigger species amongst this taxonomic class. Of these, only one species is listed in an elevated threat category, one is listed as potentially range-restricted and the remaining six are migratory. A high-level assessment of potential invertebrate CH trigger species is provided in Table 5.10. Following individual species-by-species assessment, none of the invertebrate taxa identified by IBAT are considered likely to trigger CH for the project.

Freshwater fish

Although survey of the project area did not include the nearby Araz River, there exists a potential for downstream impacts to the river via groundwater impacts within the catchment. The CH screening identified several potential freshwater fish sensitivities, a high level appraisal of which is provided in Table 5.11. Following individual species-by-species assessment, three of the freshwater fish taxa identified by IBAT are considered likely to trigger CH under Criteria 3 for the project. It is however acknowledged that the functional pathway between the project site and river itself is indirect, and therefore there is unlikely to be significant potential for impacts to occur to this habitat.

Table 5.9: Summary of species assessments for potential mammalian CH trigger species

Scientific Name	Common name	IUCN Status	Potential Trigger Criteria	Assessment
Panthera tigris	Tiger	EN	C1	Tiger is historically distributed as far west as Türkiye but is now extinct throughout the Caucasus and Azerbaijan (IUCN, 2023). It is not expected to trigger CH.
Acinonyx jubatus	Cheetah	VU	C1	Cheetah was historically distributed as far north as Georgia on the western side of the Caspian Sea and into Central Asia but is now extinct throughout the Caucasus and Azerbaijan. It is not expected to trigger CH.
Panthera pardus	Leopard	VU	C1, C5	It should be noted that the IUCN assessment for *P. pardus saxicolor* (Persian Leopard) lists the Caucasian subpopulation as being EN (IUCN, 2023). Leopard is historically much more widely distributed than its current range, having been expectedly extirpated from much of Azerbaijan. The species is still thought to occur in Arasbaran in northern Iran and into the Zangezur Ridge (IUCN, 2023), however this is expectedly a small population, isolated to mountainous habitats. The habitats of the project area are not expected to bear significance for Leopard, and it is not considered to be a CH trigger for the project area. It is considered however that should a Leopard be identified on site during construction or operation, it should be treated as protected and managed appropriately in subsequent management plans.
Rhinolophus mehelyi	Mehely's Horseshoe Bat	VU	C1	This species relies heavily on caves for roosting but does forage over steppe and grassland habitats (IUCN, 2023). While it is a widely and patchily distributed species, it is known to occur in this part of Azerbaijan and would likely make use of habitats within the project area. It is not however expected that removal of these habitats would cause the species to be elevated to EN or CR status and it is therefore not considered a trigger for CH.

Scientific Name	Common name	IUCN Status	Potential Trigger Criteria	Assessment
Vormela peregusna	Marbled Polecat	VU	C1, C5	While expected to occur in the wider area, this species is naturally rare across its range. Given the wide distribution of this species, it is not expected that the habitats of the project area, while suitable, would constitute a significantly important stronghold for the species. It is therefore considered not to trigger CH, however its status as an EDGE species does warrant its consideration as a priority biodiversity feature and, if encountered, it should be considered protected and managed appropriately in subsequent management plans.
Capra aegagrus	Wild Goat	NT	C3	A well studied species which is widely distributed from Türkiye to Pakistan (IUCN, 2023). This species is known to occur in the nearby Lesser Caucasus mountains but expectedly does not range into the project area and is thus not considered to trigger CH.
Nyctalus noctula	Noctule	LC	C3	While widely distributed over Europe, this species exhibits preferences for wetland, woodland and pasture habitats for foraging, and trees and caves for roosting (IUCN, 2023), thus making its heavy reliance on the habitats of project area unlikely. It is therefore considered not to trigger CH.
Pipistrellus nathusii	Nathusius' Pipistrelle	LC	C3	While widely distributed over Europe, this species exhibits preferences for wetland and woodland habitats for foraging, and trees and caves for roosting (IUCN, 2023), thus making its heavy reliance on the habitats of project area unlikely. It is therefore considered not to trigger CH.
Vespertilio murinus	Particoloured Bat	LC	C3	While widely distributed over Europe and Asia, this species forages over various habitats including steppe grassland, and roosts in trees and caves (IUCN, 2023). While it likely does occur over the project area, it is not expected to congregate in any sort of significant number in the area, thus making its heavy reliance on the habitats of project area unlikely. It is therefore considered not to trigger CH.
Lepus europaeus	European Hare	LC	C3	A widespread and adaptable species, the European Hare is not known to exhibit significant migratory movements but is potentially congregatory in suitable habitat during the breeding season. It is however not expected to place significant reliance on the habitats of the project area and would not be considered to trigger CH.

Scientific Name	Common name	IUCN Status	Potential Trigger Criteria	Assessment
Cervus elaphus	Red Deer	LC	C3	A widespread species of broadleaf open woodland habitats, often in mountainous areas. This species is thought to be rare across much of the Caucasus and unlikely to occur in significant numbers as low down as the project area. It is therefore not expected to trigger CH for the project area.
Eptesicus serotinus	Serotine Bat	LC	C3	While widely distributed across the palearctic, this species forages primarily in and over the canopy of trees and roosts in buildings and caves (IUCN, 2023). While it likely does occur over the project area, it is not expected to congregate in any sort of significant number in the area, thus making its heavy reliance on the habitats of project area unlikely. It is therefore considered not to trigger CH.
Pipistrellus pipistrellus	Common Pipistrelle	LC	C3	While widely distributed over Europe and central Asia, this species forages over various habitats and roosts in trees and caves. While it likely does occur over the project area (IUCN, 2023), it is not expected to congregate in any sort of significant number in the area, thus making its heavy reliance on the habitats of project area unlikely. It is therefore considered not to trigger CH.
Plecotus auritus	Brown Long-eared Bat	LC	C3	In the wider project area, this species is thought to be limited to the nearby Zangezur ridge (IUCN, 2023). This species exhibits preference for forest edges, woodland and gardens, with tree cavities providing the most common natural roosting habitat. This species is therefore not expected to trigger CH for the project area.

Table 5.10: Summary of species assessments for potential invertebrate CH trigger species

Scientific Name	Common name	IUCN Status	Potential Trigger Criteria	Assessment
Onychogomphus flexuosus	Waved Pincertail	VU	C1	A patchily distributed species, recorded from 55 localities across Southwest and Central Asia (IUCN, 2023). This species is strongly associated with riparian habitats, particularly large brooks and rivers with extensive gravel banks. As such, this species is not expected to place significance on the habitats of the project area and is not considered to trigger CH.
Esymus alkani	-	DD	C2	Very little is known about this species of beetle and as such it is listed as DD by IUCN. Its potential extent in Azerbaijan is not known and it is unclear whether this species actually occurs in the country. It is however expected to be highly localised and is coprophagous, suggesting a close association with larger herbivores and livestock (IUCN, 2023). It is therefore not expected to rely heavily on the steppe habitats of the project area and is not considered to trigger CH.
Anax ephippiger	Vagrant Emperor	LC	C3	A very widely distributed species of dragonfly, occurring across Africa, Europe and Central Asia (IUCN, 2023). Given its wide distribution and close association with wetland habitats, it is not expected that a significant population will exist within the project area at any time of year. It is therefore not considered to trigger CH.
Pantala flavescens	Wandering Glider	LC	C3	A very widely distributed species of dragonfly, occurring on all continents except for Antarctica (IUCN, 2023). Given its wide distribution and close association with wetland habitats, it is not expected that a significant population will exist within the project area at any time of year. It is therefore not considered to trigger CH.
Tramea basilaris	Keyhole Glider	LC	C3	A very widely distributed species of dragonfly, occurring across Africa and Southern Asia (IUCN, 2023). Given its wide distribution and close association with wetland habitats, it is not expected that a significant population will exist within the project area at any time of year. It is therefore not considered to trigger CH.

Scientific Name	Common name	IUCN Status	Potential Trigger Criteria	Assessment
Sympetrum depressiusculum	Spotted Darter	LC (VU)	C3	A very widely distributed species of dragonfly, occurring across Europe and parts of Asia (IUCN, 2023). Given its wide distribution and close association with temporal pools, wetland habitats, and artificial pools, it is not expected that a significant population will exist within the project area at any time of year. It is therefore not considered to trigger CH.
Vanessa atalanta	Red Admiral	LC	C3	A widely distributed butterfly, occurring across North America and Eurasia (IUCN, 2023). Given its wide distribution and close association with marsh and riparian habitats, it is not expected that a significant population will exist within the project area at any time of year. It is therefore not considered to trigger CH.
Vanessa cardui	Painted Lady	LC	C3	The most widely distributed butterfly species on earth (IUCN, 2023), this species is a seasonal migrant to Europe. Given its wide distribution and broad habitat preferences, it is not expected that this species will heavily rely on any given habitat, or that a significant population will exist within the project area at any time of year. It is therefore not considered to trigger CH.

Table 5.11: Summary of species assessments for potential freshwater fish CH trigger species

Scientific Name	Common name	IUCN Status	Potential Trigger Criteria	Assessment
Acipenser nudiventris	Ship Sturgeon	CR	C1	This species migrates up the Kur River to spawn and can occasionally be found in the Araz River catchment but not in the section near the project area. This species would therefore not be expected to trigger CH for the project AOI (IUCN, 2023). The assessment includes the *Acipenser nudiventris Caspian Sea subpopulation* as listed separately by IUCN.
Acipenser stellatus	Stellate Sturgeon	CR	C1, C3	This species migrates up the Kur River to spawn and can occasionally be found in the Araz River catchment but not in the section near the project area. This species would therefore not be expected to trigger CH for the project AOI (IUCN, 2023). This assessment includes the *Acipenser stellatus Caspian Sea subpopulation* as listed separately by IUCN.
Acipenser gueldenstaedtii	Russian Sturgeon	CR	C1, C3	This species migrates up the Kur River to spawn and can occasionally be found in the Araz River catchment but not in the section near the project area. This species would therefore not be expected to trigger CH for the project AOI (IUCN, 2023). This assessment includes the *Acipenser gueldenstaedtii Caspian Sea subpopulation* as listed separately by IUCN.
Huso huso	Beluga	CR	C1, C3	This species migrates up the Kur River to spawn and can occasionally be found in the Araz River catchment but not in the section near the project area. This species would therefore not be expected to trigger CH for the project AOI (IUCN, 2023). This assessment includes the *Huso huso Caspian Sea subpopulation* as listed separately by IUCN.

Scientific Name	Common name	IUCN Status	Potential Trigger Criteria	Assessment
Cyprinus carpio	Eurasian Carp	VU	C1, C3	Common throughout its range and widespread across Black, Aral and Caspian Sea basins (IUCN, 2023). This species exhibits preference for deep, slow-flowing, lowland rivers, lakes and backwaters. It is expected to occur in the Araz River catchment but, due it is abundance within its native range, would expectedly not result in a trigger for CH under either C1 or C3.
Luciobarbus brachycephalus	Aral Barbel	VU	C1, C3	This species is listed as VU globally, but is CR listed within Europe due to its rapidly declining population (IUCN, 2023). It has been extirpated form the Aral Sea but survives in the Aral Basin, and drainage of the Southwestern Caspian Sea. Historically known to migrate up tributaries of the Araz River to spawn however the river itself is dammed below the site and it is therefore not expected that this species would occur in the upper reaches near to the project site. This species is therefore not expected to trigger CH for the project site.
Luciobarbus capito	Bulatmai Barbel	VU	C1, C3	This species migrates up tributaries in the Caspian basin to spawn but has been significantly impacted by damming of rivers (IUCN, 2023). It is expected that this species is however extant in the upper reaches of the Araz River and would likely trigger CH (C3) for the water course which crosses the wider project AOI.
Leuciscus aspius	Eurasian Asp	LC	C3	This species is very widely distributed in rivers and lakes across eastern Europe and the Caucasus, given its extremely wide range, it is not expected that any population utilising the project area would exceed the threshold for C3 (IUCN, 2023). It is therefore not expected to result in a trigger for CH.
Rutilus frisii	Black Sea Roach	LC	C3	This species migrates up tributaries in the Caspian basin to spawn but has been significantly impacted by damming of rivers (IUCN, 2023). It is expected that this species is however extant in the upper reaches of the Araz River and would likely trigger CH (C3) for the water course which crosses the wider project AOI.

Scientific Name	Common name	IUCN Status	Potential Trigger Criteria	Assessment
Rutilus rutilus	Common Roach	LC	C3	This species is very widely distributed in rivers and lakes across Europe and Russia, given its extremely wide range, it is not expected that any population utilising the project area would exceed the threshold for C3. It is therefore not expected to result in a trigger for CH.
Sander lucioperca	Eurasian Pikeperch	LC	C3	This species is very widely distributed in rivers and lakes across Europe, central Asia and Russia (IUCN, 2023). Given its extremely wide range, it is not expected that any population utilising the project area would exceed the threshold for C3. It is therefore not expected to result in a trigger for CH.
Vimba vimba	Vimba Bream	LC	C3	This species is very widely distributed in rivers and lakes across Europe, central Asia and Russia (IUCN, 2023). Given its extremely wide range, it is not expected that any population utilising the project area would exceed the threshold for C3. It is therefore not expected to result in a trigger for CH.
Blicca bjoerkna	White Bream	LC	C3	This species is very widely distributed in rivers and lakes across Europe and the Caucasus (IUCN, 2023). Given its extremely wide range, it is not expected that any population utilising the project area would exceed the threshold for C3. It is therefore not expected to result in a trigger for CH.
Squalius cephalus	Eurasian Chub	LC	C3	This species is very widely distributed in rivers and lakes across Europe, the Caucasus and Russia (IUCN, 2023). Given its extremely wide range, it is not expected that any population utilising the project area would exceed the threshold for C3. It is therefore not expected to result in a trigger for CH.
Abramis brama	Common Bream	LC	C3	This species is very widely distributed in rivers and lakes across Europe, central Asia and Russia (IUCN, 2023). Given its extremely wide range, it is not expected that any population utilising the project area would exceed the threshold for C3. It is therefore not expected to result in a trigger for CH.

Scientific Name	Common name	IUCN Status	Potential Trigger Criteria	Assessment
Morone saxatilis	Striped Bass	LC	C3	This species is native to North America and has been introduced to Eurasia (IUCN, 2023), hence its inclusion in the IBAT data package. This species is not found in Azerbaijan, therefore not considered to trigger CH.
Luciobarbus caspius	Caspian Barbell	LC	C3	This species migrates up tributaries in the Caspian basin to spawn but has expectedly been significantly impacted by damming of rivers and fishing (IUCN, 2023). It is expected that this species is however extant in the upper reaches of the Araz River and would likely trigger CH (C3) for the water course which crosses the wider project AOI.

5.3.2.2 Flora

Surveys were conducted for both the northern and southern clusters to identify floral complexes and habitats occurring within the project footprint. Results from this study are reported separately for each of these areas.

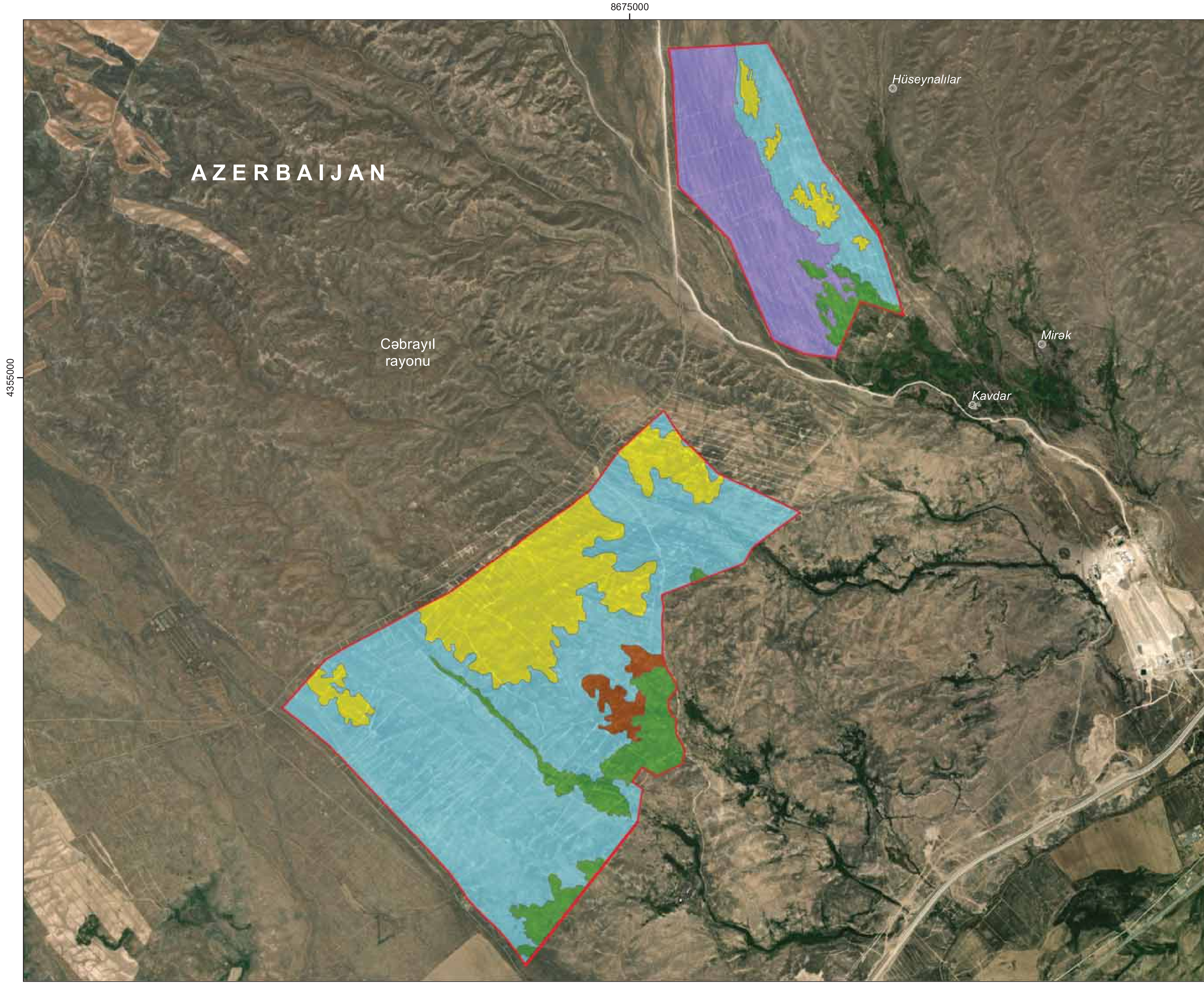
Habitats and mapping

Survey of the project footprint identified a mosaic of 5 key habitat types as detailed in Table 5.12 and shown in the figures that follow.

Table 5.12: Key habitat complexes identified (May 2023)

Habitat	Natural / Modified	Notes
Secondary Vegetation	Human modified	Opportunistic species may dominate in areas which have been fallowed, and as such this habitat comprises a mix of both native and invasive species. While not considered a "natural habitat" in the context of the CHA, this habitat may still support significant numbers of potentially sensitive fauna.
Steppe	Natural	Steppe grassland habitats cover much of the wider ecoregion but are in decline across Azerbaijan. These habitats comprise annual and perennial grasses and are typically devoid of larger plant species and trees. Despite being considered semi-arid, these habitats host significant fauna biodiversity and, in some areas, may support charismatic megafauna such as grey wolf and brown bear.
Wormwood semi-deserts	Natural	These habitats are interwoven into the steppe grasslands and are separated from one another by the dominance of either wormwood (*Artemesia*) or saltwort (*Salsola*) species. The disjunct vegetation of these areas provides refugia to small mammals as well as avifauna and are noted for their high salt tolerance.
Saltwort small-shrub semi-deserts	Natural	
Lowland Meadows	Natural	Occurring in sloping depressions, these habitats comprise a heterogenous flora from the remainder of the site, typically including grasses, herbs, shrubs and other non-woody plants. These habitats provide ecologically important areas for foraging, pollination, nesting and courtship displays for a variety of species. These habitats are known to be particularly vulnerable to the effects of climate change

In the process of completing the floral studies, both the northern and southern clusters were mapped for their habitat and vegetation coverage. Individual trees and shrubs are not represented on the maps, because they do not have a zonal distribution (the exact number of species, specimens and their GPS coordinates are provided in the baseline reports, see Appendix 2e). Figure 5.21 shows the coverage of habitats and vegetation complexes across both the northern and southern clusters.



Legend:

- Towns and villages
- Project Area

Habitats

- Lowland meadow
- Saltwort small-shrub semi-desert
- Secondary vegetation
- Steppe
- Wormwood semi-desert

Notes:
This map contains data from the following sources:
DATA SOURCE (DATE)

Coordinate System: Pulkovo 1942 GK Zone 8
Projection: Gauss Kruger
Datum: Pulkovo 1942
Units: Meter

Rev	Date	Description	Drn	Chk	App
01	01/02/2024	Final	USeid	LS	FG
00	05/10/2023	Draft A	USeid	LS	FG

Project Sunrise

RSK

Figure 5.21:
Habitat and vegetation coverage for the northern and southern clusters

0 500 1,000
Meters

SCALE: 1:27,000 @ A3

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Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Northern cluster habitat and floral complexes

Secondary vegetation

As illustrated in Figure 5.21 a large proportion of this section of the site is made up of secondary regrowth vegetation, following on from historic use of the area for vineyards. The species composition of this habitat comprises invasive and segetal vegetation, replacing the abandoned cultivation. This develops between the wild bushes of the *Vitis vinifera* vineyard and includes such species (amongst others) as *Onopordum acanthium*, *Eryngium campestre*, *Picnomon acarna*, *Limonium scoparium*, *Centaurea solstitialis*, *Carthamus lanatus*, *Achillea micrantha*, *Salvia nemorosa*, *Cirsium vulgare*, *Peganum harmala*, *Chondrilla juncea*, and *Scorzonera leptophylla*.

Other opportunistic species which regenerate well in the fallowed habitat include steppe flora and subshrubs such as *Bassia prostrata*, *Artemisia lercheana,* and *Bothriochloa ischaemum*.

Steppe

In the northeastern and eastern zones of the northern area, on slopes and shallow depressions, there are sagebrush steppes dominated by *Artemisia lercheana,* and *Bothriochloa ischaemum*. This habitat occurs in isolated patches and is not contiguous across any of the northern area of the site.

Wormwood semi-deserts

In the southern part of the plain, in the former vineyards and along the slopes, semi-desert formations of wormwood are noted with a dominance of *Artemisia lercheana* and *Poa bulbosa*. Within this habitat, there is also a diversity of ephemeral synusia which include species such as *Filago pyramidata*, *Koeleria phleoides*, *Lolium rigidum*, *Helianthemum salicifolium*, *Nigella arvensis*, *Hordeum leporinum*, *Euphorbia falcata* and others.

Wild bushes of *Vitis vinifera* and occasional *Capparis spinosa* were noted frequently within this habitat.

Lowland meadows

In the southern and southwestern parts of the northern cluster, notably on sloping depressions, there are areas of lowland meadow vegetation. These are dominated by shrub formations including *Lycium ruthenicum* and *Alhagi pseudalhagi*, with *Artemisia lercheana* and *Lagonychium farctum*.

Shrub formations are created by *Lycium ruthenicum*. The topsoil is covered by perennials such as *Cynodon dactylon* and *Limonium scoparium*, *Cardaria draba*, *Polygonum argyrocoleon*, *Hordeum leporinum*, *Tripleurospermum parviflorum*, *Phleum paniculatum*, *Anisantha rubens*, *Torilis nodosa*, *Lagoseris sancta* and *Lagonychium farctum*.

Beneath the former vineyards, shrub formations are transformed into communities dominated by *Alhagi pseudalhagi* and *Lagonychium farctum*. The grass cover is also dominated by *Cynodon dactylon*. Additionally, semi-shrubs *Capparis spinosa* (see Figure 5.22) and *Zygophyllum fabago* were also recorded.

Figure 5.22: Caper bush (*Capparis spinosa*)

Source: Guliyev (May 2023)

Other trees and shrubs

Throughout the northern cluster, xerophytic species of trees and shrubs characteristic of arid light forests were also recorded during the May 2023 surveys. These included:

- several bushes of *Celtis glabrata*
- a group of four trees of *Robinia pseudoacacia* (invasive/non-native species)
- a large White Mulberry (*Morus alba*) tree
- several small unidentified Tuta (Mulberry) trees
- several large pistachio trees (*Pistacia mutica*)
- a sapling of Common Fig (*Ficus carica*)
- bushes of Wild Almond (*Amygdalus nana*)
- cultivated specimens of garden grapes, *Vitis vinifera*
- dense shrub formations of Russian Box Thorn (*Lycium ruthenicum*).

During the October surveys, several additional small Nettle trees (*Celtis glabrata*) and sapling Pistachio trees (*Pistacio mutica*) were identified at various points around the northern area.

Southern cluster habitat and floral complexes

Steppe

As illustrated in Figure 5.21 lower mountain steppe formations are typical on the tops and slopes, with a dominance of *Bothriochloa ischaemum* and *Stipa lessingiana*, along with herbaceous species such as *Helianthemum lasiocarpum*, *Koeleria cristata*, *Lappula squarrosa*, *Euphorbia orientalis*, *Teucrium capitatum*, *Trachynia distachya*, *Medicago caerulea*, *Galium verum*, *Linum corymbulosum*, *Arnebia decumbens* and *Ephedra distachya* shrub.

The soil cover under the steppe formations is densely covered with lichen of Parmelia sp.

In the October surveys, new formations were identified within the steppe phytocenosis of the southern cluster, including *Bothriochloa ischaemum* and *Artemisia lercheana*, with characteristic steppe ephemerals such as *Poa bulbosa*, *Filago pyramidata*, *Lepidium perfoliatum*, *Tanacetum achilleifolium*, *Erodium ciconium*, *Bromus japonicus*, *Aegilops triuncialis*, *Bupleurum semicompositum*, *Helichrysum arenarium*, *Limonium sp*. and *Astragalus sp*.

In addition, xerophytic-shrub steppe was identified on the tops of slopes in the central and southern part of the southern cluster, predominantly associated with rubbly and sandy loam soils. This mixed formation was dominated by *Ephedra procera* (see Figure 5.23) and *Bothriochloa ischaemum* and includes characteristic steppe species such as *Bassia prostrata*, *Bromus anatolicus*, *Koeleria cristata*, *Teucrium capitatum*, *Stachys atherocalyx*, *Onobrychis cyri*, *Teucrium chamaedrys*, *Helichrysum arenarium*, *Achillea millefolium*, *Agropyron cristatum*, *Limonium sp*. and *Astragalus microcephalus*.

Figure 5.23: *Ephedra procera*, fruit bearing shrub

Source: Guliyev (October 2023)

Wormwood semi-deserts

In depressions and on the plain between the slopes, semi-desert communities have developed, dominated by *Artemisia lercheana* and *Poa bulbosa*, with typical semi-desert ephemerals such as *Filago pyramidata*, *Lepidium perfoliatum*, *Tanacetum achilleifolium*, *Erodium ciconium*, *Bromus japonicus*, *Aegilops triuncialis*, *Bupleurum* *semicompositum*, *Convolvulus arvensis*, *Malvalthaea transcaucasica* (hybrid), *Alyssum turkestanicum var. desertorum*, and *Delphinium divaricatum*.

In communities of *Artemisia lercheana*, the flowering subshrub *Capparis spinosa* is also scattered throughout the study area.

Saltwort small-shrub semi-deserts

There are saltwort small-shrub semi-deserts on flat plains. They are made up of pure and mixed formations of saltwort such as *Salsola dendroides* and *Salsola ericoides* with ephemerals. In places, there are individual specimens of *Suaeda microphylla* in the composition.

Common ephemerals are dominated by *Poa bulbosa*, *Allium rubellum*, *Hordeum leporinum*, *Aegilops cylindrica*, *Phalaris minor*, and of herbs such as *Senecio vernalis*, *Lagoseris sancta*, *Medicago denticulata*, *Stellaria media*, *Filago pyramidata*, *Medicago sativa*, *Sisymbrium loeselii*, *Tanacetum achilleifolium* amongst others.

Lowland meadows

In wet depressions of the plain and along the edges of the Araz tributary, *Alhagi pseudalhagi* formations develop, in some places in combination with saltwort species such as *Salsola dendroides* and *Salsola tragus*.

The phytocenosis includes *Poa bulbosa*, *Filago pyramidata*, *Lepidium perfoliatum*, *Bromus japonicus*, *Papaver arenarium*, *Alyssum turkestanicum*, *Medicago sativa*, *Hordeum geniculatum*, *Lolium rigidum*, *Adonis bienertii*, *Eryngium campestre*, and *Atriplex lehmanniana*.

Other trees and shrubs

As in the northern cluster, xerophytic species of trees and shrubs characteristic of arid light forests are observed in the southern cluster, including:

- Tamarisk (*Tamarix ramosissima*)
- a group of wild Common Fig (*Ficus carica*) trees (see Figure 5.24)
- *Ephedra distachya* on the tops of rocky slopes
- *Atraphaxis spinosa* in the dry bed of the Araz tributary, on rocky mounds
- three saplings of Wild Olive (*Elaeagnus angustifolia*) inside a dried-out ditch
- one bush of wild Common Pomegranate (*Punica granatum*).

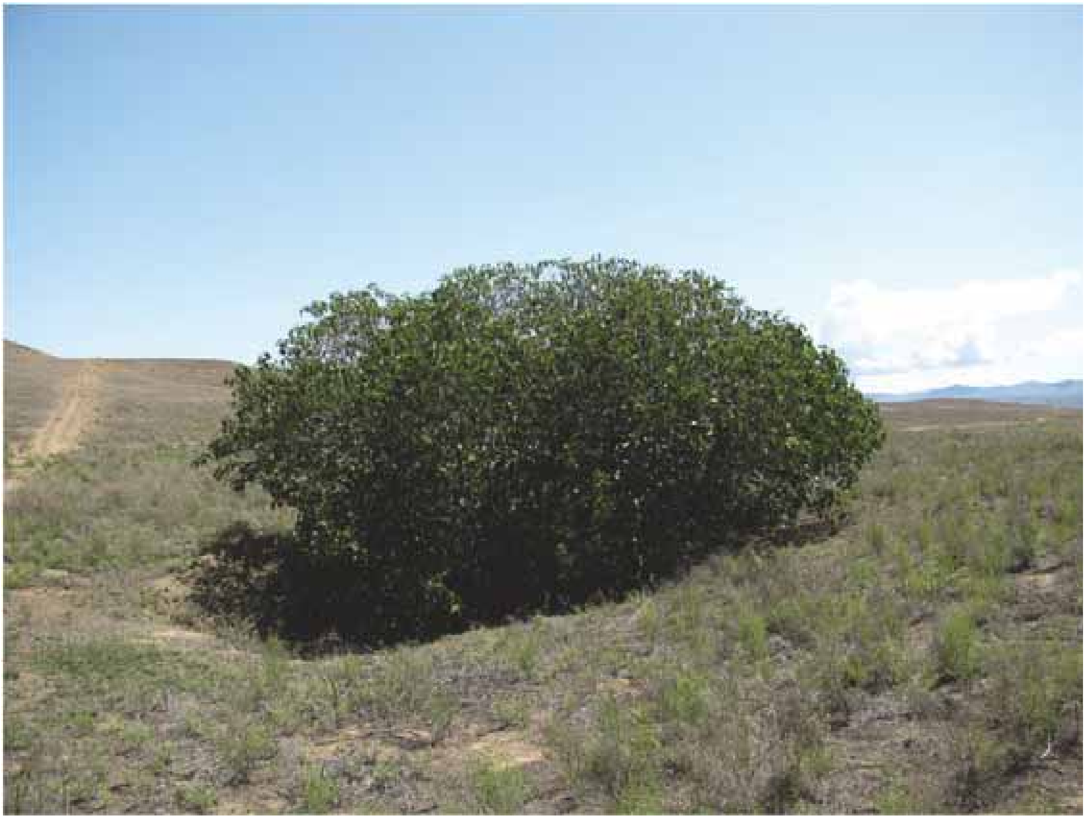


Figure 5.24: Common Fig (*Ficus carica*)

Source: Guliyev (May 2023)

Notable findings

Two rare species listed in the Red Book of Azerbaijan (nəşr, 2023) were found in the study areas, namely:

- Common Fig (*Ficus carica* - LC)
- Common Pomegranate (*Punica granatum* - LC).

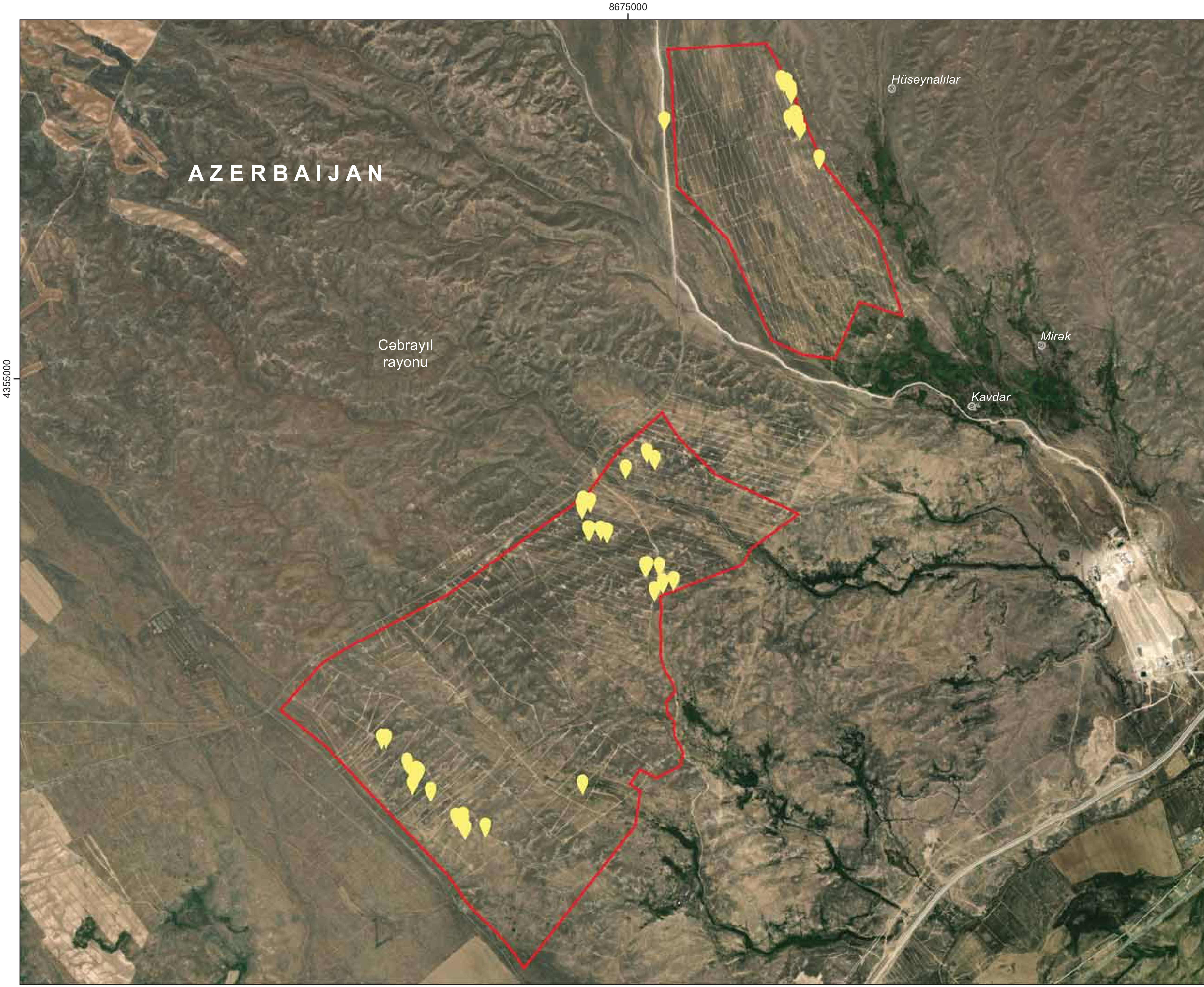
Additionally, steppe formations should be considered to be of conservation value as this habitat is shifting towards semi-deserts throughout the ecoregion (UNEP-WCMC, 2023).

During the October surveys, an unconfirmed species of iris (presumably *Iris lycotis* or *I. acutiloba*) was identified on both the northern and southern clusters. Both of these species are listed in the Red Book of Azerbaijan (nəşr, 2023) and considered as protected species. The flowers, which are the main morphological identifier for these plants, are visible for a very short window of between 15-20 days in late April – early May. Within the study area, these plants were found in steppe and semi-desert formations, forming small populations on slopes in small clumps. The locations of the iris clusters with the northern and southern clusters are illustrated in Figure 5.25.

The locations for each identified floral species of conservation concern are provided in Appendix 2e.

Potential CH Triggers

The CH screening identified several potential floral sensitivities, a high level appraisal of which are provided in Table 5.13. Following individual species-by-species assessment, none of the floral taxa identified by IBAT are considered likely to trigger CH for the project.



Legend:

Iris clusters

Towns and villages

Project Area

Notes:
This map contains data from the following sources:
DATA SOURCE (DATE)

Coordinate System: Pulkovo 1942 GK Zone 8
Projection: Gauss Kruger
Datum: Pulkovo 1942
Units: Meter

Rev	Date	Description	Drn	Chk	App
01	01/02/2024	Final	BC	FG	KC
00	27/11/2023	Draft A	BC	FG	KC

Project Sunrise

Figure 5.25:
Locations of unidentified species of Iris clusters in relation to the project sites
(as recorded in Autumn biodiversity survey, 2023)

0 500 1,000
Meters

SCALE: 1:27,000 @ A3

REV 01

Document Path: P81137\P81137 - Figure 5.25.mxd

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Table 5.13: Summary of species assessments for potential floral CH trigger species

Scientific Name	Common name	IUCN Status	Potential Trigger Criteria	Assessment
Trifolium bobrovii	Bobrov's Clover	CR	C1, C2	A rare species which is completely endemic to the Greater Caucasus, this species occurs around 2,000 m in stream-side meadows in the subalpine belt. It is not expected to occur within the project AOI.
Astragalus bylowae	Bylov's Milk Vetch	CR	C1, C2	A rare species which is completely endemic to the Zangezur floristic region , this species occurs around 1,400 m. It is not expected to occur within the project AOI.
Silene chustupica	Khustup Campion	CR	C1, C2	A rare species which is completely endemic to the Zangezur floristic region, this species occurs around 3,000 - 3,200 m. It is not expected to occur within the project AOI.
Carum komarovii	Komarov's Caraway	EN	C1, C2	A rare species which is completely endemic to three locations in the Lesser Caucasus. It is not expected to occur within the project AOI.
Centaurea rhizocalathium	Root-headed Centaury	EN	C1, C2	A rare species which is restricted to two locations in the Lesser Caucasus and three in Türkiye. It is not expected to occur within the project AOI.
Cousinia macrocephala	Cousinia macrocephala	EN	C1, C2	This species is endemic to the Caucasus Biodiversity Hotspot and Gean steppe of Azerbaijan. Its mapped distribution directly overlaps the project area; however it was not recorded during surveys of the project area. It is noted in the IUCN assessment that it occurs above 700 m in the Lesser Caucasus which would expectedly place it altitudinally above the project site. If present within the wider AOI, this species would expectedly trigger both C1 and C2, due to its highly restricted distribution and rarity.
Pyrus sosnovskyi	Sosnovsky's Pear	EN	C1, C2	A rare species which is completely endemic to the Lesser Caucasus. It is not expected to occur within the project AOI.
Amblyopyrum muticum	-	EN	C1, C2	This species is native to the Lesser Caucasus and Türkiye and has been introduced elsewhere in Western Europe. It is not expected to occur in the project AOI.
Gypsophila szovitsii	Szovits' Gypsophila	VU	C1, C2	While this species is expected to occur in the wider area it is strongly associated with rocky and stoney habitats and is thus unlikely to occur significantly within the steppe habitats of the project area. It was also not identified during survey activities.
Thesium maritimum	Coastal Bastard Toad-flax	VU	C1, C2	While this species is expected to occur in the wider area it is strongly associated with rocky/stoney habitats and clayey soils and is thus unlikely to occur significantly within the steppe habitats of the project area. It was also not identified during survey activities.

Scientific Name	Common name	IUCN Status	Potential Trigger Criteria	Assessment
Scorzonera czerepanovii	-	VU	C1, C2	While this species does occur in Azerbaijan and likely in the nearby Kur Lowlands, it is strongly associated with rocky habitats and clayey soils is thus unlikely to occur significantly within the steppe habitats of the project area. It was also not identified during survey activities.
Lathyrus cyaneus	-	VU	C1, C2	A rare species known from a limited number of sites where it is typically found in very low numbers, this species occurs between 1,600 and 2,000 m in moist meadows and rocky cliff-faces. It is not expected to occur within the project AOI.
Pyrus elata	Tall Pear	NT	C2	A rare species which is completely endemic to the Lesser Caucasus. It is not expected to occur within the project AOI.
Onopordum cinereum	Ash-coloured Scotch Thistle	LC	C2	A rare species which is completely endemic to the Lesser Caucasus. It is not expected to occur within the project AOI.
Lathyrus rotundifolius	Round-Leaf Vetchling	NT	C2	This species is expectedly introduced to Azerbaijan and is not considered to trigger CH.
Pyrus zangezura	Zangezurian Pear	NT	C2	A rare species which occurs in several floristic regions of the Lesser Caucasus, including Garabagh in Azerbaijan. It is not expected to occur within the project AOI.
Cerastium szowitsii	Szowitz's Chickweed	LC	C2	This species meets the threshold for C2; however it occurs primarily on rocky cliffs and slopes in the alpine and subalpine belt and is therefore not expected to occur within the project AOI.
Dianthus bicolor	Bicolour Pink	LC	C2	This species is known from a limited number of locations . It is not expected to occur within the project AOI.
Heracleum schelkovnikovii	Shelkovnikov's Cow-Parsnip	LC	C2	A rare species which occurs in the Lesser Caucasus regions. It is not expected to occur within the project AOI.
Psephellus karabaghensis	Karabaghian Psephellus	LC	C2	A rare species which occurs in several floristic regions of the Lesser Caucasus, including in Garabagh in Azerbaijan. It is not expected to occur within the project AOI.
Lathyrus roseus	-	LC	C2	This species is known from a number of locations in western Asia and the Caucasus where it occupies pine forests. It is therefore not expected to occur within the project AOI.

5.4 Socioeconomic Baseline

5.4.1 Introduction

This section describes the existing socioeconomic conditions, or baseline, in and around the project AOI. The baseline's purpose is to describe the socioeconomic receptors that could potentially be affected by the proposed project and provide a reference case against which potential impacts can be assessed and monitored.

5.4.1.1 Social receptors

Receptors in the primary AOI include:

- the project site
- local settlements and local population
- the Horadiz–Jabrayil–Zangilan–Aghband highway
- economic/industrial developments (Araz Valley Economic Zone Industrial Park)
- the town of Horadiz.

In order to provide context, the following socioeconomic topics are addressed (mainly at national level) in the baseline:

- territorial context, governance and administration
- demographics
- health
- education
- economy and livelihoods
- natural resource use
- land use and tenure
- infrastructure and services
- worker's rights and labour practices
- community safety, security and welfare
- tangible and intangible cultural heritage.

5.4.1.2 Sources of data

The socioeconomic baseline is based on a review of qualitative and quantitative secondary data from various sources to provide contextual information at the national level, as well as primary data gathered during meetings with key stakeholders in the Jabrayil district and Baku in October to November 2023.

The cultural heritage baseline study builds on the desk-top work undertaken for the scoping phase, which included consultation of secondary data sources, and a TCH field survey conducted in May 2023. The objectives of this field survey were to examine locations considered to have a high potential for cultural heritage assets.

Secondary data sources include:

- environmental, social and cultural heritage studies undertaken in recent years within Azerbaijan
- lists of sites published by the Ministry of Culture of the Republic of Azerbaijan

- information held in Azerbaijan's national archives and museums
- aerial photography and historical satellite sources (USGS, 2023)
- reports published by research institutes and international organisations
- research papers published in academic journals
- reputable public internet sources.

Primary data collection

Primary data were collected at national and local level by consultants from RSK.

One-to-one interviews were carried out with key informants with specialist knowledge of the social receptors. A semi-structured questionnaire related to the receptors was used during the interviews. The meetings were organised at a convenient time and location to the informant. All meetings were conducted in Azerbaijani. Participants included in the study are outlined in Table 5.14 below. Further details on stakeholder engagement activities are provided in Section 6.

Table 5.14: Primary data collection participants

National level	Local level
AzerEnerji	Special Representative of the President in Jabrayil, Qubadli and Zangilan districts
State Committee on Urban Planning and Architecture	Road/infrastructure construction companies (Araz Valley Economic Zone Industrial Park)
MENR	Road/infrastructure construction companies
Ministry of Labour and Social Protection	Horadiz health clinic
ANAMA	
NGO - Chairman of the Public Council of MENR	
Ministry of Culture	
Ministry of Energy	
Azerbaijan Renewable Energy Agency (AREA) under the Ministry of Energy	

5.4.1.3 Structure of the section

This baseline is structured as follows:

- Section 5.4.2 describes the existing social conditions, or baseline, at the **national level** (e.g., in Azerbaijan).
- Section 5.4.3 presents information at the **local level**, in the primary AOI. This includes the districts of Jabrayil and Fuzuli and the towns of Jabrayil City and Horadiz.

5.4.2 Socioeconomic Baseline: National Level

5.4.2.1 Territorial context, governance and administration

At the time of writing, The Republic of Azerbaijan is made up of 14 'economic regions' (see Figure 3.1), which contain 78 towns, 14 urban districts, 261 settlements, 1,726 rural administrative divisions and 4,248 rural settlements (FAO, 2022). In July 2021, by presidential decree, the country's economic regions were reconfigured to enhance the economic development of the country following the liberation of territories from a three decades long occupation.

Governance

Azerbaijan is a republic with a presidential form of government, where the President serves as both the head of state and head of government. The Constitution of Azerbaijan states that there are three branches of power – executive, legislative and judicial.

Local governance

Azerbaijan has undertaken efforts to decentralise governance, aiming to empower local authorities and enhance their capacity to address local issues. Key elements of local governance are outlined below:

- **Municipalities:** are responsible for managing local affairs, providing public services, and implementing development projects at the community level. Municipalities are composed of elected representatives who serve on municipal councils.
- At the district and city levels, local executive authorities are responsible for implementing state policies and decisions.
- **Participation and Engagement:** Public participation and engagement in local governance are encouraged. Local residents have the opportunity to voice their concerns, participate in decision-making processes, and contribute to the development of their communities, by means of 'public discussions' (Council of Europe, 2018).
- **Local Development Initiatives:** Local governance structures, such as relevant state bodies and civil society organisations, are involved in planning and implementing development projects to address the specific needs of their communities. This includes infrastructure development, social programs, and initiatives to improve the quality of life for residents.

5.4.2.2 Demographics

At the time of writing, the population of Azerbaijan is estimated to be 10.13 million (UNFPA, 2023). The population growth rate, which is 0.91%, has decreased year on year since 2015, and the trend is expected to continue until the population is expected to plateau around 2045. The fertility rate in Azerbaijan is 2.08 births per woman, just below the population replacement level of 2.1 (World Population Review, 2023).

The majority of Azerbaijan's urban population resides in the capital, Baku. Just under half of the population (47%) lives in rural areas. The sex ratio at birth is 1.126 to 1 (male births to female births) (World Bank, 2022b). The life expectancy in 2020 was 75.3 for females and 70.3 for males.

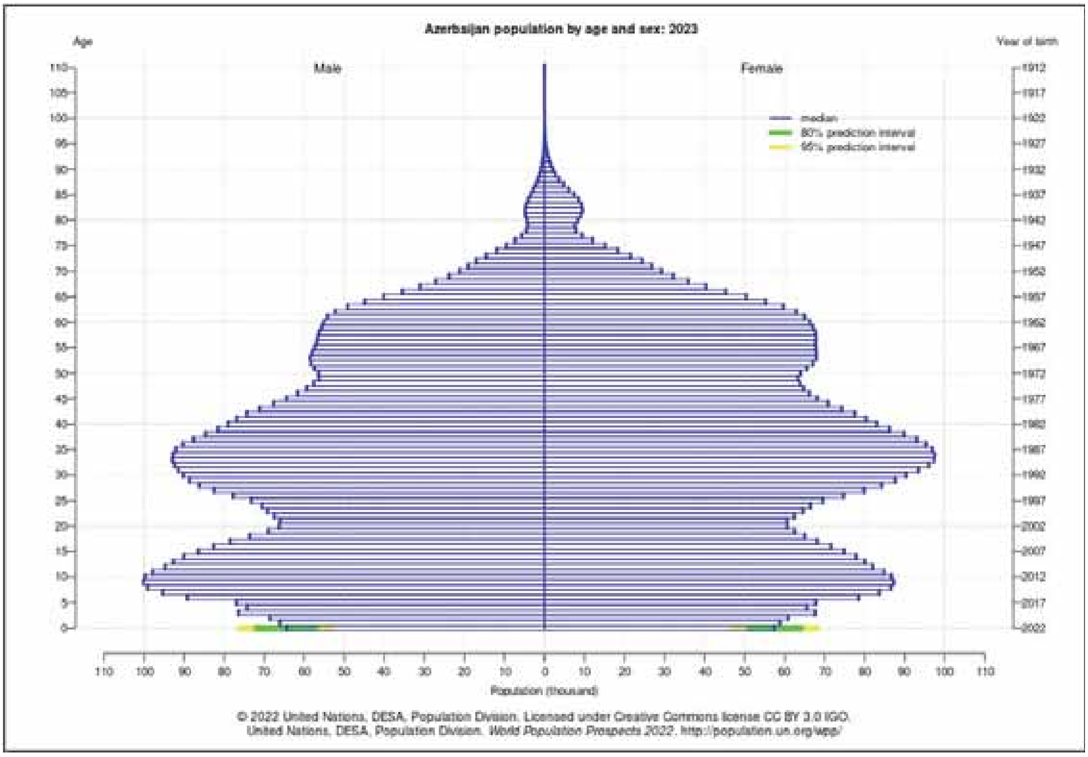


Figure 5.26: Population structure of Azerbaijan, disaggregated by sex

Source: UN (2022b)

The population in Azerbaijan remains relatively 'youthful'. The majority of the population is aged between 30 and 40 years old, followed by those aged between 5 and 15 years old. A significant proportion are aged between 50 and 60 years old (see Figure 5.26). The country has been experiencing greater longevity and a decrease in birth rates, which has led to an increase in the share of the older population (Zaidi and Um, 2021). The proportion of older people (aged 60+) reached 11.6% in 2020 (UN, 2019).

Ethnicity and religion

Azerbaijan's population is diverse, with a blend of ethnicities, languages, and cultures. Azerbaijani is the official language and is spoken by the majority of the population. Russian, English and other languages are also spoken, reflecting the country's historical ties and global influences.

Islam is the predominant religion in Azerbaijan. The majority of Azerbaijanis adhere to Shia Islam. However, there is also a Sunni Muslim minority in the country. In addition to Islam, there are other religious minorities in Azerbaijan, such as Christians and Jews. The government supports a secular society where various religious groups can peacefully coexist.

Migration

The pace of internal migration for labour is increasing, and includes migration between regions, within regions and from rural to urban areas (Social Research Center (STM), 2020 in FAO, 2022). The average age of labour migrants is 23, indicating that the movement away from villages is mainly a trend among young jobseekers (FAO, 2022).

Vulnerable groups

A number of vulnerable groups were identified in Azerbaijan, including:

- **Women**: Multiple factors contribute to women's vulnerability in Azerbaijan. These include:
    - social norms, which limit women's access to education and employment.
    - the prevalence of gender-based violence which undermines women's health, well-being, and autonomy.
    - gaps in national laws, policies, and institutional mechanisms restricting women's rights and opportunities, affecting women's mobility and the unequal distribution of inheritance (UN, 2022a).
- **Youth:** Youths are reported to be vulnerable, as they have limited access to productive assets (such as land or capital) and many lack vocational skills. Youth unemployment and underemployment are recognised as challenges. The government has recently developed and implemented a national strategy, the Azerbaijani Youth Development Strategy for 2015-2025.
- **Persons with disabilities**: People with disabilities (PWD) are estimated at 6.2% of the total population. PWD represent one of the largest vulnerable groups in Azerbaijan. Azerbaijan ratified the Convention on the Rights of Persons with Disabilities) and its Optional Protocol in January 2009. Over the past decade, the government has invested in improving social protection and delivery of special services for the PWDs, including medical rehabilitation, access to public space, transport, and sport facilities.
- **Internally displaced peoples**: The government recognises IDP as a vulnerable group under its commitment to "leave no one behind" in implementing the 2030 Agenda (FAO, 2022).
    - In 2020, an estimated 650,000 people were classified as IDP in Azerbaijan, primarily former residents of the Armenian occupied Garabagh region of Azerbaijan including the seven surrounding territories. .
    - IDP in rural areas are highly dependent on seasonal agriculture as one of the few available forms of employment. IDP communities generally fare worse than the local host communities in terms of housing and infrastructure conditions, access to health care and social connections (FAO, 2022).
    - Women among rural IDP communities are particularly vulnerable (Special Rapporteur on the human rights of internally displaced persons, 2015 - (FAO, 2022)). Since the 2015 report was issued, the government has further enhanced measures to monitor and act on gender violence and violence against children, protecting victims and providing the relevant assistance. The project 'Early Recovery and Community Resilience for the Most Vulnerable in Fuzuli-Horadiz, Aghjabadi and Tartar regions of Azerbaijan' was implemented in cooperation with United Nations Development Programme (UNDP) to improve the wellbeing of women and girls and identify the essential necessities of communities affected by war, facilitated by establishing Community Resource Hubs in the three districts (OHCHR, 2022).

- There has been an effective humanitarian response to internal displacement in Azerbaijan, with the government dedicating approximately USD 5.5 billion for assistance to IDPs since the early 2000s (Special Rapporteur on the human rights of internally displaced persons, 2015). The government has allocated special benefits to IDPs, including temporary housing, subsidised utilities, educational support, employment support, assistance to access medical treatment, tax exemptions and fee waivers for certain administrative procedures (FAO, 2022).

Human development

Azerbaijan's human development index (HDI) value for 2021 was 0.745, putting it at 91 out of 191 countries and territories. However, when adjusted for inequality, the HDI fell to 0.685. From 1990 to 2019, the HDI value for Azerbaijan increased by 25.2% (UNDP, 2020d). The Gender Inequality Index, which measures gender inequalities in reproductive health, empowerment, and labour, showed a value of 0.294, ranking the country 70 out of 170 countries. The values for Azerbaijan are just below the average value for European and Central Asian countries combined (UNDP, 2020d).

Although Azerbaijan is expected to make considerable progress in achieving the sustainable development goals (SDGs), the UN has noted that serious development challenges remain, including "ongoing gender, socioeconomic and spatial disparities between regions and urban and rural communities; challenges to [accessing] quality services in agriculture, education, health and justice; demographic and labour market challenges; and environmental and conservation threats" (United Nations and the Government of Azerbaijan, 2021).

5.4.2.3 Health

Azerbaijan has made significant progress over the past 15 years on key health indicators including life expectancy, maternal mortality, and infant mortality.

Key information related to Azerbaijan's health sector is presented in Table 5.15 below.

Table 5.15: Key information related to Azerbaijan's health sector

Component	Key information
Public health system	The Ministry of Health (MoH) is the central authority responsible for healthcare policies and regulations in Azerbaijan. The healthcare system is currently in the process of large-scale reform as a result of which the majority of medical services were transferred to State Agency on Mandatory Health Insurance (TABIB) financing, though certain facilities continue to be financed by MoH (Ismayilov, 2022).
Healthcare infrastructure	Azerbaijan has a network of healthcare facilities, including hospitals, clinics, and medical centres, both in urban and rural areas. The current system generally consists of a set of primary, secondary and tertiary healthcare facilities. While tertiary level care is concentrated mainly in Baku, the secondary level is located in all districts and cities across the country, and primary healthcare has the widest network, including medical/doctoral points in villages, ambulatories and policlinics (child and adult).

Component	Key information
Health insurance	People from socially vulnerable groups face difficulties accessing health care. TABIB was established to attempt to implement mandatory health insurance in Azerbaijan. The goal is to ensure that all citizens have access to essential healthcare services.
Primary healthcare	Primary healthcare services are provided through a network of community clinics and healthcare centres. Emphasis has been placed on preventive care and early detection of diseases through primary healthcare services.
Specialised medical services	Specialised medical services are available in hospitals and clinics of regional centres across the country but are limited in smaller villages. This includes services in various medical specialities such as cardiology, oncology, surgery, and paediatrics.
Health programmes and initiatives	The government (often in collaboration with other organisations) has implemented various health programs and initiatives to address specific health issues, including maternal and child health, infectious diseases, and non-communicable diseases (UNICEF, 2022a).
International cooperation	Azerbaijan collaborates with international organisations and partners to enhance its healthcare system. This includes participation in global health initiatives and receiving support for healthcare projects through organisations such as the World Health Organization (WHO).

National health concerns

Non communicable diseases

The mortality rate for non communicable diseases among the population aged 30–70 years is 22% in Azerbaijan. Most deaths are due to diabetes, hypertension, obesity and smoking-related illnesses. (UN, 2022a).

Maternal and child health

Azerbaijan’s maternal mortality rate was 41 deaths per 100,000 live births in 2020 (UNICEF, 2022b). In 2021, neonatal mortality and under-five mortality rates were 10 deaths per 1,000 and 19 deaths per 1000 live births respectively (UNICEF, 2022b). Maternal mortality ratio is triple in the rural areas with 27.3 per 100,000 live births vs 7.4 in urban areas.

Nutrition and food security

Malnutrition, anaemia, and obesity remain significant public health issues in the country, particularly among children and women (FAO, 2022). To address this, the UN continues to provide technical assistance, funding, and expertise to help the government address these challenges and improve nutrition outcomes for its citizens.

Mental health

According to UNFPA approximately 15.1% of men, and about 32.5% of women screened positively for depression in a study on health and gender equality in Azerbaijan (UNFPA, 2018).

Road safety

In 2020, Azerbaijan had the 5th highest road crash fatality rate in the Eastern Partnership (EaP) region, with 6.91 fatalities per 100,000 inhabitants, and the 8th highest fatality rate in the European Union-17 (EU-27) (World Bank Group and Eastern Partnership, 2021).

5.4.2.4 Education

Free compulsory primary and secondary education is available to all children. The Ministry of Science and Education is the central executive body that implements and regulates the government's education policy and manages the education processes.

Azerbaijan has moderate levels of educational attainment among its adult population. In 2019 the majority of adults (aged 25–64) had a secondary-level education (76.4%), while 16.6% had completed higher education and 7.1% had primary education or lower secondary education. The reported literacy rate is very high, at 99.8%.

The education system in Azerbaijan is organised around three main levels: primary, secondary and higher education. Higher education in Azerbaijan includes universities and other tertiary institutions.

The total number of students in the country has been increasing, reaching 2.033 million in the 2019– 2020 academic year. Enrolment statistics for the 2020/2021 academic year are shown in Figure 5.27. According to available statistics, there are 4,427 primary and secondary schools in Azerbaijan. Of these, 900 are in a state of disrepair, either requiring significant renovation or full reconstruction (UNICEF, 2019).

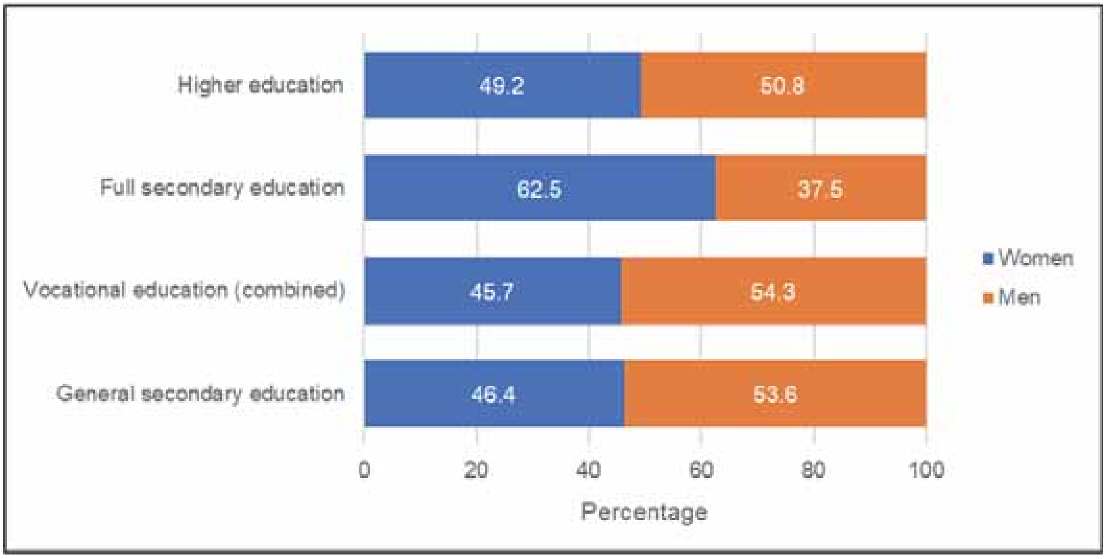


Figure 5.27: Enrolment in the 2020/2021 academic year, by type of educational institution and sex

Gender

Girls tend to stay in general education after Grade 9 and represent a minority of students in technical and vocational education and training.

Vocational training that prepares students for skilled manual labour is seen as mainly a “male” training context. There are also clear gendered patterns in educational choices after compulsory education to “female” professions, such as teaching, health care and social services. These subjects prepare students for public sector work that tends towards low pay but also to greater social protections that help women reconcile work with family duties.

Women represent a relatively high proportion of higher education graduates in the fields of science, technology, engineering and mathematics , but they also encounter barriers to advancing their careers in these fields (FAO, 2022).

5.4.2.5 Economy and livelihoods

The economy expanded by 4.6% in 2022. While the energy sector contracted by 2.7% from the previous year, non-energy sectors grew by 9.1% in comparison to 2021. Among the main drivers of growth were tourism, accommodation and public catering, transport and warehousing, information and communications, and construction. The surge in global energy prices has boosted external revenues and boosted the country’s foreign exchange reserves and fiscal buffers (UN, 2022a).

Effective as of 1 January 2023, the government introduced a series of fiscal policy measures, including the increase of the minimum wage, pensions, and subsistence minimum, in order to limit the impact of higher prices on vulnerable groups. Despite gross domestic product (GDP) growth and solid fiscal buffers, Azerbaijan’s economic transition performance is lagging behind the regional average, especially in resilience and competitiveness, as noted in the transition quality report of the European Bank for Reconstruction and Development (EBRD, 2023).

Despite the collapse in global oil prices in 2020, Azerbaijan’s economy remains heavily dependent on oil revenues, and the government is committed to diversifying revenues while improving the efficiency of public spending. The 2020 economic lockdown resulting from the COVID-19 pandemic undermined growth, reduced fiscal resources, increased levels of unemployment, and disrupted essential public and social services. Meanwhile, containment measures introduced by the government and fear of contagion weakened consumer demand, particularly in the tourism, hospitality, and retail sectors.

Information about key economic sectors is outlined below.

- **Oil and gas:** Azerbaijan is a significant player in the oil and gas sector, with extensive operations in the Caspian Sea. This industry has been a major driver of the country’s economy, contributing significantly to its revenue and energy production.
- **Agriculture:** Agriculture is a crucial sector in Azerbaijan, providing employment opportunities and contributing to food security. The country’s diverse climatic zones allow for the cultivation of a wide variety of crops and agricultural products.
- **Tourism:** Azerbaijan is actively developing its tourism sector, capitalising on its cultural heritage, natural landscapes, and historical sites. Baku, the capital city, has emerged as a prominent tourist destination.

- **Construction and real estate:** The construction industry has experienced substantial growth, driven by infrastructure development projects and investments in both residential and commercial real estate properties.
- **Services and trade:** The services sector, encompassing areas like retail, finance and telecommunications, plays a vital role in Azerbaijan's economy. Domestic and international trade are essential components of the country's economic activity.
- **Transportation and logistics:** Azerbaijan's strategic location as a crossroads between Europe and Asia has led to significant investments in transportation and logistics infrastructure. Key projects include the Baku-Tbilisi-Ceyhan (BTC) oil pipeline, the Southern Gas Corridor (SGC) gas pipeline and the Baku-Tbilisi-Kars (BTK) railway.
- **Information technology:** The country is actively nurturing its information technology sector, with a focus on digitalisation and technological innovation. Baku is home to a growing number of tech startups, and government initiatives supporting the development of the IT industry.

Challenges

Access to agricultural resources and inputs

Farmers face difficulties such as inadequate agricultural extension and rural advisory services, and an inability to afford machinery and equipment. Women are mainly viewed as auxiliary workers, and are often overlooked as potential recipients of extension services. Furthermore, it is expected that men are the target of information about new technologies, practices and skills, and that they will share their knowledge with family members and farm employees. Women in rural areas also face mobility and time constraints that impede their ability to attend training activities unless these are considering women's particular circumstances.

Poverty

Poverty rates have declined in Azerbaijan, but within the overall positive trend, poverty rates are higher for the rural population as a whole and for women compared to men. Self-employment is the primary source of income for rural households, followed by agriculture and employment in equal measure. Rural households rely on benefits and social transfers to a greater extent than urban households. Households headed by women (mainly single older women or single mothers with dependent children) derive a considerable proportion of their income from social transfers or sources other than employment (such as remittances), putting them at greater risk of poverty.

Official poverty rates for particularly vulnerable groups (IDPs, refugees, ethnic minorities, older people, single parents, children and people with disabilities) are not available publicly in Azerbaijan, which complicates assessments of poverty risks for these segments of society. Each of these groups is especially vulnerable to poverty and social exclusion, and vulnerabilities are compounded for households in rural areas or households in which the head has a low education level (FAO, 2022).

Employment and economic activity

Analyses of the data before the COVID-19 pandemic indicate that Azerbaijan has a relatively high economically active population and a low unemployment rate (4.8% in 2019 with 5.7 % for women and 4.0% for men and 12.4 % for youth). Young women are more likely than men to be affected by vulnerable and marginal work (ETF, 2020).

5.4.2.6 Natural resource use

Ecosystem services

Ecosystem services in Azerbaijan are primarily based on resources from the following habitats:

- the Caspian Sea
- mountain ecosystems (including pastures)
- inland water ecosystems
- forest ecosystems.

The common drivers for the transformation and loss of biodiversity and ecosystem services include land degradation, habitat fragmentation, unsustainable use of natural resources, climate change and invasive alien species (NEA, 2020).

5.4.2.7 Land use and tenure

The laws related to land in Azerbaijan are primarily governed by the Land Code of the Republic of Azerbaijan, which was adopted in 1999.

- **Land ownership:** In Azerbaijan, land ownership is generally divided into state and private ownership. State-owned land includes land reserved for public use, defence, and other state purposes. Private ownership includes agricultural and non-agricultural land.
- **Land use rights:** Private individuals and legal entities can acquire the right to use land through ownership, lease, or other legal means. Land use rights may be subject to certain restrictions and conditions. Municipalities could have zoning regulations that determine the permissible land uses in different zones (e.g., residential, commercial, industrial).
- **Land transactions:** The Land Code regulates various aspects of land transactions, including the sale, lease, and exchange of land. Transactions may be subject to approval by relevant authorities, and there are provisions to prevent unauthorised land transactions.
- **Agricultural land:** Specific regulations govern the use and ownership of agricultural land. The government may impose restrictions on the use of agricultural land to ensure efficient agricultural practices and food security.
- **Land registration:** The Land Code establishes procedures for the registration of land rights. Registration is essential for legal recognition and protection of land rights.
- **Land taxation:** The government may impose land taxes or fees based on the type and purpose of land use. The amount and conditions of land taxation are specified by law.
- **Protection of ecologically important areas:** There are provisions in the Land Code aimed at protecting ecologically important areas. Certain lands may be designated for special protection to preserve biodiversity and prevent environmental degradation.

- **Ownership of land and farming practices:** The absence of sex-disaggregated records on landownership poses problems for determining women's representation as agricultural landowners. The World Bank estimates that women make up 42% of all registered landowners in Azerbaijan (World Bank Group, 2016). According to the most recent household budget survey, less than half of female-headed households are landowners compared with almost two-thirds of male-headed households.

Households with women heads tend to have smaller plots of land (one acre less) than households with male heads. Most of the land parcels are backyard plots or gardens, but male-headed households are slightly more likely to have land that is used for family farming. Although there are no legal barriers to women's landownership in Azerbaijan, in practice it is generally accepted that male family members inherit and manage land. Women often consent to land being granted to a male relative, or for parents to sell land shares and pass the income to their daughters (FAO, 2022).

5.4.2.8 Infrastructure and services

Electricity

Approximately 90% of energy produced in Azerbaijan comes from fossil fuel power stations with hydroelectric power plants (HPP) contributing to supply dependent on season and water availability. Azerbaijan is a major exporter and producer of both oil and gas, and most of its domestic electricity is generated by gas-fired power plants. Within Azerbaijan the greenhouse gas emissions per capita are around the world average, however that is not counting the oil and gas it exports (Ritchie, 2020).

The total production capacity of the country is 8,320 megawatt (MW) from; 22 thermal (6,633 MW); 46 hydroelectric (1,301.8 MW); one solid waste (37 MW); five wind (66.5 MW); nine solar (281.9 MW) and three hybrid power plants (0.7 MW). The total capacity generated from renewable energy sources (including hydroelectric) is 1,687.8 MW, which is approximately 20.3% of the total capacity. This is an increase from 7% in 2022

Electricity is distributed across urban centres by underground cables. Regional and urban distribution networks utilise self-supporting insulated cable lines and the remaining uninsulated 0.4 kW network will soon be replaced. Grid stabilisation presents a challenge within the country (key informant interview (KII) with Azerbaijan Renewable Energy Agency (AREA), 2023).

Water and sanitation

About 30% of water requirements in Azerbaijan is derived from rivers, 40% from lakes, 20% from reservoirs, and the remaining 10% from spring and groundwater sources. Mingachevir reservoir on the Kur River serves as a significant source of drinking water for the population.

Overall, the majority of water in Azerbaijan is used for agriculture and livestock (77%), followed by industry (19%) and municipalities (4%). Wastewater treatment plants are available in 16 cities and regions; most of them are partially or completely non-functional.

Solid waste disposal and management

Population growth, economic development and urbanisation are causing a surge in municipal solid waste (MSW) globally, including in Azerbaijan. Mismanagement of MSW poses significant health and environmental risks, including soil and water pollution, water-borne diseases, and methane emissions. Uncontrolled waste burning is often seen. Azerbaijan is investing in waste management infrastructure, like sanitary landfills and waste treatment facilities. However, illegal dumping remains a problem, especially in rural areas.

Recycling initiatives are emerging in some urban areas but face challenges due to limited infrastructure and public awareness.

The private sector's involvement in waste management began in 2017, offering incentives for environmentally friendly technologies. However, challenges include fragmented processes, conflicts of interest, and insufficient infrastructure (IDD, 2023).

Transport services

Azerbaijan has a well-established transportation infrastructure, covering air, rail, road, maritime, and pipelines. It is a vital logistics hub connecting Europe to Central Asia, the Middle East, and the Far East. Notably, it serves as a key point on the transport corridors like TRACECA (Transport Corridor Europe-Caucasus-Asia) and the North-South routes that link the Black Sea to the Caspian Sea.

The Shukurbayli-Jabrayil-Hadrut highway passes through Khojavand, Fuzuli, and Jabrayil districts. The highway covers about 20 settlements in the region, including the Hadrut settlement and Jabrayil City (Caliber.Az, 2023).

Azerbaijan was ranked 36th out of 137 countries in the Global Competitiveness Index for the quality and extensiveness of its road infrastructure. There are ongoing efforts to modernise and expand all types of roads through rehabilitation and extensions (WEF, 2017).

Telecommunications infrastructure, communications facilities and capacities

Telecommunications in Azerbaijan cover various services such as phones, internet, radio and TV. The Ministry of Digital Development and Transportation, as well as being an operator through its role in Aztelekom, is both a policymaker and a regulator (EBRD, 2022).

Azerbaijan is focusing on Information and Communications Technology (ICT) as a key sector for economic diversification. The government has set up technology parks across the country, offering incentives to companies. The Government is also investing in ICT to create 'smart villages' in recently liberated territories. 'Smart villages' refer to a concept ostensibly intended to boost the rural economy through high-speed Internet access, green technology, and the digitisation of many aspects of life, including interaction with the government.

5.4.2.9 Worker's rights and labour practices

Information about worker's rights and labour practices (according to the Labour Code of Azerbaijan) are outlined in Table 5.16.

Table 5.16: Key information about worker's rights and working practices

Component	Key information
Working Hours	The standard working week is 40 hours, typically spread over five working days. Overtime work is subject to specific regulations, and employees are entitled to additional compensation for working beyond regular hours.
Minimum Wage	Azerbaijan has a minimum wage, and employers are required to pay their employees at least the minimum wage set by the Government.
Leave Entitlements	Workers are entitled to annual paid leave, and the duration may vary depending on factors such as the length of service. Maternity leave is also provided for pregnant employees. Paternity leave is also provided, however for a maximum length of 14 days.
Health and Safety	Employers are obliged to provide a safe and healthy working environment for their employees. There are regulations in place to ensure workplace safety, and employees have the right to refuse to work in unsafe conditions.
Social Security and Benefits	Azerbaijan has a social security system that covers various benefits, including health care and pensions. Employers and employees contribute to this system.
Discrimination and Harassment	The Labor Code prohibits discrimination and harassment in the workplace based on factors such as gender, race, religion, and disability.
Termination of Employment	The Labor Code outlines the procedures and grounds for the termination of employment contracts. Employees are generally entitled to receive notice or compensation in case of termination.

Source: the Labor Code of Azerbaijan (1999)

5.4.2.10 Community safety, security and welfare

Ordnance

There are a significant number of landmines and ERW remaining within the formerly occupied regions, posing a serious threat to the safety of communities in the affected areas. The UN continues to work with the government to build capacities to clear landmines and ERW, and educate local communities on ERW risk. The capacity of ANAMA was enhanced in terms of information management, including recent and historic mine and victim location data, usage of satellite imagery, remote sensing data and drones (UN, 2022a).

Gender based violence

An estimated quarter of women and girls in rural and urban areas of Azerbaijan have experienced either physical, sexual or emotional violence in their lifetimes. The Government has made fundamental changes to the national legislation; and a legal framework, special mechanisms and coordinated programmes with other government agencies have been established in order to eliminate violence against women[13] (OCHCR, 2022). Some services, such as a national telephone hotline established in 2020, are accessible throughout the country. However, critical specialised services, including temporary shelters for victims of violence, remain insufficient and lacking in rural communities (FAO, 2022).

5.4.3 Socioeconomic Baseline: Local Level

5.4.3.1 Project location

The project is located in the Jabrayil district, approximately 6 km south of Jabrayil City. The region takes its name from the name of an 8th century ruler, but the remnants of the numerous monuments, caves, castles, towers and worshipping sites located in the region date its history back to much earlier times. Jabrayil was occupied by Armenian armed forces in October 1993 and liberated from the occupation by Azerbaijan armed forces in October 2020. The Jabrayil district is bordered to the north by Khojavend district, to the east by Fuzuli district, to the west by the Qubadli and Zangilan districts and to the south by Iran. Jabrayil is approximately 338 km from Baku. The population of the Jabrayil district is Turkic-speaking people as is the population of Garabagh.

5.4.3.2 Local social receptors

As outlined in Section 5.4.1.1, the key social receptors in the primary AOI include:

- the project site (northern and southern cluster)
- local settlements and local population
- the Horadiz–Jabrayil–Zangilan–Aghband highway
- economic/industrial developments (Araz Valley Economic Zone Industrial Park)
- the town of Horadiz.

These are discussed in more detail below.

5.4.3.3 Project site

The typical landscape around the project site is illustrated in Figure 5.28.

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[13] This includes; approval of The National Action Plan to Combat Domestic Violence for 2020-2023; The National Action Plan for 2022-2025 for the Implementation of UN Security Council Resolution 1325 on Women, Peace and Security in the Republic of Azerbaijan was approved by the Decree of the President of the Republic of Azerbaijan No. 1294 dated March 6, 2021.

Figure 5.28: Landscape around project site, Jabrayil district

The land in the study area is state-owned, i.e., reserved for public use, defence or other state purposes.

As shown in Figure 5.28, the land is not currently cultivated, and all former agricultural land has been abandoned due to the occupation. There are no residential, commercial or public buildings in the area.

Explosive remnants of war and landmines

As outlined in Section 5.4.2.10, landmines and ERW pose a threat in Azerbaijan, including in the study area. Contamination from anti-personnel mines is also a risk. Since the ceasefire in November 2020 and up to 6 October 2023, ANAMA has recorded 329 casualties in the formerly occupied territories as a result of ERW incidents (Azertac, 2023).

ANAMA have undertaken significant mine-clearing operations. According to ANAMA, between November 2020 and 5 October 2023, 1,004,678 m^2 were cleared from mines and ERW with 95,638 units detected (Azertac, 2023). The project sites were surveyed and cleared of ERW in 2023 (as described in Section 3.1.3).

Efforts to demine the area are ongoing, however the demining process in the region is slow due to the scattered and randomised location of mines and explosive munitions. All areas that are reported clean of munitions and mines are marked clearly with signs. Uncleared areas outside of the cleared area are also clearly marked with signs of no entry. According to ANAMA, it is highly likely demining process will take years before the area would be considered safe for independent movement.

Additionally, the quality of land, which has been heavily degraded by mines and ERW for decades, has suffered: wherever they are scattered, mines outlive their legitimate military objective and will continue to contaminate the environment for decades to come, with large tracts of land becoming uncultivatable and uninhabitable (ReliefWeb, 2023).

5.4.3.4 Local settlements and local population

Both recent and historic conflict has played an important role in shaping the contemporary demographic profile of south-west Azerbaijan. The majority of the towns and villages within the districts of Fuzuli, Jabrayil, Zangilan, Qubadli, Aghdam, Kalbajar, and Lachin were occupied by the Armenian armed forces with the local population expelled during the first Garabagh war (1988 – 1994). The occupied territories included the Garabagh region of Azerbaijan and the seven adjacent Azerbaijani regions.

The districts were liberated and returned to Azerbaijan's control in 2020, in the wake of the second Garabagh war. However, at the time of writing, there is no civilian population in most towns, villages and areas within the districts, including Jabrayil City, which is the closest settlement to the project site.

Jabrayil City currently hosts military personnel, representatives from ANAMA and construction workers involved with the government's Post-Conflict Construction Plan (PCCP)[14]. These are temporary residents who are accommodated in workforce accommodation facilities. It is the intention of the Government of Azerbaijan to repatriate displaced civilian communities and former residents to the city as part of the 'State Program on the Great Return'[15] (President of the Republic of Azerbaijan, 2022a). The State Committee on Urban Development and Architecture's (ArxKom) general plan for development of the Jabrayil district includes an initial stage of development (up to 2026). During this stage reconstruction works and the resettlement of Jabrayil City and the villages of Shukurbayli, Horovlu, Sarijanli, Mashanli, Boyuk Marcanli, Karkhulu, Cocuq Marcanli and Mehdili are planned. The MENR have also communicated during stakeholder engagement meetings that the villages of Hajili and Minbashili should be considered in the ESIA (KII with MENR, 2023).

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[14] Following extensive mine-clearing operations, the Government of Azerbaijan has developed a Post-Conflict Construction Plan (PCCP) for the East Zangezur Economic Region. At present, plans are underway to transform the region into a SMART zone; restore and redevelop settlements; revitalise the economy and build physical and social infrastructure in the liberated territories. The aim is to return and resettle populations to Jabrayil City, and other villages in the district that were evacuated during the former occupation of the region and remain unoccupied today.

[15] The State Program on the Great Return to the territories liberated from occupation of the Republic of Azerbaijan, Decree of the President of the Republic of Azerbaijan, presents several large infrastructure-related target projects between 2022 and 2026, a number of which are already under way. For example, the road connecting Horadiz to Jabrayil to Zangilan, to be completed by 2025; housing, public buildings, educational institutions and electricity and internet infrastructure in the Jabrayil district; and irrigation infrastructure for agricultural activities.

The closest settlement with a civilian resident population is Horadiz, which is located in the neighbouring Fuzuli district, approximately 40 km east from the project site. At the time of writing, the population of Horadiz is approximately 7,000 people.

Horadiz has functioning social infrastructure and services, including a healthcare facility, a school and various commercial enterprises. It is likely that some of the project workforce will be accommodated in guesthouses (or similar) in Horadiz.

5.4.3.5 The Horadiz-Jabrayil-Zangilan-Aghband highway

At the time of writing, the Horadiz–Jabrayil–Zangilan–Aghband (Zangezur Corridor) highway is under construction. The road starts from Fuzuli's Ahmadbayli village (see Figure 5.1) and has a total length of 123.6 kilometres (km).

The completion of the project was estimated at 57% in August 2022 (AZERNEWS, 2022). The State Program on the Great Return suggests this project will be completed by 2025 (President of the Republic of Azerbaijan, 2022a).

The road will serve the future populations in the district and wider region, and improve the quality of the urban environment. As the road will be newly constructed, conditions of the road are expected to be good.

Road construction is being undertaken by Kalyon Holding, who have a fleet of approximately 300 trucks. Kalyon Holding employ approximately 3,000 people including truck drivers, domestic and support staff, and operators. 70% of workforce is considered ‘local’ (i.e., from the region). Workers are accommodated in four temporary accommodation facilities close to the construction areas (see Figure 5.29).

Project-related traffic during the construction phase will represent an increase in the number of vehicles on the road. As there are currently no communities using the road network, this is unlikely to pose a significant risk to local populations, however there are risks of increased road traffic accidents (RTAs) between project staff and construction workers.

RTAs constitute a public health challenge in Azerbaijan. Stakeholders have raised concerns about potential issues in terms of risks for personnel working on the road construction. During KII it was reported that pilot projects and infrastructure development projects are also being developed concurrently which is increasing pressure on the network and the risk of RTAs.

Figure 5.29: Temporary accommodation for motorway construction workforce

Source: Lightsource bp (May 2023)

5.4.3.6 Economic/industrial developments

Prior to the occupation and the expulsion of settlements by Armenian armed forces, the main branch of the economy in the Jabrayil district was agriculture (wine-production, tobacco-growing, livestock farming, and grain-growing). There was a livestock feed lot, as well as poultry farms and sericulture enterprises. Carpet weaving occupied an important place in local industry. The district hosted a grape-processing factory and a bakery, as well as enterprises for repairing agricultural machinery (ISSC, 2010).

Future development within the Jabrayil district will be based around logistics, green energy and agriculture.

Araz Valley Economic Zone Industrial Park

The Araz Valley Economic Zone Industrial Park covers a 200- ha area and is located approximately 2 km south of the project site (see Figure 5.1).

The park has already been constructed and at the time of writing, is being used by organisations, mainly for warehouse storage, although it is still largely unoccupied at present. The park currently employs 40 local staff. In future, it will be divided into agricultural processing, industrial, social and technical zones. Plans are in place to create a logistics and trade centre, warehouse complexes, wholesale and retail facilities, customs, refuelling stations, car maintenance areas and other equipment repair stations.

In October 2022, the construction of an electrical substation with a capacity of 40 MVA and an administrative building had begun in the Industrial Park (Ministry of Economy of the Republic of Azerbaijan, 2022).

Horadiz

Health

At the time of writing, primary health care (PHC) in the study area is provided at Horadiz Clinic and Bala Bahmanli Clinic (located in Fuzuli district) (ISSC, 2010). Secondary health care (SHC) is currently available at Fuzuli central hospital.

Horadiz clinic provides free, basic PHC. This includes general care and treatment, screening via in-patient and out-patient services, emergency services, maternity services, pharmacy, immunisations, basic dental services and basic monitoring services. The clinic has 20 rooms and is sufficient to cater for the current population. 46 staff, 14 clinical staff (including doctors, nurses and midwife) and 22 domestic staff (cleaning staff and security personnel) work at the clinic.

As part of the PCCP, new healthcare facilities will be developed, including the Jabrayil District Central Hospital which will be established in the southern part of Jabrayil City and will provide SHC to residents. The 150-bed hospital will have an infectious diseases unit and several technical buildings.

Health concerns

The key health concerns reported in Horadiz include:

- acute viruses
- colds
- diabetes
- heart disease
- mental illnesses.

Mental health is a major concern in areas affected by conflict. This was reported as a key health issue in Horadiz, where impacts of the occupation and war have reportedly increased the occurrence of post-traumatic stress disorders. Some patients reportedly struggle with lack of sleep, fear of violence, and inability to concentrate.

Gender based violence is reportedly not an issue in Horadiz.

Water and sanitation diseases were not reported. Water supply and quality is adequate and sanitation facilities are good.

5.4.3.7 Educational facilities

The Minister of Science and Education has reported that there are 550 students and 84 teaching staff in 7 educational institutions in the Shusha, Fuzuli, Zangilan, Lachin districts, and the Talish and Sugovushan villages of the Tartar district as part of the State Program of the Great Return, with schools to be opened in Aghdam, Jabrayil and Kalbajar districts within the next academic year (Xalq qezeti, 2023).

A 960 seat secondary school opened in Shusha in November 2023. Construction of a vocational school and college is also progressing in the city (Ministry of Science and Education, 2023). Garabagh University will be opened in Khankendi in 2024, accommodating 800 – 1000 students and 30 – 40 academic staff (News.az, 2023).

Within Jabrayil district construction of a school in Soltanli has commenced, as a gift from the Hungarian government (Trend, 2023) and the government has allocated 500,000 AZN to the Ministry of Science and Education for the design and construction of Mehdi Mehdizade secondary school with a capacity of 960 students in Jabrayil City (AZTV, 2023). Construction of Mehdi Mehdizade school commenced in October 2021 (President of the Republic of Azerbaijan, 2023).

5.4.3.8 Electricity infrastructure

The liberated territories have been fully integrated into Azerbaijan’s transmission and distribution grid system. While electricity is not currently produced in Jabrayil district, two HPPs with a total installed capacity of 280 MW (Khudafarin and Giz Galasi) are under construction and due to be completed within a short period of time.

As there is no settlement yet within the liberated territories the number of households connected to the network is currently zero. The electrical infrastructure needed to supply the resettled towns will be established before each household returns.

The main challenge to the electrical network at both national and local level is grid stabilisation (KII with AREA, 2023).

5.4.4 Tangible and Intangible Cultural Heritage

TCH is defined as moveable or immovable objects, sites, structures, or groups of structures having archaeological, palaeontological, historical, cultural, artistic, and religious values (IFC 2012).

Intangible cultural heritage (ICH) is defined as cultural resources, knowledge, innovations and practices of local communities embodying traditional lifestyles (IFC 2012).

Cultural heritage provides continuity between tangible and intangible forms and between the past, present and future. People identify with cultural heritage as a reflection and expression of their constantly evolving values, beliefs, knowledge and traditions. Cultural heritage, in its many manifestations, is important as a source of valuable scientific and historical information, as an economic and social asset for development, and as an integral part of people’s cultural identity and practice’ (World Bank 2017).

5.4.4.1 Data analysis and considerations

Data for TCH and ICH were collected from a study area boundary that is 2 km from the project area boundary of the northern and southern clusters.

All cultural heritage features identified during the field surveys were recorded in a geographical information system (GIS) to identify their positions relative to the tangible and intangible cultural heritage AOI. Sites outside the 2 km wide zone were excluded from the data analysis. The remaining cultural heritage features were then classified into two categories:

- Category 1 – tangible cultural heritage:
    - archaeological sites
    - areas of high archaeological potential

- Category 2 – tangible cultural heritage with strong intangible elements:
  - o cemeteries and graves

The desk-based assessment and tangible field survey provided information to identify and describe the Category 1 and 2 cultural heritage features in the AOI. There is confidence that the full range of types of features have been identified for Category 1 and 2.

The collected baseline data is sufficient to:

- define the types of cultural heritage features in each of the two categories that may be found in the project area
- complete the impact assessment
- guide the preconstruction programme required to help identify areas with a high potential for additional cultural heritage features in sections of the project area not covered during the surveys
- identify the mitigation measures for cultural heritage assets that are encountered during construction.

The tangible cultural heritage field survey report is provided in Appendix 2g.

Limitations

Nearly all secondary data sources refer to the results of work before about 1990. No fieldwork has been undertaken by Azerbaijani archaeologists in the intervening years due to the occupation of the territories. The condition of cultural heritage features referred to in earlier studies is not currently known because of the occupation.

5.4.4.2 Historical background

Archaeology in Azerbaijan has a long and distinguished history dating back to the second half of the nineteenth century, as described in Appendix 2h. The establishment of the Museum of the History of Azerbaijan in 1920 gave a considerable boost to archaeological studies, as did the foundation of the Academy of Sciences in 1945. The Institute of Archaeology, Ethnography and Anthropology of the Academy of Sciences now has responsibility for archaeological investigations in the country as well as curatorial authority with the Ministry of Culture over the archaeological resource.

The Law on the Protection of Historical and Cultural Monuments 1998 provides a strong regulatory framework and requires that archaeological studies are conducted before construction works in areas with archaeological significance. Encouragement of clearly defined and applied standards and consistency of excavation and recording techniques between different researchers is a long-term aim of all cultural heritage work in Azerbaijan.

5.4.4.3 Tangible cultural heritage features identified within the study boundary

Within the 2 km-wide study boundary, 14 cultural heritage features were identified during the tangible and intangible cultural heritage field survey that fall in Category 1 and 2 (see Section 5.4.4.1):

- six within the project footprint (inside)
- two within 100 m of the project area and may be susceptible to some form of impact (close)
- six beyond the area expected to be affected (outside).

Table 5.17: Tangible and intangible cultural heritage features within the study boundary

Type	Source	No.
Tangible cultural heritage	Tangible cultural heritage field survey	4
Cemetery	Secondary data, tangible cultural heritage field survey	2
Structure	Tangible cultural heritage field survey	8
Total		**14**

The location of these sites are shown in Figure 5.30.

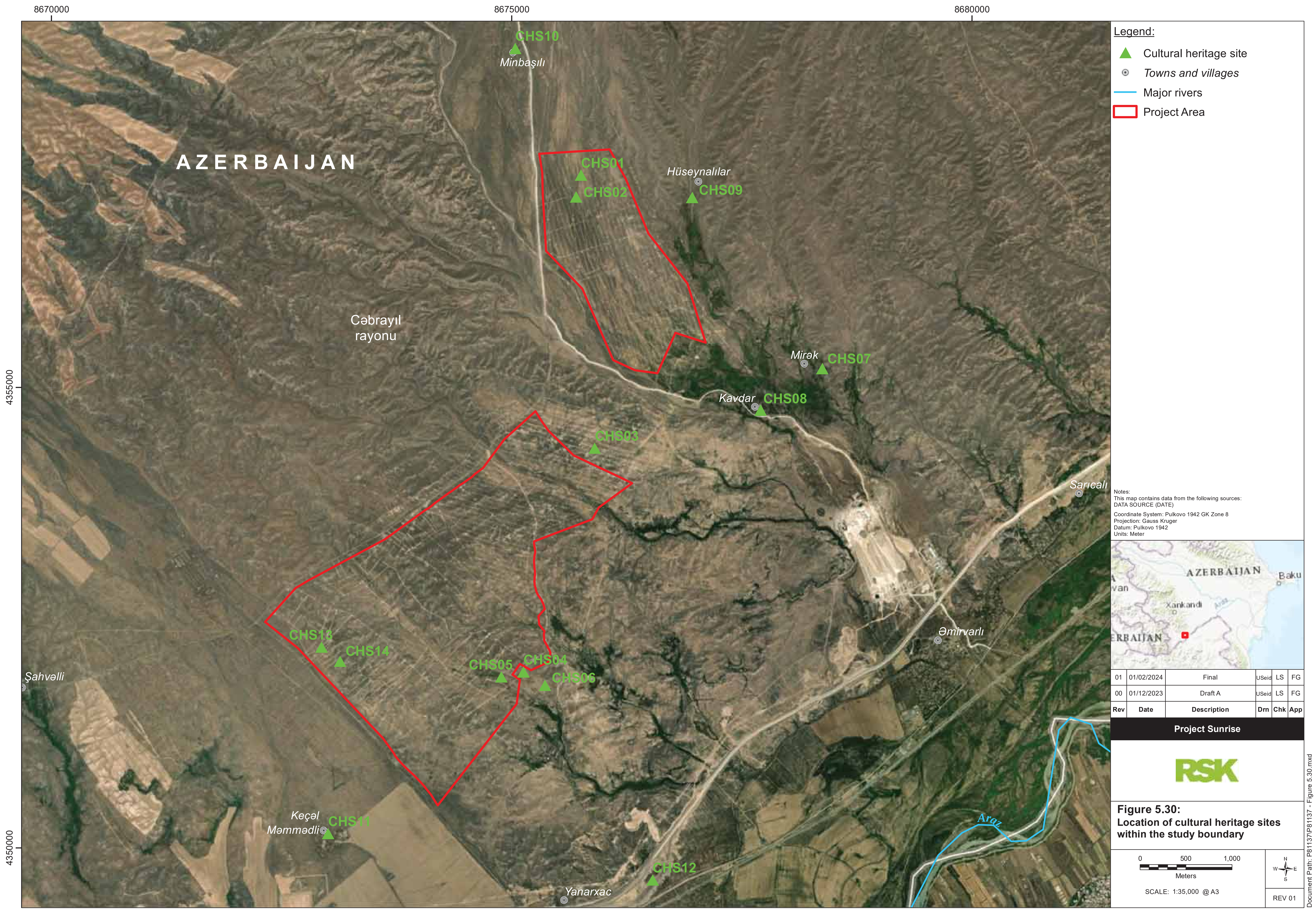


Figure 5.30:
Location of cultural heritage sites within the study boundary

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

From the baseline data collected the following cultural heritage features could be identified for Categories 1 and 2 see summary below and Table 5.18 at the end of this section.

Category 1:

- Sites with pottery remnants - the cultural heritage field survey identified sites with pottery lying on the ground surface (see Figure 5.31)
- Sites with stone tools - during the field survey a number of sites with evidence of stone tools were found. All are thought to be of Stone Age date.
- Over-wintering transhumance sites - the field survey identified the location of a former over-wintering site, used as part of the transhumant stock raising economy. The extent of this area can be seen from satellite images. Other similar areas may exist but could be confused with military fortifications built by the Armenian army.
- Derelict villages – Within the 2 km boundary surrounding the project area are a number of derelict villages, residents of which were expelled in the 1990's. These are identified by name and will contain a number of features, probably including some of intangible value.

Category 2:

- Graves and cemeteries - At present, two cemeteries have been identified within the project footprint. It is possible that additional graves and cemeteries will be found during construction:
    - a cemetery on the south eastern boundary of the southern cluster containing 40-50 identifiable graves dating from approx. 1830s to 1970s (see Figure 5.32 to Figure 5.35).
    - a cemetery on the southwestern boundary of the southern cluster containing a number of graves marked with carved stone headstones (see Figure 5.36).

Figure 5.31: A range of ceramic pieces found during the cultural heritage survey (Middle Age) (CHS02, CHS03)

Source: Najafov (May 2023)

Figure 5.32: A general view of the cemetery within the project area (CHS04, southern cluster, eastern boundary)

Source: Najafov (May 2023)

Figure 5.33: Gravestones with inscriptions within the cemetery (CHS04, southern cluster, eastern boundary)

Source: Najafov (May 2023)

Figure 5.34: Graves marked with stones within the cemetery (CHS04 southern cluster, eastern boundary)

Source: Najafov (May 2023)

Figure 5.35: Graves only marked by depressions within the cemetery (CHS04, southern cluster, eastern boundary)

Source: Najafov (May 2023)

Figure 5.36: Graves marked by headstones within the cemetery (CHS06, southern cluster, western boundary)

Source: Lightsource bp (May 2023)

5.4.4.4 *Intangible cultural heritage*

Silkworm farming, or sericulture, involves both agriculture and industry. The Ministry of Agriculture is the governmental body with responsibility for the development of sericulture under its division on livestock. Sericulture is also considered a protected form of "applied arts and folk art" under the law On the Legal Protection of Expressions of Azerbaijani Folklore.

Intercultural and interreligious dialogue is one of the government's highest priorities, as well as safeguarding the cultural heritage of national minorities. The government funds radio shows in Kurdish, Lezgin, Russian and Georgian, as well as more than 15 newspapers and magazines and 5 local TV/radio channels in minority languages.

Financial aid is granted to religious communities, such as the Caucasian Muslims Board, the Russian Orthodox Church of Baku and the Baku European Jews. In 2014, an international multiculturalism centre was set up to evaluate the suitability of multicultural models in other countries with the domestic multicultural framework. The government designated 2016 as the Year of Multiculturalism in Azerbaijan and launched a plan of action to protect and broadcast ideas of multiculturalism at the national and international levels (UN, 2017).

Recreational activities

Azerbaijan's citizens enjoy a wide range of recreational activities and entertainment options. Azerbaijani culture is steeped in traditions and folklore. Citizens often participate in and attend cultural events, including traditional music performances, dance festivals and theatre productions. The Mugham music genre (added to the list of UNESCO Intangible Cultural Heritage list in 2008), classical Azerbaijani music, and national dances like the Yalli are well loved.

The country hosts various cultural festivals throughout the year, celebrating its heritage, arts, and traditions. The Novruz Bayramı (the start of spring and the New Year) is a significant cultural event marked by various customs and ceremonies, including colourful public celebrations and the preparation of traditional dishes.

Azerbaijan has a strong sports culture, and citizens are enthusiastic about both watching and participating in sports. Wrestling, particularly freestyle wrestling, is a popular sport with a rich tradition in the country. Football (soccer), basketball, and volleyball are also widely followed (ExpatWomen, 2017).

5.4.4.5 Trend in condition and sensitivity to change

Limited information exists on trends in condition of cultural heritage sites in the region around the project. Agriculture, expanding and new settlements, infrastructure, mines left in the area from the times of occupation and other developments affect the cultural heritage baseline. Tangible cultural heritage is a finite resource, so loss is permanent.

It is difficult to determine the intangible cultural heritage value of the area as the former population were expelled and the area was abandoned for some time. Much of the landscape has been destroyed during the intervening period, meaning that when the population return, they may identify a different range of intangible values.

5.4.4.6 Key considerations

The key considerations are as follows.

- The tangible and intangible cultural heritage identified is considered to be a representative sample. The sample represents the full range of features for categories 1 and 2 likely to be encountered.
- No known high sensitivity category 1 and 2 features are affected by the project, but a range of minor features are anticipated to be affected by project activities.
- Sufficient data has been collected to inform the tangible and intangible cultural heritage programmes for construction of all project components.

Table 5.18: Category 1 and 2 cultural heritage features identified within the study area boundary

Label	Location	Heritage Name	Type	Source	Tangible	Intangible Value	Category	Location
CHS01	47.03827778° E 39.33094444° N	1 Stone grinder, 1 flint flake	Surface finds	Najafov 2023	Yes	No	1	Inside
CHS02	47.03758333° E 39.32883333° N	Pottery	Surface finds	Najafov 2023	Yes	No	1	Inside
CHS03	47.03922222° E 39.30425000° N	Pottery	Surface finds	Najafov 2023	Yes	No	1	Close
CHS04	47.02961111° E 39.28252778° N	Cemetery	Cemetery	Najafov 2023	Yes	Yes	2	Inside
CHS05	47.02682561° E 39.28209688° N	Overwintering site	Village	Najafov 2023	Yes	No	1	Inside
CHS06	47.03228473° E 39.28116883° N	Overwintering site	Village	Satellite source	Yes	No	1	Close
CHS07	47.06807006° E 39.31150382° N	Hajili	Village	Satellite source	Yes	No	1	Outside
CHS08	47.06017385° E 39.30758496° N	Kavdar	Village	Satellite source	Yes	No	1	Outside
CHS09	47.05218423° E 39.32850792° N	Mirak	Village	Satellite source	Yes	No	1	Outside

Label	Location	Heritage Name	Type	Source	Tangible	Intangible Value	Category	Location
CHS10	47.03035558° E 39.34347990° N	Minbashili	Village	Satellite source	Yes	No	1	Outside
CHS11	47.00457819° E 39.26715987° N	Kechalmamedli	Village	Satellite source	Yes	No	1	Outside
CHS12	47.04524622° E 39.26192180° N	Tagh	Village	Satellite source	Yes	No	1	Outside
CHS13	47.004296° E 39.285386° N	Cemetery	Cemetery	Lightsource bp survey	Yes	Yes	3	Inside
CHS14	47.006589° E 39.283978° N	Overwintering site	Village	Satellite source	Yes	No	1	Inside

6 STAKEHOLDER ENGAGEMENT

6.1 Introduction

Stakeholder engagement is an integral part of the ESIA process and the foundation for developing and maintaining a project's social licence to operate. Stakeholder engagement activities help to develop and sustain trusting relationships and build a project's reputation as a venture that is socially responsible and acts with integrity.

Stakeholder engagement for this project is being undertaken in accordance with the requirements of Azerbaijani legislation, Lightsource bp's policies for stakeholder engagement, and good international industry practices (GIIP).

A stakeholder engagement plan (SEP) was developed for the project in September 2023. This section describes how stakeholder engagement activities have been undertaken, in compliance with the SEP, starting from the scoping phase of the ESIA.

This chapter is structured as follows:

- objectives of the stakeholder engagement
- stakeholder identification and analysis
- stakeholder activities undertaken
- grievance management procedure
- recommendations and ongoing engagement.

6.2 Objectives of Stakeholder Engagement

The objectives of engagement are to raise awareness of the project among the stakeholders, and to understand their concerns and recommendations so that these can be considered in the overall ESIA.

The stakeholder engagement process is also used to facilitate data collection activities for the socioeconomic baseline, through key informant interviews (KII) and focus group discussions (FGD). These meetings are used to help develop a more comprehensive understanding of the project's AOI, enable accurate identification of vulnerable groups, and conduct data collection activities with these groups.

Effective engagement should enable stakeholders to do the following.

- Understand the project-related information and the ESIA process (including the stakeholder engagement process and the grievance management procedure).
- Be provided with details about the stand-alone grievance management procedure, to be used to submit grievances arising during the ESIA phase.
- Understand how they might be affected by the project, including potential project benefits, and understand their potential role in impact identification and management.
- Provide input into the scope of the ESIA with regards to socioeconomic and environmental baseline studies, impact identification, potential sources of cumulative impact and to discuss how best to avoid, mitigate or offset impacts.
- Express their opinions, concerns and recommendations about the project, and for these to be considered in the ESIA and related management decisions.

Engagement should also facilitate the following.

- Manage stakeholder expectations, thus supporting the prevention of potential conflict in the future.
- Ensure that all stakeholders, including women and those who are considered to be vulnerable, are included in engagement activities and have equal opportunity to participate.
- Establish the basis for building positive relationships with key stakeholders and rightsholders and establish the means and methods of communication when the project progresses into the construction and operation phases.

6.3 Stakeholder Identification and Analysis

In the context of the ESIA, stakeholders are defined as persons or groups external to a project's core operation that may be affected by the proposed project, have an interest in the project or have influence over it.

This section outlines the methodology for stakeholder identification and analysis and provides an overview of the stakeholder groups for the project.

6.3.1 Stakeholder Identification

6.3.1.1 Stakeholder groups

Desktop research has identified the stakeholder categories in Table 6.1.

Table 6.1: Stakeholder categories

Categories	Stakeholders
Relevant authorities	National government ministries and authorities Regional authorities District / local authorities and community leaders
Civil society	Non-government organisations (NGOs) (international, national and regional) and associations Community organisations, e.g., civil society organisations (CSOs), development associations, women's groups or other activity-based cooperatives Cultural heritage organisations
Academia	Relevant universities and research centres
Business	Commercial and industrial enterprises, traders and service providers, informal businesses
Potentially affected communities /groups	Community members Potentially vulnerable and/or marginalised groups including youth, women, elderly, minority groups[16]

[16] It is important to note that vulnerable groups may experience obstacles to their participation in the project, and may require separate specific engagement strategies. Vulnerable groups may include youth, women, the elderly minority or marginalised groups and Internally Displaced Persons (IDPs).

The SEP sets out a complete methodology for stakeholder identification. The process of stakeholder identification is dynamic and ongoing; additional stakeholders may be identified during the course of the consultations (e.g., during the engagements with stakeholders themselves) and throughout the ESIA process. Where additional stakeholders are identified, the SEP will be updated accordingly.

Table 6.2 outlines an initial overview of the stakeholders that were identified for the ESIA phase.

Table 6.2: Preliminary list of ESIA stakeholders by category

Stakeholder category	Stakeholders
National stakeholders	
National government authorities	Ministry of Ecology and Natural Resources (MENR) ANAMA Ministry of Labor and Social Protection State Committee for Affairs of Refugees and Internally Displaced Persons of the Republic of Azerbaijan State Committee on Urban Planning and Architecture Ministry of Agriculture Ministry of Culture AzerEnerji
Civil society and NGOs (national)	Labour rights NGO Azerbaijan Chairman of Environmental Public Council of MENR
District/local stakeholders	
District government authorities	Jabrayil Executive Committee Special Representative of the President in Jabrayil, Qubadli and Zangilan districts
Local communities	Communities found to be residing near the project site (if applicable, e.g., in Jabrayil district) Communities residing in Horadiz IDP communities not currently residing in Jabrayil district
Representatives of local social services	Medical facilities, e.g., representative from Horadiz City Hospital and Education facilities, e.g., representative from Horadiz and Jabrayil City (Mehdi Mehdizade school under construction)
Commercial and industrial enterprises	Industrial park Road/infrastructure construction companies

6.3.2 Stakeholder Analysis

Stakeholder analysis is undertaken to determine the most appropriate strategies and methods of engagement for each stakeholder, including the types of meetings required (e.g., individual, small group or community). It also helps to identify those stakeholders who can best assist the ESIA process, and the project during its operation.

Stakeholder analysis consists of two main steps.

- Categorising the stakeholders in terms of the level of influence they may have over the project, the interest they may have in the project (based on specific knowledge of the social) and the level of impact of the project on them (based on early scoping of impacts).
- Stakeholder mapping: making visual the relationship between stakeholder influence, interest and impact.

6.3.2.1 Criteria for analysis

Stakeholders are first analysed in terms of the following criteria.

- The level of influence they have over the project:
  - **low:** the stakeholder cannot influence the execution of the project
  - **medium:** the stakeholder has some influence over the project and can cause some damage to its reputation in this context
  - **high:** the stakeholder can cause considerable delays or changes to the execution of the project and/or cause considerable damage to its reputation in this context
  - **critical:** the stakeholder could have major influence on the project execution (positive or negative) and/or major influence (positive or negative) on the project's reputation.
- The level of interest they have in the project:
  - **low:** the project is of little, if any, interest to the stakeholder
  - **medium:** the project is of some interest to the stakeholder
  - **high:** the project is of considerable interest to the stakeholder
  - **critical:** the project is of major interest to the stakeholder.

The types of engagement approach are summarised in Figure 6.1 and are further elaborated in Table 6.3.

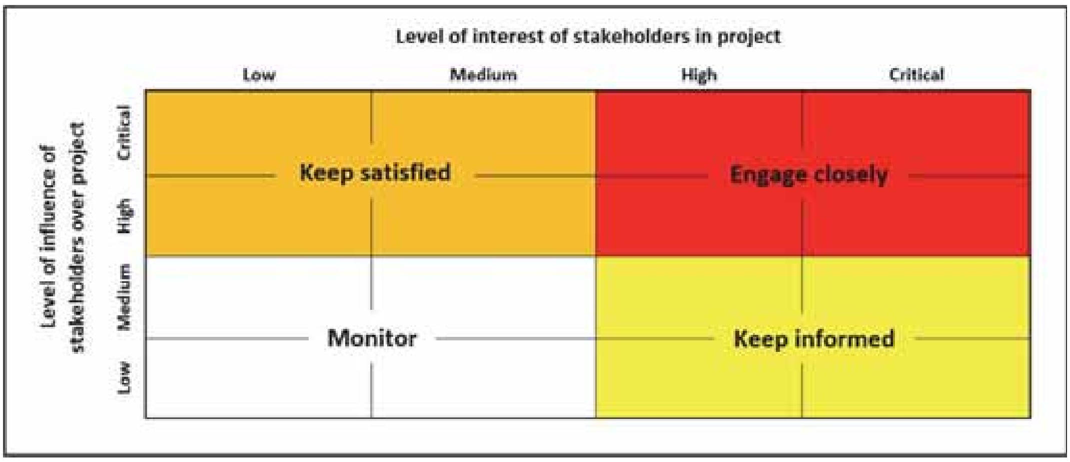


Figure 6.1: Stakeholder analysis matrix

Table 6.3: Frequency and type of engagement activities according to approach to engagement

Approach to engagement	Frequency and type of engagement activities
Engage closely	Stakeholders are engaged on a regular basis. Communication is two-ways and is likely to revolve around the conduct of direct, in-person meetings to discuss the project and ensure that relevant information and feedback from stakeholders is considered in the ESIA.
Keep satisfied	Stakeholders are engaged on an as-needed basis (e.g., major milestones in the ESIA that may be of interest/relevant to the stakeholder). Initially, communication tends to be one-way and revolves around the distribution of written information via email or post. Where appropriate, and at the stakeholder's request, there may be more direct contact.
Keep informed	Stakeholders are engaged on an as-needed basis (e.g., major milestones in the project ESIA that may be of interest/relevant to the stakeholder). Communication tends to be one-way and revolves around the distribution of written information via email or post.
Monitor	There are no deliberate plans to engage with these stakeholders. However, stakeholders' interest in and opinions of the project are monitored (e.g., through the receipt of correspondence, online – including social media – activities) to identify any change in perceptions and the potential need for engagement, as appropriate.

Stakeholders may be further analysed in terms of the level of potential impact that the project may have on them.

- **Low**: the project is unlikely to cause any significant changes to the stakeholder's health, well-being and livelihood.
- **Medium:** the project may cause some changes to the stakeholder's health, well-being and livelihood.
- **High:** the project may cause considerable (temporary or permanent) changes to the stakeholder's health, well-being and livelihood.
- **Critical:** the project could cause permanent change to the health and / or wellbeing and / or temporary or permanent loss of livelihood of the stakeholder.

During the ESIA process, all stakeholders identified as having the potential to experience medium or high impacts as a result of the project will be offered the opportunity to be engaged closely over the life of the project, regardless of their level of influence or interest.

The SEP provides a preliminary analysis of stakeholders, disaggregated by stakeholder group, including a justification for the analysis of influence and interest for each stakeholder, and the engagement approach desired. The detailed mapping results are an internal confidential document of Lightsource bp.

It is important to note that stakeholder identification and analysis is a dynamic and continuous process which is ongoing throughout the project lifecycle and will continue to be reviewed and updated as the project progresses to reflect relevant insights and additional information gained.

6.4 Stakeholder Engagement Activities Undertaken

6.4.1 Scoping Phase Verification Exercise

Given the nature and geography of the project area (i.e., the absence of established communities, settlements and livelihood activities), the scoping phase verification exercise was limited to consultation with representatives of the ANAMA Jabrayil district, who facilitated a site walkover and verification exercise. This was conducted between 11-13 May 2023. The purpose of this site visit was to obtain an understanding of the local environmental and social context and identify possible constraints associated with the project.

6.4.1.1 Relevant findings from the scoping site visit

Table 6.4: Relevant summary findings from the scoping phase site visit

Socioeconomic findings			
Jabrayil has a population of 82,500 (according to the statistics committee as of January 2022) who are all internally displaced people residing in settlements in other regions of Azerbaijan. As a recently liberated territory, there is currently no resident civilian population or regular commercial activities carried out in Jabrayil.			
Stakeholder engagement activities			
Consultation location: stakeholders/ groups	**Characteristics of the stakeholders met**	**Issues, concerns, and opinions about the project**	**Relevant to the ESIA**
Jabrayil ANAMA	Responsible for ERW clearance across the project site to facilitate safe access	ANAMA has personnel operating nearby, in Jabrayil City and Horadiz. They use the main road connecting Horadiz and Jabrayil. Their interest is: 1) In making sure there are no incidents during the construction and operations phase, and 2) Ensuring the recognition of their work.	Yes

6.4.2 ESIA Phase Stakeholder Engagement

6.4.2.1 Activities undertaken

During the ESIA phase, stakeholder engagement activities were linked to the socioeconomic data collection process. Data collection focused on gathering relevant information at the national level (meaning authorities and agencies with mandates covering the entire country) and district/local level (meaning stakeholders involved in the administration/operation of districts, and local service providers) to understand and describe the importance and sensitivity of the receptors potentially affected by the project. The methodology for the social baseline data collection is described in Section 5 of this ESIA.

In addition to the above, additional identified stakeholders that were not engaged in the scoping phase were met to inform them about the project and to receive their comments, which have been included in the ESIA.

A total of 14 meetings with key informants were held. 13 KIIs were conducted in-person, and one was conducted remotely. KII took place between 26 October and 4 December 2023 with the stakeholders as shown in Table 6.5.

Table 6.5: Stakeholder engagement meetings held during the ESIA phase

Date	Stakeholder
26 October 2023	Araz Valley Industrial Zone park
26 October 2023	ANAMA
27 October 2023	Horadiz Family Health Centre
27 October 2023	Kalyon infrastructure company
30 October 2023	Azerenerji OJSC
31 October 2023	Urban Planning and Architecture Committee
31 October 2023	Ministry of Labour and Social Protection
3 November 2023	Ministry of Ecology and Natural Resources
16 November 2023	Labour rights NGO
17 November 2023	Ministry of Agriculture
20 November 2023	Special Representative of the President in Jabrayil, Quabadli and Zangilan districts, East Zangezur Economic Region.
28 November 2023	Environmental NGO –– Chairman of Environmental Public Council of MENR
1 December 2023	Ministry of Culture
7 December 2023	Azerbaijan Renewable Energy Agency under the Ministry of Energy (written response to KII provided by email on 20 December 2023)

The process for arranging and conducting these meetings is outlined in Sections 6.4.2.2. and 6.4.2.3.

6.4.2.2 Preparation for meetings

Arranging the meetings

At the national and district level, letters of invitation were sent before the meetings. KIIs with stakeholders at the local level, including business, industry and local service providers (e.g., health clinics) were arranged through letters, emails, WhatsApp messages, phone calls and ad-hoc encounters. Follow up phone calls took place to confirm dates and venues.

Venues for meetings were selected based on proximity to stakeholders, ease of access and adequate seating capacity.

Presentation materials

Materials were prepared ahead of the meetings to enhance communication and ensure an informed discussion.

- A background information document (BID) introducing the project and outlining the ESIA process (produced in Azerbaijani and English).
- A frequently asked questions (FAQ) document (for use by the stakeholder team) to assist with responding to stakeholder questions. The document was prepared by RSK and approved by Lightsource bp.
- Questionnaires/key informant interview guides to collect socioeconomic baseline data.

6.4.2.3 Conducting the meetings

A team of two people from RSK (a facilitator and an assistant facilitator) conducted the meetings. The timing of each meeting was arranged to ensure maximum attendance and minimise interference with the stakeholders/communities' daily commitments.

All meetings were held in Azerbaijani, and the BID (produced in Azerbaijani) was distributed to all stakeholders.

The meetings began with introductions and opening remarks by the facilitators who outlined the purpose and format of the meeting to set the group at ease. The facilitators explained that participation was voluntary and that stakeholders were able to decline to participate at any point.

Facilitators asked participants for oral consent to participate and permission to audio-record the conversations. Facilitators explained that no names would be used when reporting the findings unless consent was given.

Data collection activities commenced with a stakeholder engagement event (the project, the ESIA process, and the stakeholder engagement process were presented using the stakeholder materials - BIDs). After this, the floor was opened and a question and answer session was conducted. Sufficient time was allocated to the question and answer session and efforts were made to enable all stakeholders present to have their concerns heard. All verbal questions and responses from the participants were recorded, to which the facilitators provided responses. Photographs were taken after permission was granted by participants.

The FAQ document was used by facilitators to respond to questions as needed.

A grievance mechanism (see Section 6.5) was clearly laid out including contact details, enabling stakeholders to comment on the project or ask further questions.

6.4.2.4 *Analysis of stakeholder feedback*

Generally, stakeholders were supportive of the project and provided positive feedback. Stakeholders identified several economic and environmental benefits of the project and recognised the potential of the project to contribute to development in the EZER.

The key interventions, disaggregated by topic area are outlined in Table 6.6.

Table 6.6: Interventions raised by stakeholders, disaggregated by topic area

Stakeholder	Topic	Issue raised by stakeholder
MENR	Local employment	Positive benefit of the project is the creation of local job opportunities.
	Project characteristics	Positive benefit of the project is the ability to provide cheaper, greener energy.
	Environment	No environmental, ecological or natural resource challenges were noted.
	Health and safety	Presence of ERW is a challenge in the region.
	ESIA related	Requested that the plans for resettlement of Hajili and Minbashili be included in the social assessment.
AzerEnerji	Employment	Recognition of potential benefits associated with local employment opportunities.
	Project characteristics	bp is the operator of Sangachal Terminal, which will be buying energy from Project Sunrise, subject to Sangachal partners' approval. In parallel to Project Sunrise, Sangachal electrification project is being assessed. The key thing is the two projects will happen simultaneously – important that this does not impose extra pressure on the network. bp is producing energy from gas at Sangachal. Connecting to the grid and buying greener energy will reduce gas usage and create a decarbonisation opportunity.
Ministry of Labour and Social Protection	Employment	Employment opportunities are important: there are vocational training centres close to district which could be involved to train prospective project employees. State Employment Agency (SEA) would be interested to support with provision of employment opportunities. SEA interested to know more about number of employment opportunities and the types of skills required. People who are to be relocated to Jabrayil should be prioritised for employment opportunities.
Ministry of Agriculture	Employment	Positive impacts of potential employment opportunities
	Project characteristics	Identification of positive impact that the project could help to bring down the cost of energy.
	Environment	General recognition of challenges related to water for water-intensive activities such as agriculture.

Stakeholder	Topic	Issue raised by stakeholder
Ministry of Culture	Project characteristics	Identification of positive impact that the project could help future investment in the region, including for management of cultural artefacts (e.g., use of lighting at preserved sites).
State Committee for Urban Planning and Architecture	Future development in the area	The Horadiz–Aghband road is important: as settlements will be developed along that road (Shukurbayli, Sarijanli, Mashanli) this project will help to secure energy supply for those areas. The project will help to achieve the net zero goal for the liberated territories (2030) and fulfil commitments to the alternative energy strategy.
	Health and safety	Important to be aware of hazards, including mines and ERW in the area.
Infrastructure company (Kaylon)	Health and safety	Main concern is the use of the road – if Lightsource bp is going to use the main road, it may create issues in terms of traffic and risks for the personnel working on the road construction (the road is not yet finalised). Traffic accidents are already reported, including ones involving employees of Kalyon. Therefore, the recommendation is to get an area briefing. Heavy use of the road will create significant dust (potential impact). Snakes are also a potential hazard in the area.
	Environment	The area is prone to flooding with many seasonal stream crossings. These need further investigation.
Social/labour rights NGO	Employment	Monitoring of local employment is recommended in order to enhance potential positive impacts. Upholding and protecting the human rights of project employees, specifically regarding workers' rights, is an important issue and requires close attention
Azerbaijan Renewable Energy Agency of the Ministry of Energy	Energy production and distribution	Renewable energy projects will have a positive impact on the transformation of the liberated territories to a 'green energy zone' by 2050 and the project is an innovative approach to virtual energy exchange/offsetting. It is intended to have a Power Purchase Agreement with Sangachal Terminal and Project Sunrise will play an important role in the decarbonisation of the Terminal. Green energy can be used locally in Jabrayil district, contributing to green energy and zero emissions targets and the Paris agreement. Provision of electricity to the liberated territories is the highest priority task. Implementation of the State Program on the Great Return should be supported. The hybrid solution to provide electricity and heat to remote and mountainous regions should be explored, as there is no gas network.

Stakeholders typically raised questions and comments relating to their mandate/area of interest and expertise. In general, the most common interventions across all meetings were employment-related, followed by questions and comments about project characteristics and health and safety.

Questions were raised during the meetings about the types of environmental and social studies that would be conducted, their timing, and information on when the final ESIA would be made available to the public. Discussions pertaining to the types of required permits and approvals also took place.

Figure 6.2: KII conducted with Kalyon, infrastructure company (27 October 2023)

Source: RSK (October 2023)

Figure 6.3: KII conducted at Araz Valley Economic Zone Industrial Park (26 October 2023)

Source: RSK (October 2023)

6.5 Grievance Management Procedure

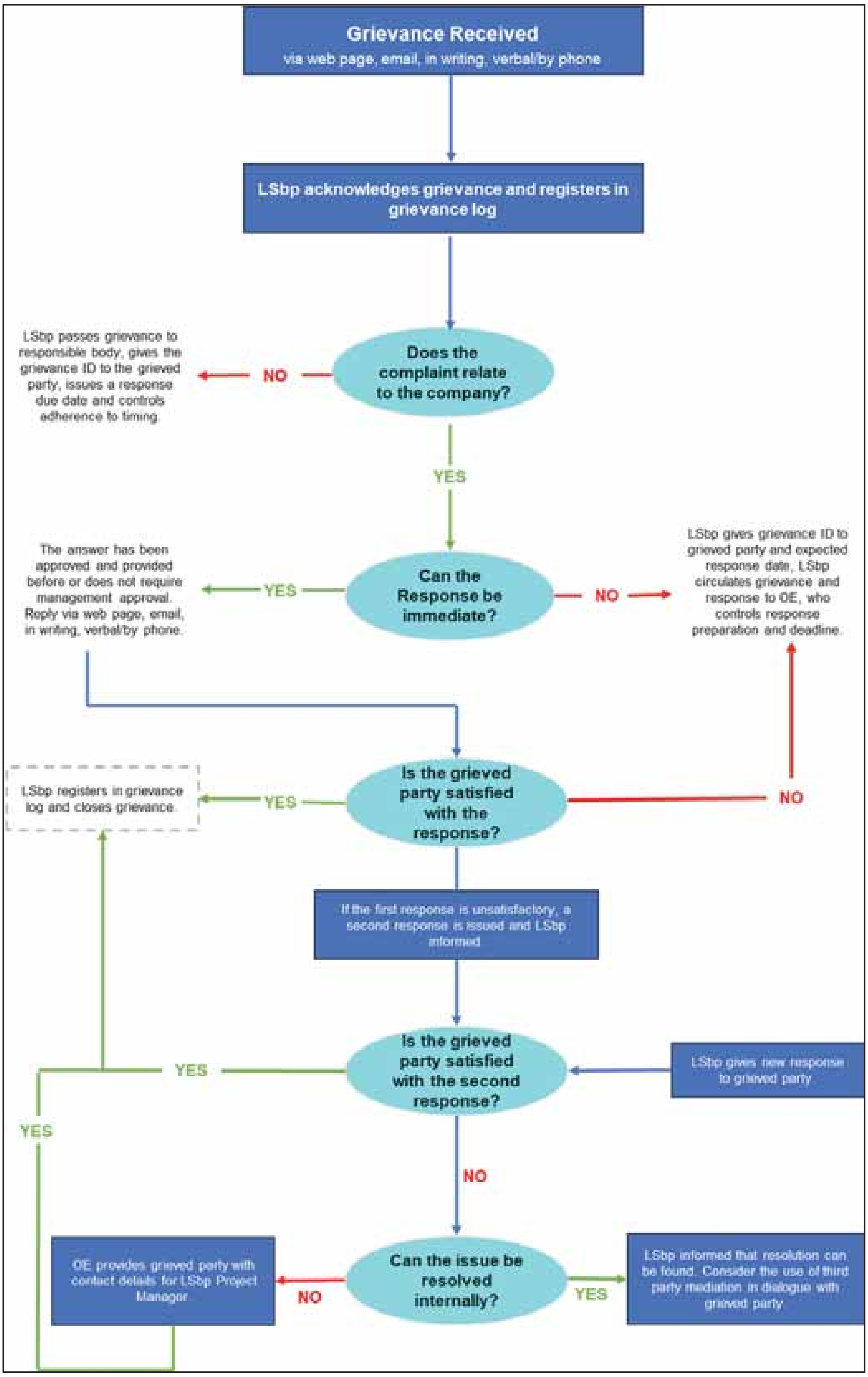
In line with international best practice, and to ensure that all complaints and grievances that may arise because of the project are resolved as quickly as possible to prevent escalation, a grievance management procedure is required. Lightsource bp and RSK understand that the management of grievances is a vital component of stakeholder engagement and an essential element of risk management.

The grievance management procedure that facilitates the identification and response to grievances will also provide an opportunity for Lightsource bp and stakeholders to build productive, respectful and mutually beneficial relationships between project personnel, communities and other stakeholders, which lays a strong foundation for future development activities at the site. Monitoring of grievances will signal any recurrent issues or escalating conflicts and disputes.

Lightsource bp's existing grievance management procedure comprises five steps, which are as follows.

- receipt
- assessment and recording
- investigation
- resolution and implementation
- close out.

During the ESIA phase stakeholders will be able to submit their comments, concerns or grievances via an email address, which will then be entered into a grievance log and the response and resolution process will be managed by Lightsource bp as shown in the flowchart in Figure 6.4.



* OE = Owners Engineer

Figure 6.4: Lightsource bp grievance mechanism

Source: RSK (2023)

6.6 Recommendations and Ongoing Engagement

Further stakeholder engagement meetings will be held during the public disclosure phase of the ESIA with the aim of ensuring that stakeholders are informed of and comprehend the outcome of the draft ESIA, in particular the identified impacts and mitigation measures. Stakeholders will be able to provide comments and questions on the draft ESIA report that will then be addressed in the final version.

6.7 Public Disclosure

This draft of the ESIA document has been prepared for public disclosure and comment. It is disseminated widely to obtain comments for incorporation into the ESIA as appropriate, prior to formal submission to the Government.

Anyone can comment on the ESIA at any time during the 30-day public disclosure period. All comments should be submitted in writing and addressed to bp Xazar Centre in Baku. Comments can also be made on the bp website.

In early February 2024 the draft ESIA will be available in the public domain for consultation. This involves:

- the full ESIA document and the ESIA Executive Summary in Azerbaijani and English being available at the following locations:
    - selected libraries and universities
    - bp Xazar Centre, Baku
    - on the bp website
- a public meeting to present the ESIA
- the BID describing the project, key features of the site and the ESIA process will be distributed to the attendees of the public disclosure meeting and key stakeholders.

Announcements of the exact dates and locations for disclosure will be made through the press two weeks prior to the public meeting.

Following the disclosure period, all the comments will be reviewed and the ESIA will then be updated taking the relevant comments into account. The document will be finalised and published upon completion of the permitting process with the government.

7 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT METHODOLOGY

7.1 Introduction

The assessment of impacts for all project components has been undertaken in a structured and consistent manner. The impact assessment methodology has been developed to meet the Azerbaijani legislative requirements, and the IFC PS on Environmental and Social Sustainability (IFC, 2012).

The methodology has been developed to take into consideration the potential impacts on the physical environment (air quality, noise and vibration, soil, groundwater and surface water and landscape), the biological environment (terrestrial and aquatic habitats, flora and fauna) and the socioeconomic environment (people and livelihoods).

The impact assessment covers:

- planned activities – those that correspond to routine (normal) activities associated with the construction, operation and decommissioning phases of the project
- unplanned events – those events defined as reasonably foreseeable that are not planned to occur as part of the project works, but which may plausibly occur, even with a low probability.

The assessment of planned activities and unplanned events has been carried out on the assumption that GIIP - as presented as management control measures - have been applied to all project activities.

As per best international practice, project-specific mitigation measures are required for significant negative impacts only. The main goal of this process is to reduce impact significance to levels that are ALARP. Enhancement measures for positive benefits will also be documented where relevant.

7.2 Scope and Objectives of the Environmental and Social Impact Assessment

The scope of the impact assessment includes impacts identified in the project's AOI[17] (see Section 5.1.2) and associated facilities over which the project can reasonably exercise a degree of control. The IFC definition of AOI includes associated facilities, as identified in Section 3.13.

The overarching objectives of the ESIA are to evaluate the possible impacts of the project on the natural and social environments in which it is being constructed and to identify the measures that could limit negative impacts and optimise positive impacts of the project.

[17] AOI is based on the IFC (2012) Performance Standard 1 definition. This is the area likely to be affected by the project, project-related activities, the facilities that are directly owned, operated or managed and that are a component of the project, and associated facilities (refer to Section 3.13). This includes direct, undirect, planned, unplanned and cumulative impacts.

The findings of the ESIA will feed into the project decision-making process. A further objective of the ESIA is to support the project in complying with Azerbaijani national legislation, Lightsource bp's environmental and social performance requirements, and aligning the project with internationally accepted best practice.

7.3 Overall Approach

Project Sunrise could give rise to several impacts on a wide range of environmental and social receptors. To assess these impacts, an ESIA has been undertaken, following the overall process illustrated in Figure 7.1. The key steps of the ESIA are described in the subsequent sections:

- identify potential environmental and social impacts
- assess impact significance by estimating the magnitude of a potential impact (taking into account management control measures) and the sensitivity of receptors
- propose mitigation measures to avoid or minimise the potential impacts, and enhancement measures to maximise beneficial impacts
- determine any residual impacts.

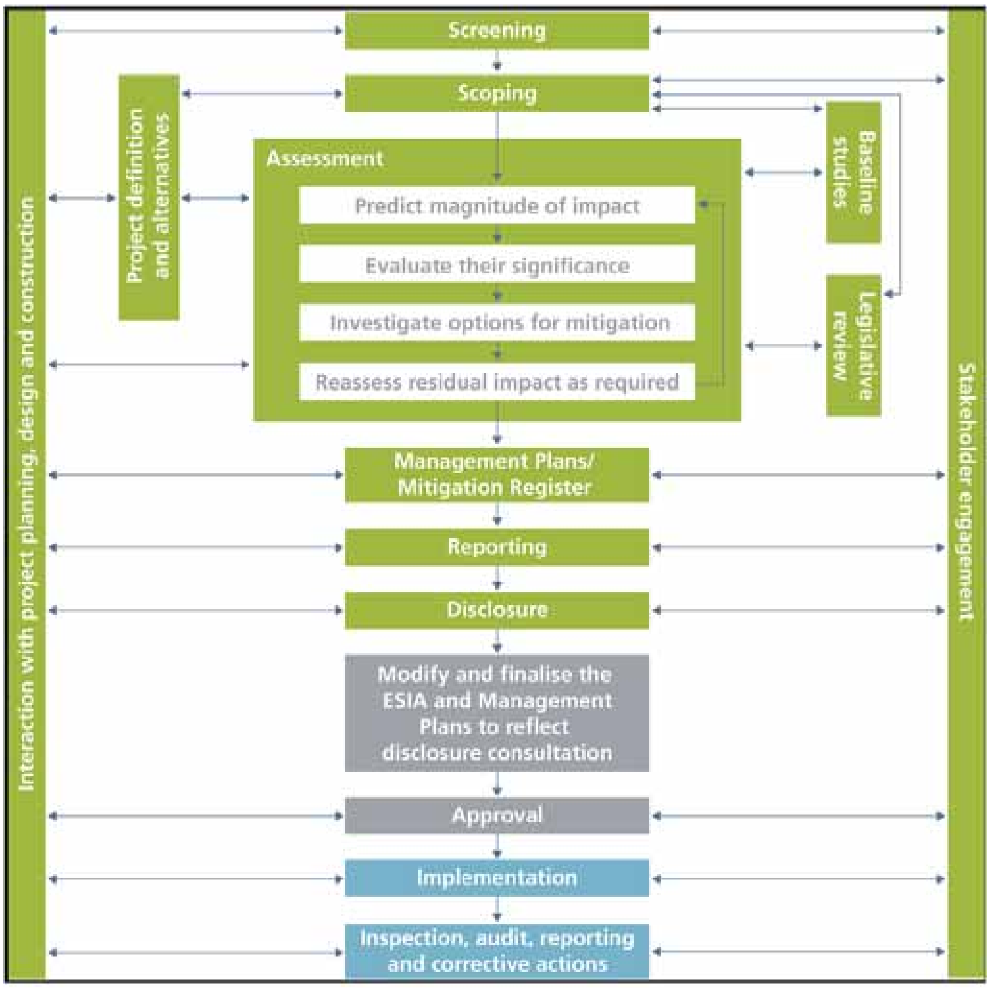


Figure 7.1: ESIA process

Source: RSK (2023)

7.4 Impact Identification and Evaluation

Potential interactions between project activities and the physical, biological and social environment were identified based on the information provided in Section 3, Project Description, and data collected on the baseline conditions provided in Section 5, Baseline Conditions. Potential environmental and social impacts were identified considering aspects of the project that could change baseline conditions.

The assessment of magnitude with regard to human receptors takes into account their ability to adapt to and manage the effects of an impact.

Impacts can be classified as follows.

- Positive - an impact considered to represent an improvement to the baseline environmental or social conditions, or that introduces a new desirable factor
- Negative - an impact considered to represent an adverse change from the baseline conditions, or that introduces a new undesirable factor
- Direct - an impact that results from a direct interaction between a project activity and the receiving environment
- Indirect - an impact between a project activity and the environment because of subsequent interactions, for example, the impact of pollution of a watercourse on users of water abstracted from the watercourse or loss of habitat affecting the viability of a species population
- Induced – impacts from non-project activities that are encouraged to happen because of the project and that would not occur in the absence of the project, for example new businesses established to cater for an increased number of construction workers in the area
- Cumulative - an impact that acts together with other impacts (including from other third-party project or projects) to affect the same receptor(s)
- Perceived - issues that stakeholders believe would change baseline conditions even when there is no factual basis for the concern. Stakeholder views are obtained via stakeholder consultation.

Transboundary impacts (i.e., impacts that cross the border from Azerbaijan) where identified have been described and assessed.

7.5 Impact Assessment Methodology for Planned Activities

7.5.1 Impact Magnitude

Impact magnitude is defined according to its **extent** (geographical)**,** the **duration** (time) of the impact, and the **frequency** (probability). The criteria for four different grades of impact magnitude were defined, as described in Table 7.1, from 1 (very low) to 4 (high), based on definitions of negative effects. A rating of 0 is also provided for beneficial (positive) effects.

Table 7.1: Impact magnitude

Score	General	Baseline	Definition of impact magnitude
0 Positive	Beneficial effects	Physical	Beneficial to the physical environment (including landscape).
		Biological	Beneficial to habitats and species.
		Social	Beneficial to local communities, health, resources/ecosystem services, cultural heritage.
1 Very Low	Negligible or non-detectable effects. **<u>Extent</u>**: site-specific (project footprint and immediate surrounding area) **<u>Duration</u>**: transient (limited to the duration of the activity in question, i.e., days or weeks) **<u>Frequency</u>**: improbable (never heard of in the industry)	Physical	**Air quality:** emissions do not breach licence limits, or national/international standards and have negligible impact.
			Noise*: emissions do not breach licence limits, or national/international standards and have negligible impact. Noise levels may still be audible.
			Water resources, surface and groundwater (quality): no noticeable change to hydrology or hydrogeology. Effluent discharges do not breach licence limits, or national/international standards and have negligible impact. Spill or accidental event that causes local contamination only and can be restored to an equivalent capability in a period of days up to one month.
			Soils (quality):** effluent discharges do not breach licence limits, or national/international standards and have negligible impact. Spill or accidental event that causes immediate area damage only and can be restored to an equivalent capability in a period of days up to one month.
			Landscape: changes to the landscape caused by the project are noticeable but not dominant.
		Biological	**Biodiversity (protected areas):** no protected or internationally designated areas affected.
			Biodiversity (habitat): disturbance of habitat limited to the immediate area, with rapid recovery without intervention.
			Biodiversity (species): planned activity or unplanned incident causes disturbance to individuals of a species that is similar in effect to the random changes in population due to normal environmental variation. No discernible effect of disruption of behaviour or species interactions of nationally/internationally important species of conservation concern.
		Social	**Livelihoods:** changes to economy, employment, livelihoods and infrastructure are within normal variations in baseline levels. Very limited/intermittent interference, may be noticed by users of resources/ecosystem services.
			Social cohesion: changes to community dynamics are within normal variations in baseline levels.

Score	General	Baseline	Definition of impact magnitude
			Health and safety: changes to health, community safety, security and welfare are within normal variations in baseline levels. Transitory, negligible decrease in the psychological wellbeing of the local community due to perceived safety risks.
			Cultural heritage: negligible degradation of tangible cultural heritage sites or intangible cultural heritage.
2 Low	Impact affects the receptor in such a way that natural, cultural and social functions and processes are minimally affected. **Extent**: localised (impacts may be experienced within the AOI for the aspect) **Duration**: short term (up to one year) **Frequency**: probable good possibility (≤ 50%) that the impact will occur (has occurred in the industry and so therefore could occur)	Physical	**Air quality:** minor elevation in ambient pollutant levels well below WHO guidelines.
			Noise*: minor elevation in ambient noise levels well below WHO guidelines.
			Water resources: a noticeable but not fundamental change to hydrology or hydrogeology.
			Surface water (quality): reduction in water quality (suspended sediment, turbidity, colour, odour and taste) downstream of project activities is likely to be discernible by local users, but is unlikely to cause users to use less water than they normally use or to seek supplementary sources of water.
			Groundwater (quality): localised impact that may take up to one year to restore to baseline quality.
			Soils (quality):** minor losses of productivity expected to last up to one year after reinstatement and/or localised compaction of agricultural land or natural/semi-natural habitat that can be alleviated, e.g., by deep cultivation. Localised contamination may take up to one year to restore to pre-existing capability/function.
			Landscape: the development would result in minor changes in views without affecting the overall quality of views. Minor permanent change in the landscape – new element is only slightly out of character; existing landscape quality is maintained.
		Biological	**Biodiversity (protected areas):** minor loss or alteration to a legally protected or internationally recognised site whereby key elements or features are retained and the ecosystem continues to function as before.
			Biodiversity (habitat): reduction in habitat integrity, ecosystem function or ecosystem services. Recovery to baseline state is expected within a year with minimal intervention.
			Biodiversity (species): disturbance of a local population or individuals of a species resulting in a decline in abundance or distribution over one or more generations, but that does not change the overall longevity or viability of the population of the species or populations of other dependent species.
		Social	**Livelihoods:** reduction in community and household assets, or access to assets, such that economic displacement (as defined in IFC PS 5 affects 1–4 individuals, households or businesses. Short-term financial loss to business owners where recovery is likely.
			Social cohesion: unplanned in-migration is not expected to cause infrastructure capacity exceedance.

Score	General	Baseline	Definition of impact magnitude
			Increases in incidences of cultural conflict, but expected to be contained within existing social control norms.
			Health and safety: incident that requires mobilisation of on-site response equipment and crews. Increased public exposure to health threats that may increase morbidity rates. Decline in access to health care facilities and acquisition of treatment.
			Cultural heritage: activity that may cause minor disturbance and/or superficial damage to tangible cultural heritage site(s) or intangible cultural heritage that is easily and effectively mitigated.
3 Medium	Where the affected receptor is altered but natural, cultural and social functions and processes continue, albeit in a modified way Valued, important, sensitive or vulnerable systems or communities are negatively affected. **Extent**: regional **Duration**: medium-term (1–5 years) **Frequency**: highly probable most likely (50–90% chance) that the impact will occur (has occurred or is expected to occur during the project or very likely to)	Physical	**Water resources:** fundamental change to hydrology and hydrogeology within a catchment resulting in temporal changes to the water shed.
			Surface water (quality): reduction in water quality (suspended sediment, turbidity, colour, odour and taste) downstream of project activities is sufficient to cause complaints from local users but is unlikely to cause users to use less water than they would normally use or to seek supplementary sources of water.
			Groundwater (quality): localised impact that may take 1–5 years to restore to baseline quality. Widespread (regional) impact that may take up to one year to restore to baseline quality.
			Soil (quality):** minor losses of productivity expected to last 1–5 years after reinstatement and/or widespread compaction of agricultural land or natural/semi-natural habitat that can be alleviated, e.g., by deep cultivation. Localised contamination (within single fields) that may take more than one year to restore to pre-existing capability/function and/or widespread damage that may take up to one year to restore to pre-existing capability/function.
			Landscape: the development would result in a noticeable change in the existing view and or would cause a noticeable change in the quality and/or character of the view. Permanent changes in the landscape predicted in a localised area; new elements may be prominent, but not significantly uncharacteristic.
		Biological	**Biodiversity (protected areas):** moderate loss or alteration to a legally protected or internationally recognised site whereby key elements or features will be changed but the overall integrity of the site is not affected.
			Biodiversity (habitat): changes to a habitat or ecosystem ecological features and ecosystem services, structures or functions that reduce its integrity, but recovery to baseline state is expected within five years with some intervention.
			Biodiversity (species): disturbance of a sufficient portion of the bio-geographic population of a species to cause a decline in abundance, distribution or size of genetic pool such that natural recruitment would

Score	General	Baseline	Definition of impact magnitude
			not return the population of the species, and other species dependent on it, to former levels within several generations.
		Social	**Livelihoods:** physical resettlement (as defined in IFC PS 5) of 1–20 households/businesses. Reduction in community and household assets, or access to assets, such that economic displacement (as defined in IFC PS 5) affects 5–20 individuals, households or businesses. Medium-term (1–5 years) financial loss to owners of businesses where recovery may be difficult.
			Social cohesion: unplanned in-migration flows considered sufficient to cause an exceedance of the capacity of at least one component of physical or social infrastructure. Increases in cultural conflict are likely to not be contained within existing social control norms.
			Health and safety: incident that requires mobilisation of national/company response equipment. Increased public exposure to health threats that may increase mortality rates. Increases in rates of serious crimes involving violence and property theft.
			Cultural heritage: activity or accident that damages a site of tangible cultural heritage importance or affects intangible cultural heritage and requires immediate repair by existing project resources or mitigation.
4 High	Where natural, cultural or social functions and processes are altered to the extent that it will temporarily or permanently cease. Valued, important, sensitive or vulnerable systems or communities are substantially affected. **Extent**: national or transboundary. **Duration**: long-term (> 6 years). **Frequency**: definite (> 90%) chance of the	Physical	**Water resources**: widespread and permanent change to hydrology and hydrogeology in an internationally or nationally designated site.
			Surface water (quality): reduction in water quality (suspended sediment, turbidity, colour, odour and taste) downstream of project activities is likely to cause users to use less water than they normally use and to seek supplementary sources of water to make up the deficit.
			Groundwater (quality): localised impact that may take more than five years to restore to baseline quality. Widespread impact that cannot be restored to baseline quality within one year.
			Soil (quality):** major losses of productivity predicted to last >1 year after reinstatement and/or widespread compaction of agricultural land or natural/semi-natural habitat that cannot be alleviated, e.g., by deep cultivation. Localised contamination that cannot economically be restored and/or widespread damage that cannot be restored to pre-existing capability/function within one year.
			Landscape: the development would result in a prominent/dramatic change in the existing view and/or would cause a prominent/dramatic change in the quality and/or character of the view. Permanent changes over an extensive area and/or new development that will result in significant negative change to the existing landscape character (e.g., because of loss of key elements of the existing landscape, or introduction of elements that are uncharacteristic compared to existing features).

Score	General	Baseline	Definition of impact magnitude
	impact occurring regardless of any prevention measures (expected to happen frequently in a year or is almost certain to happen, or an event which is expected to occur multiple times).	Biological	**Biodiversity (protected areas):** major loss or alteration to a legally protected or internationally recognised site whereby key elements or features will be fundamentally changed such that the overall integrity of the site is affected.
			Biodiversity (habitat): long-term and widespread changes to a habitat, ecosystem function or ecosystem services that reduce its integrity, affects the ability to sustain valued components, and may require extensive intervention. The habitat or ecosystem service may not recover to its baseline state.
			Biodiversity (species): disturbance of a sufficient portion of the bio-geographic population of a species may cause a decline in abundance, distribution or size of genetic pool such that natural recruitment could not return the population of the species, and other species dependent on it, to former levels.
		Social	**Livelihoods:** physical resettlement (as defined in IFC PS 5) of more than 20 households/businesses. Reduction in community and household assets, or access to assets, such that economic displacement (as defined in IFC PS 5) affects 20 or more individuals, households or businesses. Job losses in small communities with very limited alternative opportunities nearby. Long-term (> 5 years) financial loss to owners of businesses where recovery may be difficult.
			Social cohesion: significant unplanned in-migration flows considered sufficient to cause an exceedance of the capacity of at least three components of physical or social infrastructure. Increases in cultural conflict not able to be contained within existing social control norms.
			Health and safety: incident that requires mobilisation of international response equipment and crews. Increased public exposure to health threats that will very likely increase mortality rates. Significant increases in rates of serious crimes involving violence and property theft.
			Cultural heritage: activity or accident that seriously damages a site of tangible cultural heritage importance, notifiable to the relevant authority and requiring specialist skills to repair or seriously affects intangible cultural heritage requiring extensive mitigation.

* Noise impact magnitude categories are defined in more detail in Section 8

**Soil quality includes soil productivity potential (being a function of soil type, structure and fertility), soil compaction and soil contamination.

7.5.2 Receptor Sensitivity

For the impact assessment, RSK has used professional judgement to assess the quality and sensitivity of the receptor or resource affected by the impact, taking into account its local, regional, national and international designations, its importance to the local or wider community and its economic value. The assessment of the sensitivity of human receptors, for example, a household, community or wider social group, has taken into account their likely response to change and their ability to adapt to and manage the effects of the impact.

Stakeholder concerns associated with the type of receptor and the potential for cumulative impacts to occur have also been taken into consideration.

The sensitivity of receptors has been determined based on four categories, from 1 (very low) to 4 (high), as described in Table 7.2.

Table 7.2: Receptor sensitivity

Score	Baseline	Definition of receptor sensitivity
1 Very Low	Physical	**Surface water (resources):** surface waters with no community use or only used for low-grade industrial use.
		Groundwater (quality): very low-quality groundwater/ groundwater not used by the community.
		Soil (quality): soils identified as being tolerant of the proposed change without perceptible detriment to its character.
		Landscape: landscape that is dominated by derelict, disused or degraded man-made structures and/ or which is not valued by local communities or others. A natural landscape severely degraded or modified by cultural land uses, such as intensive arable or pastoral agriculture. Visual receptors with no or very limited views.
	Biological	**Biodiversity (habitat):** commonly occurring habitats and species, not subject to significant decline. Habitats that are already disturbed/modified with little biodiversity value.
		Biodiversity (species): fauna and flora present not particularly susceptible to disturbance including noise and vibration.
	Social	**Livelihoods:** highly skilled and experienced labour pool.
		Social cohesion: project AOI includes a negligible number of inhabitants and/or resources that are not used or protected.
		Cultural heritage: no cultural heritage assets, or artefacts of low archaeological importance.
		Health and safety: no human receptors for air emissions and noise apart from the workforce.
2 Low	Physical	**Surface water (quality):** surface water and sediments with some pre-existing pollution that limits their use or value for wildlife or communities.
		Groundwater (quality): Groundwater with some pre-existing pollution/degradation that limits its use or value for wildlife or communities.
		Soil (quality): soils with no geological, ecological, agricultural or economic value. Soils that respond well to restoration techniques.
		Landscape: a landscape with few intact or distinctive natural or historic features but which is valued at settlement/district/municipal level (e.g., attracts local visitors). Landscape with large, dominant, numerous and/or noisy modern man-made features. A natural landscape is degraded or modified by cultural land uses such as arable or pastoral agriculture. Visual receptors include people at their place of work, industrial facilities.
	Biological	**Biodiversity (value):** low sensitivity or local ecosystem value. Sites of local biodiversity value but not intact, fragile or unique.

Score	Baseline	Definition of receptor sensitivity
		Biodiversity (habitat): habitats that recover quickly following disturbance, e.g., habitats comprising species that rapidly recolonise disturbed areas.
		Biodiversity (species): species present are widespread common species, e.g., IUCN listed near threatened or least concern, with low biodiversity value. Fauna and flora present have low susceptibly to emissions and discharges fauna with low susceptibly to noise and vibration emissions.
	Social	**Livelihoods:** skilled labour pool that lacks relevant experience.
		Social cohesion: project AOI include a low number of inhabitants and/or resources that are used but not protected. Individuals or households in local communities have access to alternative resources, the use of which may cause limited adverse indirect impacts.
		Cultural heritage: designated and undesignated cultural heritage assets of local importance. Areas of negligible or low potential for previously unrecorded buried archaeology.
		Health and safety: human receptors for air quality and noise are limited to individuals from the local community that may pass through the area, but exposure for extended periods is unlikely.
3 Medium	Physical	**Surface water:** surface water and sediments of moderately high quality, e.g., in its natural state, or supports an area or species valued or designated for its importance at national level. Water is used for drinking or domestic use by a small number of users. Waters that support commercial or subsistence fishery.
		Groundwater: groundwater used for industrial purposes or agriculture. Groundwater that provides baseflow to surface watercourses used for fishing or bathing. Groundwater that supplies springs and wells but is not used for domestic purposes (washing, cooking, bathing).
		Soil (quality): soils that respond moderately well to restoration techniques. Soils with moderate geological, ecological, agricultural or economic value.
		Landscape: Landscape with a number of distinctive natural landforms or historic/traditional features that add character and where modern man-made features may be present but do not significantly degrade the landscape character. Landscape valued or designated for its landscape importance at national level (e.g., attracts tourists within the country). Anthropogenic landscape which has a more traditional, less intensive character and which has a higher sensitivity to change due to the presence of features such as gardens, orchards and traditional or unimproved pastures. A settlement which is valued at provincial /regional level (e.g., attracts tourists from province/region). Visual receptors include people travelling through or past the affected landscape in cars, on trains or other transport routes where higher speeds are involved and views sporadic and short-lived; people engaged in outdoor recreation where enjoyment of the landscape is incidental rather than the main interest,
	Biological	**Biodiversity (value):** medium sensitivity or regional/national ecosystem value.

Score	Baseline	Definition of receptor sensitivity
		Biodiversity (protected areas): sites of regional importance, or designated for protection at a national level, e.g., national parks/marine parks. Internationally recognised areas such as key biodiversity areas and important bird areas.
		Biodiversity (habitat): habitats providing important feeding or breeding grounds. Habitats of protected species or habitat diversity or 'naturalness', or recognised as intact or unique, or areas recognised by non-governmental organisations as having high environmental value. Habitats that are unlikely to return to natural conditions without some intervention, but which are capable of assisted recovery.
		Biodiversity (species): regionally or nationally important population of a species, either because of population size or distributional context. Species listed as vulnerable on the IUCN Red List (global or regional). Keystone species and species with long life histories, reflecting the inability of localised populations to recover from significant disturbance. Fauna and flora with moderate susceptibly to air emissions and discharges, fauna with moderate susceptibly to noise emissions.
	Social	**Livelihoods:** some households and business owners/operators perceive that the change will affect their ability to maintain their livelihood or quality of life for a significant time period (<1 year). Limited skills and experience in the labour pool.
		Social cohesion: project AOI include a moderate number of inhabitants and/or resources of regional importance. Some individuals/households depend on the affected resource with no nearby alternatives.
		Cultural heritage: cultural heritage sites or artefacts of regional or national importance. Area where archaeological or other cultural heritage resources are present, and/or area where the chance of disturbance of previously unknown or unrecorded buried archaeology is moderate.
		Health and safety: human receptors for air quality and noise include residential buildings where longer periods of exposure may occur.
4 High	Physical	**Surface water:** surface waters and sediments of very high quality, e.g., in natural state or supports an area or species valued or designated for importance at international level. Water is used for drinking or domestic use by many users. Waters that support very productive fisheries.
		Groundwater: aquifer used for drinking or domestic use (e.g., washing, cooking, bathing) by many users. Groundwater that provides essential baseflow to a watercourse.
		Soil (quality): soils with very high agricultural or economic value. Land supporting critically endangered species whose presence is dependent on soil quality, structure or properties.

Score	Baseline	Definition of receptor sensitivity
		Landscape: landscape valued or designated for its landscape importance at international level (e.g., attracts foreign tourists). Landscape with a high degree of naturalness or dominated by traditional/historic landscape features and an absence of modern man-made features or wilderness landscape. Visual receptors include occupiers of homes, users of outdoor recreational facilities where landscape value is important or integral to that activity, communities who have views of the landscape that they value highly, and homes and hotels purposely positioned/placed to take advantage of a view.
	Biological	**Biodiversity (value):** high sensitivity or international ecosystem value.
		Biodiversity (protected areas): sites of international importance/designated for protection at international level, e.g., World Heritage Area, Ramsar wetlands. Areas internationally recognised as Alliance for Zero Extinction sites.
		Biodiversity (habitat): highly threatened and/or unique ecosystems and areas illustrative of key evolutionary processes, as defined in IFC PS 6[18]. Critical habitats as defined by IFC PS 6. Habitats that are very difficult to restore to natural conditions.
		Biodiversity (species): species listed as critically endangered or endangered on the IUCN Red List (global or regional). Evolutionarily distinct species listed under the EDGE programme. Endemic and/or range-restricted species, migratory and/or congregatory species triggering critical habitat as per IFC Performance Standard. Fauna and flora with high susceptibly to air emissions and discharges, fauna with very low tolerance for noise and vibrations.
	Social	**Livelihoods:** many households and business owners/operators perceive that the change will affect their ability to maintain their livelihood or quality of life to an unacceptable extent and may have to leave the area/community. Lack of skilled and experienced labour pool.
		Social cohesion: project AOI include a significant number of inhabitants and/or resources of national or global importance. Communities depend on the affected resource(s) with no nearby alternatives.
		Cultural heritage: cultural heritage sites or artefacts of international importance such as United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Sites. Area where significant or important archaeological or other cultural heritage resources are present, and/or where the chance of disturbance of previously unknown or unrecorded archaeology is high.
		Health and safety: human receptors for air quality and noise include residential buildings, schools, hospitals where near-constant presence of people is possible and long-term exposure is likely.

[18] Critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to critically endangered and/or endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes (IFC, 2012).

7.5.3 Impact Significance

The impacts are assessed by examining both the magnitude of the impact and the sensitivity of the receptor that is affected. Together, the magnitude of the impact (1 – 4) and the sensitivity of the receptor(s) (1 – 4) allows the forecast of the impact significance. This interaction between magnitude and sensitivity can be expressed as a matrix, shown in Figure 7.2, thereby bringing a transparent structure to complex interactions.

Significance			Sensitivity rating			
			Very low	Low	Medium	High
		0 Positive	1	2	3	4
Magnitude rating	Very low	1	1 Negligible	2 Negligible	3 Minor	4 Minor
	Low	2	2 Negligible	4 Minor	6 Moderate	8 Moderate
	Medium	3	3 Minor	6 Moderate	9 Moderate	12 Major
	High	4	4 Minor	8 Moderate	12 Major	16 Major

Figure 7.2: Significance matrix

The significance of the overall assessment for each environmental and social aspect were defined as follows, based on best international practice.

- Major impact: impacts that have the potential to cause irreversible or widespread harm to an environmental or social value that is unique or has a limited capacity to adapt to change. Avoidance through appropriate design responses is the only effective mitigation.
- Moderate impact: impacts that have the potential to degrade or upset an environmental or social value due to their scale or its susceptibility to change. The value's abundance or resilience to change ensures that replacement and recovery is achievable.
- Minor impact: when an environmental or social value with low sensitivity is exposed to minor alterations that will not affect its viability, provided standard controls are adopted.
- Negligible impact: when an environmental or social value with low sensitivity is exposed to minor alterations which will not result in any noticeable change.
- Positive impact: impacts that have the potential to create beneficial or uplifting effects on an environmental or social value.

Major and moderate impacts are considered 'significant' and thus warrant identification of possible mitigation measures.

Impacts of minor or negligible impact are considered not to warrant additional mitigation measures, although in some cases low-cost actions are proposed that would be expected to further reduce corresponding impact significance. Within the social impact assessment (see Section 0) mitigation measures have been provided in most cases even where the impact has been assessed as not significant (e.g., minor or slight). This is largely because the measures set out are part and parcel of good international industry practice for socioeconomic management.

Positive impacts, particularly within the socioeconomic sphere (e.g., an increase in local employment opportunities due to the project), can result from project activities. In this circumstance, such impacts have not been ranked but were assigned a ‘positive impact’ for simplicity and discussed as appropriate, based on the assumption that any measures that would optimise benefits will be effectively implemented.

7.5.4 Mitigation Measures

Mitigation measures have been proposed to reduce potential negative impacts ranked moderate or major, and enhancement measures recommended to maximise potential positive impacts where possible. The mitigation hierarchy has been followed for identifying appropriate mitigation measures:

- avoid at source/reduce at source
- abate on-site
- abate off-site/at receptor
- repair or remedy
- compensate in kind.

The above hierarchy is aimed at ensuring that, wherever possible, potential negative impacts are mitigated at the source rather than mitigated through restoration after the impact has occurred.

7.5.5 Residual Impacts

The assessment of residual impacts is based on the effective implementation of:

- avoidance, mitigation and management measures for adverse impacts
- measures to optimise benefits.

Residual impacts with initial significance ratings of moderate or major have been discussed in more detail and required additional mitigation measures specific to that impact to reduce the impact significance down to an acceptable level. In some cases, ‘additional’ measures have been proposed even though significance is rated at ‘minor’ or less.

7.5.6 Presentation of Impact Assessment

Summary tables of impact assessment magnitude, sensitivity and significance, and residual impact where relevant, are provided for each environmental and socioeconomic aspect assessed in Sections 8.1, 0 and 0.

Full summary tables of the environmental and social impact assessment are provided in Table 8.67 and Table 8.89 respectively.

7.5.7 Cumulative Impacts

Cumulative impacts have been identified and assessed in accordance with the 'IFC Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets' (2013). The IFC Good Practice Handbook (GPH) uses a six-step approach to cumulative impact assessment (CIA), as presented in Figure 7.3. This approach is described in more detail in the sections below.

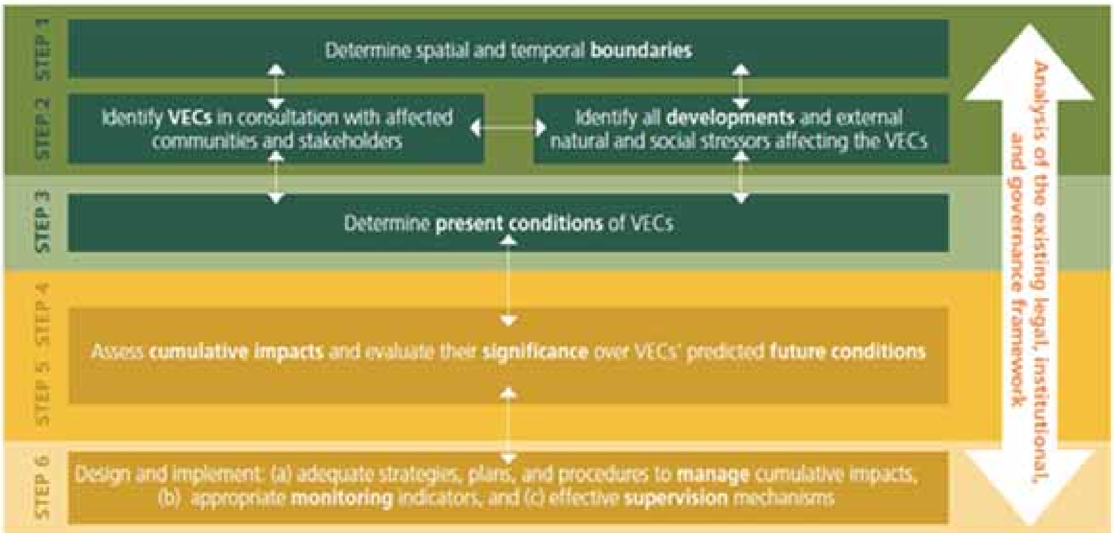


Figure 7.3: IFC cumulative impact assessment process

Source: IFC (2013)

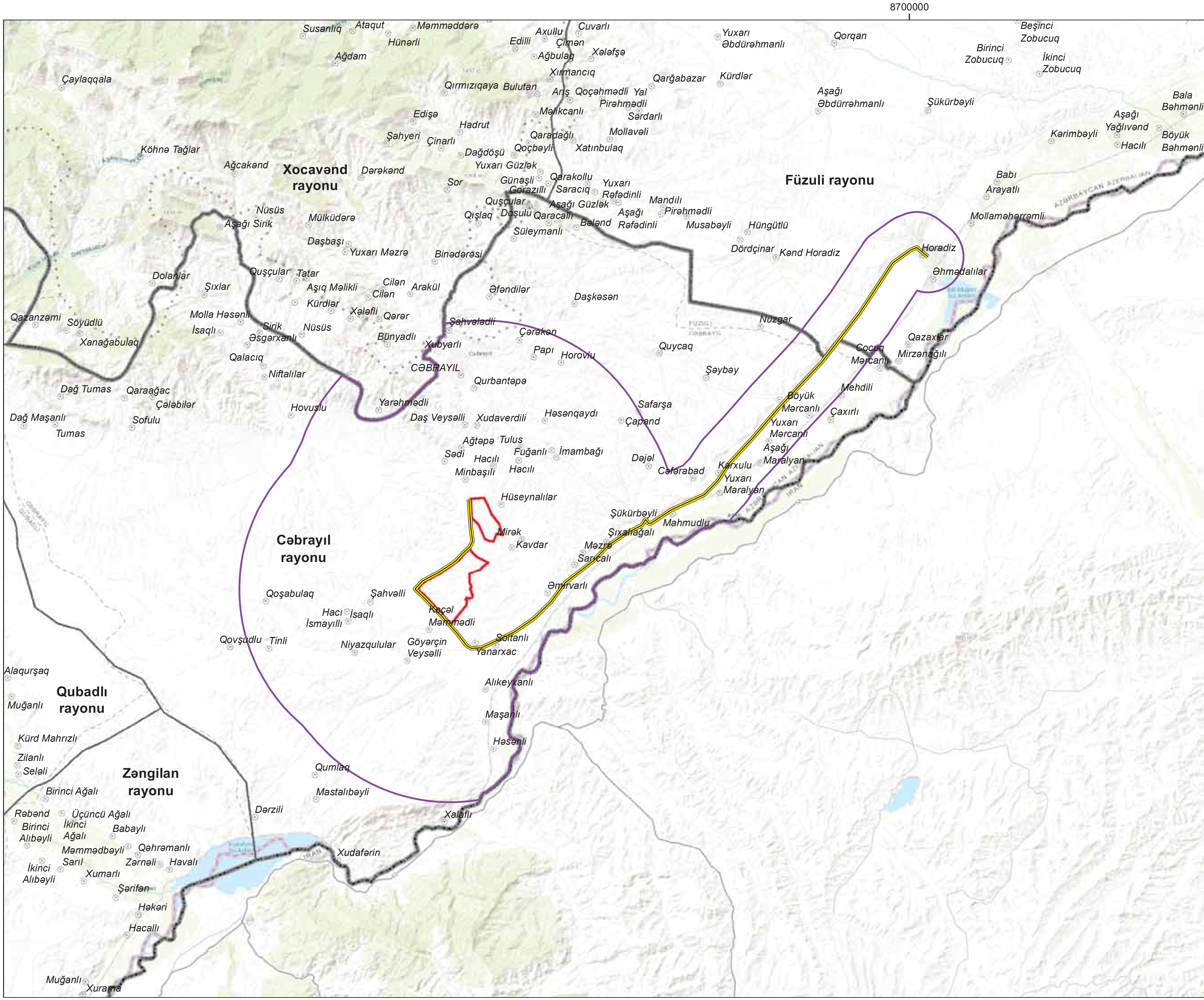
It should be noted that the GPH suggests that government and regional planners have ultimate responsibility for CIA.

7.5.7.1 Defining the area of influence (Step 1)

For the CIA, the AOI is based on that described in Section 5, Baseline Conditions. It should be noted that the unplanned/accidental events AOI is not considered in this impact assessment as the likelihood of simultaneous large-scale events is considered too remote.

The temporal boundary of the CIA AOI is the lifetime of the project, including decommissioning (35+ years), as this is the duration of potential impacts on receptors.

In addition, a precautionary study area around the project area in Jabrayil district has been used to identify third party projects that have the potential to lead to cumulative impacts. The study area, as shown in Figure 7.4, is a radius of approximately 10 km around the project site up to the Khojavend district boundary and the national boundary with Iran, plus a buffer of 2 km around the road from the project site to Horadiz (Fuzuli district).



Legend:

- Towns and villages
- Road to Horadiz
- Districts
- Economic Regions
- Project Area
- CIA Study Area

Notes:
This map contains data from the following sources:
DATA SOURCE (DATE)

Coordinate System: Pulkovo 1942 GK Zone 8
Projection: Gauss Kruger
Datum: Pulkovo 1942
Units: Meter

Rev	Date	Description	Drn	Chk	App
01	01/02/2024	Final	USeid	RB	FG
00	02/01/2024	Draft A	USeid	RB	FG

Project Sunrise

RSK

Figure 7.4:
CIA study area around the project site and road to Horadiz for identifying third party projectsStakeholder engagement (Step 2)

0 3 6
Kilometers

SCALE: 1:200,000 @ A3

N W E S

REV 01

Document Path: P81137\P81137 - Figure 7.4.mxd

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

7.5.7.2 Stakeholder engagement (Step 2)

Stakeholder engagement has been carried out with national, regional, district and community level stakeholders (see Section 6, Stakeholder Engagement). The output from this engagement has been used to identify environmental and social concerns and potential sources of cumulative impact in the AOI and study area.

7.5.7.3 Valued environmental and social components (Step 3)

The IFC GPH defines valued environmental and social components (VECs[19]) as “environmental and social attributes that are considered important in assessing risks”, (IFC, 2013). These attributes may be:

- physical features, habitats, wildlife populations (e.g., biodiversity)
- ecosystem services
- natural processes (e.g., water and nutrient cycles, microclimate)
- social conditions (e.g., health, economics), or
- cultural aspects (e.g., traditional spiritual ceremonies).

In accordance with the IFC GPH, the following criteria for the identification of VECs (or receptors) has been defined:

- identified as important and/or sensitive in Section 5 of this ESIA
- identified as important by the national/international scientific community, i.e., meeting the GPH criterion that a VEC should be recognised as important on the basis of scientific concern
- identified as important or sensitive by stakeholders.

A list of the identified VECs used for the CIA are presented in Table 7.3, a summary of the baseline condition of each VEC included in the CIA, and any trends and stressors affecting it are included in Section 5. Note, not all the receptors included in Section 5 have been included in the CIA, only those that meet the criteria outlined above.

The thresholds, limits of acceptable change, or preferred condition have also been defined in Table 7.3 on a case-by-case basis depending on the receptor and the nature of the cumulative impact being assessed. Where objective threshold values are identified by legislation, or by the IFC guidelines, these have been adopted (if relevant to the cumulative impact). For most receptors, however, threshold values are not defined and limits of acceptable change, or preferred condition have been used instead.

[19] Also known as receptors

Table 7.3: VECs used in the CIA

VEC	Reason for inclusion	Limit of acceptable change/preferred condition
Physical environment		
Air quality	The health and wellbeing of humans and biodiversity is associated with the ambient air quality in the area. Generation of dust in particular was a concern raised by stakeholders, see Section 6.	The limit of acceptable change is that the IFC Performance Standards and the WHO air quality guidelines are not exceeded from the combined effects of the project and other developments.
Climate	This VEC includes the global climate, including greenhouse gas emissions.	Azerbaijan's ability to meet its emission reduction target published as part of the UNFCCC's Paris Agreement is not impacted.
Noise	The health and wellbeing of humans and fauna is associated with the ambient sound level in the area.	No project environmental standard (see Section 8.1.4) is exceeded from the combined effects of the project and other developments.
Soil	Soil erosion is a prominent issue in in the Jabrayil region. Soil compaction can lead to alterations of drainage characteristics and may cause surface run-off and localised flooding.	The preferred condition of the soil is defined as the original state of the soil before construction. Reinstated soil should be capable of supporting its use and ecosystems as per the pre-construction state.
Hydrogeology	Screened out due to negligible impacts on groundwater from Project Sunrise.	
Surface water	Screened out due to negligible impacts on surface water bodies from Project Sunrise. The Araz River is, at its closest point, located approximately 4.7 km from the site.	
Landscape	Screened out due to no receptors in the AOI	
Biodiversity		
Habitats of conservation importance [Steppe Grassland]	The project is being developed, at least partially, in steppe grassland habitats which form part of the Azerbaijan Shrub Desert and Steppe ecoregion. The steppe habitats within this ecoregion are being increasingly converted to semi-deserts by anthropogenic forces and are declining across the wider region.	The preferred condition is that the number of species remains stable or increases, relative to the background changes in population levels. The limit of acceptable change is a short-term decrease followed by recovery to pre-construction numbers.
Habitats of conservation importance [Araz River]	This habitat feature is downstream of the project site and hosts potentially important breeding populations freshwater fish, known to be in decline across Azerbaijan and in the Caspian Region in general.	The preferred condition is that the number of species remains stable or increases, relative to the background changes in population levels. The limit of acceptable change is a short-term decrease followed by recovery to pre-construction numbers.

VEC	Reason for inclusion	Limit of acceptable change/preferred condition
Legally protected, internationally or nationally recognised areas	Screened out. The nearest protected or recognised area to the project is the Arasbaran KBA in neighbouring Iran, considered to be beyond the AOI for assessment of cumulative impacts.	
Flora species of conservation importance	Screened out. Floral species of conservation importance include habitats within the project AOI that are not common or support species that are not common and include ecological assemblages that are unique, relict, remnant, have high bioquality or support IUCN critically endangered, endangered, vulnerable, migratory, congregatory, endemic or range-restricted species, or trigger critical habitat under PS 6. See Section 5.	
Fauna species of conservation importance	Flora and fauna species of conservation importance within the project AOI include species that are IUCN (or national equivalent) critically endangered, endangered, vulnerable, protected, keystone, migratory, congregatory, endemic or range-restricted species or trigger critical habitat under PS 6.	The preferred condition is that the number of species and individuals remains stable or increases, relative to the background changes in population levels. The limit of acceptable change is a short-term decrease followed by recovery to pre-construction numbers.
Socioeconomic		
Economy	Presence of projects in the AOI may directly or indirectly impact economic activities and conditions, such as via job creation, imports and exports of project-related goods, and influx of new populations (e.g., workers from other regions, or foreign workers)	The preferred condition is for the standards of living of communities in the AOI to be equal to, or better than, before construction
Employment and skills development	Direct and indirect employment, and skills development. This was raised by the Ministry of Labour and Social Protection, see Section 6	The preferred condition is for the standards of living of communities in the AOI to be equal to, or better than, before construction
Labour and working conditions	All employees have a right to just and favourable conditions at work, There is potential for the violation of both national labour legislation and international labour standards across the developments in the AOI.	The preferred condition is for working conditions to be equal to, or better than, before construction. The limit of acceptable change is no violation of human rights
Land and livelihoods	Screened out. At the time of writing, land in the project area is not cultivated, and all former agricultural land has been abandoned. There are currently no residential, commercial or public buildings in the area.	
Infrastructure and services	Physical and social infrastructure such as access to utilities, waste services, roads, and education services	The preferred condition is defined as return to, or near the original condition of, infrastructure and services before construction

VEC	Reason for inclusion	Limit of acceptable change/preferred condition
Safety and security	Includes personal safety affected by the project from traffic and road use, and security affected by presence of workers, new populations, and security arrangements Traffic accidents were raised as a concern by stakeholders, see Section 6	The preferred condition is no increase in social ills and traffic accidents caused from the combined effects of the project and other developments
Tangible and intangible cultural heritage	TCH sites and ICH valued by communities in the AOI including cultures and traditions.	The preferred condition is for TCH to be preserved in situ. The limit of acceptable change in the event that the structure is excavated is for it to be preserved for research purposes. The preferred condition for ICH is that the use and appreciation of the ICH to be maintained. The limit of acceptable change in the event that the ICH is altered, with the agreement of stakeholder an alternative will be developed.

7.5.7.4 *Defining the sourced of cumulative impact (Step 4)*

Sources of cumulative impact (SCI) include:

- associated facilities
- third party planned developments
- induced development.

Associated facilities

IFC PS 1 (IFC, 2012) defines associated facilities as:

"facilities that are not funded as part of the project, would not have been constructed or expanded if the project did not exist and without which the project would not be viable".

IFC Guidance Note 1 (IFC, 2012), clause 52 states that:

". . . the client should normally have some commercial leverage on the operators of such [associated] facilities. Where such leverage allows, undertakings can be secured from these operators to operate their facilities consistent with the applicable Performance Standards. In addition, the client should identify its own actions, if any, that could support or supplement the actions of the operators of the associated facilities."

Third party developments

Planned third-party developments have been identified (within the study area defined in Section 7.5.7.1) based on the IFC definitions that projects are reasonably defined, reasonably predictable or foreseeable[20].

Third-party developments were identified by:

- review of district development plans and national development plans, for example the 'State Program on the Great Return' (Decree of the President of the Republic of Azerbaijan, 2022), which details the proposed development of major public infrastructure in the Jabrayil district for the period 2022-2026
- review of IFI websites for projects receiving or applying for funding
- review of other publicly available information on key developments in the region, such as websites of known developers and the press
- consultation with stakeholders.

An initial screening process was conducted to identify developments that are reasonably defined, reasonably predictable or foreseeable.

Existing third-party facilities and activities are assumed to be covered by the ESIA baseline (see Section 5).

Induced development of facilities and services

The CIA considers project-induced development, such as opportunistic businesses not directly supported by the project.

[20] Definition of projects that are "reasonably defined", taken from IFC Performance Standard 1 (IFC, 2012a). Definition of projects that are "reasonably predictable" or that are "foreseeable future developments", taken from the IFC GPH.

7.5.7.5 *Impact assessment (Step 5)*

For an impact to be assessed as cumulative, the project AOI and the source of cumulative impact AOI must overlap, and the impacts must occur in the same timescale.

The CIA includes:

- identifying potential impacts from the sources of cumulative impact and Project Sunrise on VECs
- predicting the contribution of Project Sunrise to the cumulative impact
- qualitatively determining the significance of the cumulative impact.

Where available information on SCIs is limited, professional judgement has been used to predict the impacts from these developments.

The significance of cumulative impacts has been determined qualitatively based on a predicted exceedance of VEC thresholds, limit of acceptable change or preferred condition as recommended by the GPH. The cumulative impact assessment is presented in Section 8.5.

7.5.7.6 *Management and monitoring*

The final step of the IFC GPH CIA process is concerned with designing and implementing the management and monitoring measures required to prevent significant cumulative impacts (i.e., above the threshold, or outside the limits of acceptable change) from occurring. If they are not avoidable, any adverse impact should be reduced as far as reasonably practicable. A distinction has been drawn, as discussed in the GPH, between management of significant cumulative impacts associated with Project Sunrise (where it can be expected that Lightsource bp has a high degree of control or influence over mitigation/management) and management of impacts outside of Lightsource bp’s control (because other third-party projects are the main cause of the cumulative impact). Figure 7.5, taken from the GPH, illustrates this difference and suggests how management/mitigation should proceed ideally, depending on whether the project has control or can exercise leverage, to achieve optimal cumulative impact management.

The contribution of Project Sunrise to cumulative impacts has considered three scenarios that also have implications for mitigation.

- High risk of potential cumulative impacts and Project Sunrise is an important contributor to the cumulative impact. In addition to implementing project mitigation measures, the project will design and implement monitoring or management strategies to appropriately manage cumulative impacts
- High risk of potential cumulative impacts but Project Sunrise is a small contributor to the cumulative impact on a VEC. The project will design and implement mitigation measures commensurate with the magnitude and significance of its residual contribution to the cumulative impacts
- Project Sunrise impacts have a limited/negligible contribution to cumulative impacts. No additional mitigation measures are considered necessary.

Figure 7.5: IFC guidance on responsibility for management and mitigation of cumulative impacts

Source: IFC (2013)

It is acknowledged in the GPH that the total cumulative impacts due to multiple projects typically should be identified in government-sponsored assessments and regional planning efforts. According to IFC PS 1, IFC clients are expected to ensure that their own assessment determines the degree to which each project under review is contributing to the cumulative effects. Figure 7.5 shows the importance of differentiating between those actions over which a private sector sponsor has direct control and those for which it may have leverage to influence others to achieve optimal cumulative impact management as part of a multi-stakeholder effort; an effort that ideally should be led by government agencies, but at a minimum must involve government agencies.

Management of impacts where Lightsource bp has control

As recommended in this ESIA, Lightsource bp has committed to undertake an extensive range of management and monitoring activities as part of this ESIA. Management and monitoring measures have been developed that will be sufficient to ensure cumulative impacts can be managed in accordance with the mitigation hierarchy:

- avoid at source: remove the source of the impact
- abate at source: reduce the source of the impact
- abate at the receptor: reduce the impact at the receptor
- remedy: repair the damage after it has occurred
- compensate/offset: replace in kind or with a different resource of equal value.

Where existing mitigation measures from Section 8 that are within Lightsource bp's control are sufficient to manage the cumulative impact, no further action is recommended.

Management of impacts outside of direct Lightsource bp control

Where significant potential cumulative impacts are identified but action from other parties is required to manage the cumulative impact, Lightsource bp will make best endeavours to engage with the appropriate parties and use the leverage it may have to:

- inform others of the potential cumulative impact
- exchange information to assist in the further definition of the cumulative impact as needed
- agree responsibilities for the management of cumulative impacts
- agree monitoring measures as appropriate.

These parties may include the proponents of other project developers, government agencies and affected communities. The actions taken and the effort expended will be proportionate to the likely scale of the cumulative impacts.

Proposed management and monitoring are presented in Section 10.

7.5.8 Ecosystem Services Assessment

Ecosystem services (ES) are defined as the direct and indirect benefits that people (including project affected communities (PAC)) derive from ecosystems, which are a dynamic complex of plant, animal, and micro-organism communities and their non-living environment interacting as a functional unit (World Resources Institute (WRI), 2013). ES valued by humans are often underpinned by biodiversity hence adverse impacts on biodiversity can often adversely affect the delivery of ecosystem services. ES are categorised as follows:

- provisioning services - the products people obtain from ecosystems
- regulating services - the benefits people obtain from the regulation of ecosystem processes
- cultural services - which are the nonmaterial benefits people obtain from ecosystems
- supporting services - which are the natural processes that maintain the other services.

ES within the project AOIs will be described and assessed within the ESIA. This will consider:

- the type of ES
- relevance of the ES to the project
- whether the project has direct management, control, or significant influence on the ES
- whether the project is likely to have an impact or result in adverse impacts on PAC
- whether the project will depend on the ES for its operation
- the category of the ES (1 or 2)
- whether the ES is a priority ('priority' or 'non-priority') using the matrix shown in Figure 7.6 below.

<table>
<tr><td colspan="2" rowspan="2">ES Priority Ranking</td><td colspan="3">Replaceability of ES</td></tr>
<tr><td>High (many spatial alternatives)</td><td>Moderate (some spatial alternatives)</td><td>Low or not replaceable (few to no spatial alternatives)</td></tr>
<tr><td rowspan="4">Importance of ES to beneficiaries</td><td>Essential</td><td>High</td><td>Critical</td><td>Critical</td></tr>
<tr><td>High</td><td>Medium</td><td>High</td><td>Critical</td></tr>
<tr><td>Moderate</td><td>Low</td><td>Medium</td><td>High</td></tr>
<tr><td>Low</td><td>Low</td><td>Low</td><td>Medium</td></tr>
</table>

Figure 7.6: Methodology used to determine ES priority

The ES impact assessment will be undertaken following the same methodology described above (see Sections 7.5.1 to 7.5.5). The ES impact assessment provides a significance rating for potential project-related impacts on ES pre and post mitigation (i.e., residual impacts). Where socioeconomic and/or environmental mitigation measures are required (for moderate, high and/or major impacts), applicable mitigation measures are proposed.

7.6 Impact Assessment Methodology for Unplanned Activities

An unplanned event is defined as ‘a reasonably foreseeable event that is not planned to occur as part of a project, but which may conceivably occur as a result of project activities (e.g., accidents), even with a low probability’. Unplanned events may occur during any phase of a project. The risk assessment is based on the application of experience of events or incidents to predict risk in the future. Consequences of potential impacts were first determined using severity levels and definitions. The impact of unplanned events on the environment and public health and safety, and the likelihood of their occurrence, were taken into consideration. This was distinguished from occupational safety and health issues related to the project, which are not within the scope of this ESIA.

Unplanned events have been assessed using a risk assessment matrix (RAM), which enables qualitative assessments of ‘reputation’, ‘health and safety’, ‘environment’, ‘social’ and ‘commercial’ risk (Figure 7.7). The likelihood was rated from highly unlikely to very likely (highly unlikely, unlikely, possible, probable and very likely), whilst the severity was rated from insignificant to very high (insignificant, low, medium, high and very high). The risk ranking was subsequently rated from small to critical (small, material, severe and critical).

			CONSEQUENCES TO PROJECT OBJECTIVES					LIKELIHOOD				
			Reputation	H&S	Environmental	Social **(eg accidental damage or interruption to infrastructure/cultural site etc, damage to or loss of a livelihoods asset (including livestock))** *(NB restitution/compensation for any damage is not considered within this column, only the extent of the impact)*	Commercial	Incident hardly ever occurs in industry	Occurs in <1 in 100 projects	Occurs in <1 in 10 projects	Occurs in many projects	Expected to occur in every project
								Highly unlikely	**Unlikely**	**Possible**	**Probable**	**Very likely**
								1	**2**	**3**	**4**	**5**
IMPACT	5	Very high	International Level	Multiple fatalities	Long term impact within or outside of company site. Restitution time >3 years. Tier 3 response.	>Severe damage or disruption of access to infrastructure or assets for multiple communities/ households. >Severe follow-on impacts on multiple households' livelihoods/ businesses. >Time is required to re-instate access, provide alternative access or repair damage to infrastructure or asset. >Permanent destruction or complete loss to a cultural heritage site	>$50mln loss					
	4	High	Regional Level	PTD/ Single fatality	Large effect within or outside of company site. Restitution time 1-3 years. Tier 2 response.	>Substantial damage or disruption of access to infrastructure or assets for multiple communities/ households. >Severe damage or disruption of access to infrastructure or assets for 1-2 households with follow on severe damage to those households' livelihoods. >Substantial follow- on impacts on multiple households' livelihoods/ businesses. >Time required to re-instate access, provide alternative access or repair damage to infrastructure or asset. >Substantial destruction takes place to a cultural heritage site which is at least partially repairable.	$30-50mln					
	3	Medium	Country Level	Major injury/ LTI	Any effect outside of company site. Short term effect on environment but contained within company site. Restitution time <3 months. Tier 1 response.	>Moderate damage or disruption of access to infrastructure or assets for one or two communities/ several households. >Moderate follow- on impacts on at least one households' livelihoods/ businesses. >Reinstatement of access, repair or provision of alternative infrastructure/asset can occur quickly >Some destruction takes place to a cultural heritage site, but this is repairable.	$10-30mln					
	2	Low	Industry Level	Minor injury/ RTW	Minor effect on environment & contained within company site. Restitution timer <3 months. Tier 1 response only.	>Minor damage or disruption of access to infrastructure or assets for one or two communities/ one or more households. >Minor follow-on impacts on one or more households' livelihoods/ businesses. >Reinstatement of access, repair or provision of alternative infrastructure/asset can occur quickly >No impacts at all on vulnerable individuals.	$1-10mln					
	1	Insignificant	Internal Knowledge only	Slight Injury/ First Aid	Limited or no effect on environment. Contained within site/system. Restitution time <1 month. Tier 1 response	>No livelihoods impact for any community or household as a result of damage to or interruption of access to community infrastructure or livelihood assets. >Reinstatement of access, repair of damage is immediate.	<$1mln					

Small	Material	Severe	Critical

Figure 7.7: RAM for unplanned events

8 IMPACT ASSESSMENT

8.1 Environmental Impact Assessment for Planned Events

8.1.1 Air Quality

The most common anthropogenic pollutants generated by human activities include SO_2, NO_x, CO, PM_{10}, $PM_{2.5}$ and VOCs from varied sources including energy production, industrial activities, vehicles and, agricultural activities.

Air quality data for Azerbaijan is limited, particularly for the Garabagh region where the project area is located. As discussed in Section 5, national level emissions data from the Norwegian Meteorological Institute (2011) and data from the World Bank have been used to characterise the air quality at the project area.

The project area is within a rural, non-developed area with a limited number of receptors in terms of exposure to air pollution. It is assumed that pollutant levels would be typical for this environment.

There are no towns, villages or settlements within the project AOI for air quality due to the history of Armenian occupation of the region.

8.1.1.1 Construction phase

Air emissions from construction activities are broadly categorised into:

- fugitive dust emissions from enabling works and vehicle movements on unpaved roads/dirt tracks
- exhaust emissions from construction plant and equipment on site
- exhaust emissions from the movement of vehicles in and out of the site.

A qualitative assessment of the likely significant effects of construction phase dust and particulate matter on local air quality at sensitive receptors has been undertaken following the Institute of Air Quality Management (IAQM) construction dust guidance (IAQM, 2023) and the overall impact assessment approach selected for this project as discussed in Section 7. The full construction dust assessment methodology is presented in Appendix 3. The categories of activities chosen from the IAQM guidance for this assessment are enabling works, construction, and vehicle track-out of material onto paved roads.

The following potential impacts of dust and PM_{10} have been considered in the assessment:

- the risk of health effects due to an increase in exposure to PM_{10}.

Professional judgement and experience have been applied to correlate project-specific characteristics to the three pre-defined IAQM impact magnitude categories (‘large’, ‘medium’ or ‘small’) (as detailed in Appendix 3) for each type of activity (enabling works, construction, and vehicle track-out).

The impact assessment for enabling works, other construction activities and vehicle track-out has considered both the scale and nature of the proposed project works, to determine the potential dust emission magnitude and the sensitivity of the area. To be consistent with the terminologies used in the impact assessment approach for this project described in Section 7, the IAQM impact magnitude class 'large' has been equated to 'high', 'medium' to 'medium' and 'small' to both 'low' and 'very low' magnitude categories.

The exhaust emissions from construction plant and equipment are estimated based on internationally recognised United States Environmental Protection Agency (US EPA) Nonroad Compression-Ignition Engines: Exhaust Emission Standards (March 2016). The emissions per day are estimated taking a conservative assumption of 12 hours of equipment and plant operation per day. Since details of equipment capacity and make were not available at the time of undertaking the assessment and number of equipment and vehicles are based on assumptions, the emission calculations are indicative only.

Professional judgement and experience have been applied to select the category of sensitivity. Table 8.1 indicates the receptor sensitivity used in undertaking the construction dust assessment as per the IAQM construction dust guidance.

Table 8.1: Receptor sensitivity

Sensitivity	Receptor
High	e.g., Residential properties, hospitals and schools
Medium	e.g., Commercial premises
Low	e.g., Public footpaths and roads

Potential impacts

The construction activities proposed to be undertaken within the project site and expected to have air quality impacts will include:

- site preparation and enabling works
- installation of foundations and piling activities
- construction of new access road
- installation of security provision
- installation of foundations
- development of associated infrastructure, including on-site substations and administration and control buildings.

The detailed description of the above listed construction activities is discussed in Section 3.2.

The impact assessment for dust emissions and exhaust emissions from the above proposed construction activities are discussed below.

Dust and particulate matter emissions

The magnitude of dust emissions expected from proposed construction activities at the project site is summarised in Table 8.2. No demolition work will be undertaken as part of this application, therefore, potential air quality impacts from demolition work has been scoped out.

Table 8.2: Magnitude of dust emissions

Category	Aspect	Scale and IAQM category
Enabling works	Total site area	>110,000m^2
	Soil type of the site	Silty clay, gravel, slits
	Earthmoving vehicles at any one time	>10 vehicles
	Height of bunds	<4m
	Dust emission magnitude	**Large**
Construction	Total building volume	<12,000m^3
	On-site concrete batching or sandblasting proposed	No
	Dust potential of construction materials	No
	Dust emission magnitude	**Small**
Track-out[21]	Number of heavy-duty vehicles per day	20-50 vehicles
	Surface type of the site	Silty clay, gravel, slits
	Length of unpaved road	>100m
	Dust emission magnitude	**Large**

On the basis that the construction works will take place during daytime hours, the predicted dust emissions from the construction of the project will represent a **low** to **high** magnitude, affecting **low** sensitivity receptors, which constitutes a short-term, **minor** to **moderate** negative adverse impact, see Table 8.3.

Table 8.3: Impacts of dust emissions from construction activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
PV power facility enabling works activities	Increased dust emissions	High (4)	Low (2)	**Moderate (8)**	Y
PV power facility construction activities	Increased dust emissions	Low (2)	Low (2)	**Minor (4)**	N
Track-out activities	Increased dust emissions	High (4)	Low (2)	**Moderate (8)**	Y

[21] Track-out refers to the transport of dust and dirt from the construction/demolition sites onto public road network, where it may be deposited and then re-suspended by vehicles using the network.

Mitigation measures

Impacts of dust emissions from PV power facility construction activities are considered to be minor to moderate. The dust risk categories identified have been used to define appropriate, site-specific mitigation methods. Site-specific mitigation measures are divided into general measures, applicable to all sites and measures specific to enabling works, construction and track-out. Depending on the level of risk assigned, different mitigation is assigned. The method of assigning mitigation measures detailed in the IAQM construction dust guidance has been used. Two categories of mitigation measure are described in the IAQM construction dust guidance – 'highly recommended' and 'desirable', which are indicated according to the dust risk level identified in Table 8.3. Desirable measures are presented in *italics*.

<u>Communications</u>

- Display the name and contact details of people accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
- Display Lightsource bp contact information.

<u>Pollution prevention</u>

- Develop and implement a Pollution Prevention Plan within the project ESMP that includes measures to control dust and other emissions, to be approved by Lightsource bp. The level of detail will depend on the risk and should include at a minimum the highly recommended measures. The desirable measures should be included as appropriate for the site.

<u>Site management</u>

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
- Make the complaints log available to Lightsource bp and external stakeholders if requested.
- Record any exceptional incidents that cause dust and/or air emissions, either on- or off site and the action taken to resolve the situation in the logbook.

<u>Self-verification</u>

- Carry out regular site inspections to monitor compliance with the ESMP, record results, and make the action log available to Lightsource bp and external stakeholders if requested.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.

<u>Preparing and maintaining the site</u>

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
- *Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.*
- Avoid site runoff of water or mud.
- Keep site fencing and barriers clean using wet methods, where practicable.
- Cover, seed or fence stockpiles to prevent wind whipping.

Operating vehicles/machinery and sustainable travel

- Ensure all vehicles switch off engines when stationary - no idling vehicles.
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
- *Impose and signpost a maximum-speed-limit of 30 kph on surfaced and 20 kph on unsurfaced site roads and within work areas.*

Construction activities

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g., suitable local exhaust ventilation systems.
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
- Use covered skips.
- Minimise drop heights from loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- *Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.*

Waste management

- Maintain robust waste management practices at site in line with the Waste Management Plan.
- Segregate hazardous and non-hazardous waste.
- Avoid bonfires and burning of waste materials.

Enabling works

- *Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.*
- *Use hessian, mulches, or tackifiers*[22] *where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.*
- *Only remove the cover in small areas during work and not all at once.*

Track-out

- *Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site.*
- *Avoid any dry sweeping of large areas.*
- *Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.*
- *Record all inspections of haul routes and any subsequent action in a site log book.*
- *Implement a washout station wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).*

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[22] Tackifiers are chemical compounds used in formulating adhesives to increase tack, the stickiness of the surface of the adhesive.

Residual impacts

With the implementation of the mitigation measures listed above, there will be no significant residual impacts associated with dust emissions from the PV power facility construction activities.

Exhaust emissions

The total releases (tonnes/day) of emissions of air pollutants were estimated based on the anticipated construction period, work hours per day, type of construction equipment to be used, and fuel specifications. A summary of construction emissions from the project site is presented in Table 8.4 together with exhaust emission estimates from construction equipment, vehicles and diesel generators.

Table 8.4: Construction emissions from construction equipment, vehicles and diesel generators

	CO	CO_2 eq	HC*	NO_X	SO_2	PM_{10}	$PM_{2.5}$
	Tonnes (total for 18 months of construction period)						
Construction equipment							
Backhoe	4.14	918.26	3.31	0.33	0.02	0.02	0.01
Excavator	16.91	3,754.57	13.53	1.35	0.09	0.07	0.05
Ramming machine	22.81	5,063.31	18.25	1.82	0.13	0.09	0.06
Telehandler	20.10	4,462.57	16.08	1.61	0.11	0.08	0.06
Cable pulling machine	0.37	82.39	0.19	0.02	0.00	0.02	0.01
Dumper	14.30	3,175.29	11.44	1.14	0.08	0.09	0.06
Drilling rig	37.88	8,410.24	43.30	4.33	0.30	0.22	0.15
Sub-Total	**116.52**	**25,866.63**	**106.09**	**10.61**	**0.74**	**0.58**	**0.40**
Construction vehicles							
Light vehicles	0.221	18.662	0.029	0.514	0.001	0.032	0.024
Heavy vehicles	1.29	307.93	0.23	7.65	0.01	0.23	0.17
Sub-Total	**1.52**	**326.59**	**0.26**	**8.16**	**0.01**	**0.26**	**0.19**
Diesel generators (DGs)							
DGs (150 kW)	19.92	4,150.52	2.54	75.38	5.08	3.02	2.11
Sub-Total	**19.92**	**4,150.52**	**2.54**	**75.38**	**5.08**	**3.02**	**2.11**
Total	**137.96**	**30,343.73**	**108.89**	**94.15**	**5.83**	**3.86**	**2.70**

*Note: HC refers to the volatile fraction.

On the basis that the construction works will take place during daytime hours, the predicted ambient air quality associated with exhaust emissions with the construction of the PV power facility will represent a **low** magnitude, affecting **low** sensitivity receptors, which constitutes a short-term, **minor** adverse impact. Management control measures will be implemented as part of routine construction activities to reduce exhaust emissions from construction equipment and vehicles.

- All plant, equipment, and vehicles used during the works shall be regularly serviced and fitted with appropriate emission control equipment, where practicable, to ensure optimum performance and that no excess exhaust emissions are emitted.
- Develop and implement a transport strategy that maximises the use of efficient transport methods.
- Plant, equipment, and vehicles shall be maintained in accordance with manufacturer's specifications to achieve effective combustion.
- Implementation of a Community Grievance Management Procedure.
- Sites and corresponding infrastructure shall be designed, constructed, and operated with the intention of minimising emissions of key pollutants where practicable.

The impacts of exhaust emissions from project construction activities are presented in Table 8.5.

Table 8.5: Impacts of exhaust emissions from construction activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Use of construction equipment, vehicles and diesel generators	Increased exhaust emissions	Low (2)	Low (2)	**Minor (4)**	N

Mitigation Measures

Impacts of exhaust emissions from PV power facility construction activities are considered to be **minor**. No further mitigation measures are deemed necessary, as the management control measures will suffice.

Residual Impacts

There will be no significant residual impacts associated with exhaust emissions from the PV power facility construction activities.

8.1.1.2 Operations phase

The operational phase of the project is expected to have insignificant impact on nearby sensitive receptors because of the absence of any continuously operating and polluting emission sources and very limited vehicle movements are expected at the project site for maintenance purposes.

Hence, no further assessment is undertaken for operation phase activities. It is however, recommended that the following management control measures are applied during the operational phase to minimise dust emissions and exhaust emissions during the operation phase.

- All plant, equipment, and vehicles used during the works shall be regularly services and fitted with appropriate emission control equipment, where practicable, to ensure optimum performance and that no excess exhaust emissions are emitted.
- Plant, equipment, and vehicles shall be maintained in accordance with manufacturer's specifications to achieve effective combustion.
- Sites and corresponding infrastructure shall be designed, constructed, and operated with the intention of minimising emissions of key pollutants where practicable.
- Vehicle movements should be restricted to designated roads (existing roads and tracks where possible) and approved routes and shall comply with the projects' road rules and speed limits.

A 150 kilo volt amperes (kVA) diesel generator (approximately equivalent to 150 kW) may be installed for emergency power supply purposes only, and hence this is not assessed due to its limited operation.

8.1.1.3 Decommissioning phase

The decommissioning phase will involve the removal of the solar panels and associated infrastructure from the site. Details of the decommissioning phase are not fixed at this stage, it is expected that the decommissioning phase will be similar to construction, albeit of a slightly shorter duration, with fewer road traffic movements and onsite equipment, it is therefore likely to cause a lesser impact than that assessed for the construction phase.

Based on the temporary nature of the decommissioning activities and low background pollutant concentrations in the vicinity of the site, it is considered unlikely that the effect of dust and particulate matter emissions and exhaust emissions from plant machinery and vehicles during the decommissioning phase will result in a significant effect on local air quality. It should be noted that measures implemented during the construction phase are also relevant for the decommissioning phase. Therefore, the decommissioning phase is predicted to have a temporary negative impact on local air quality.

8.1.2 GHG

Solar power plants provide an important mechanism for the reduction of carbon dioxide (CO_2), and other GHG emissions into the atmosphere by reducing the consumption of fossil fuel generated mains electricity. However, during their manufacture, construction and decommissioning, solar power plants can themselves result in GHG emissions, particularly where natural carbon stores, such as organic-rich soils and vegetation, are present and potentially impacted by the development.

This section presents a high-level assessment of the likely significant effects arising from the construction, operation and decommissioning of the proposed development upon the climate. The very nature of the proposed development is to mitigate against climate change and to align with relevant climate change legislation and planning policies, most notably the Paris Agreement.

The sensitive receptor for GHG emissions is the global climate, which is considered highly sensitive to GHG fluctuations. The proposed development has the potential to affect the climate through the addition and avoidance of GHG emissions in comparison to the baseline and future baseline scenario.

8.1.2.1 *Construction phase*

Impacts of construction activities

The majority of GHG emissions associated with the proposed development comprise those embodied emissions from infrastructure, primarily the solar PV modules. For all phases, the sensitivity of the receptor (the global climate) is considered **high**. The impact magnitude, not including any further mitigation measures, is assessed as **low**, with the residual impact significance being **moderate**.

Table 8.6: Impact to GHG emissions from construction activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Embodied emissions from infrastructure, primarily the solar PV modules	Increase in GHG emissions	Low (2)	High (4)	**Moderate (8)**	Y

Mitigation measures

The most effective mitigation will therefore be in the responsible sourcing of materials and infrastructure.

The procurement of items from countries with greener electricity should take priority, as the emissions from electricity significantly affect the overall emissions associated with the manufacture of materials. Procurement from China, although the dominant source for many materials, should be avoided wherever practically and reasonably possible due to the relatively high emissions associated with their electricity supply.

Environmental Product Declarations should be required and scrutinised for materials and equipment wherever possible, most particularly for the solar PV modules. Use of products with lower embodied/pre-use phase emissions will significantly improve the GHG impact of the proposed development.

In addition to procurement, a construction phase ESMP should be implemented which will include the following measures to decrease GHG emissions from the construction process phase.

- Implement measures to decrease fuel use by maximising energy efficiencies, for example to ensure all vehicles switch off engines when stationary and ensure construction vehicles are well maintained and conform to current emissions standards.
- Promoting the use of sustainable fuels in construction vehicles.

- Liaising with construction staff to minimise GHG emissions associated with commute to site, including provision of staff minibuses, and promoting of lower carbon modes of travel such as car sharing options.
- Promoting the use of locally sourced and/or produced materials. The use of recycled aggregates, where appropriate, for foundations, subbases and hard-standings.
- Promoting the recycling of materials by segregating construction waste to be re-used and recycled where practical.

Residual impact

Even if all the proposed additional mitigation measures were applied to maximum effect, there would still be a certain unavoidable amount of GHG emissions during the construction phase. For all phases, the sensitivity of the receptor (the global climate) is considered **high**. The impact magnitude, following the implementation of mitigation measures, is assessed as **very low**, with the residual impact significance being **minor**.

Table 8.7: Residual impact to GHG emissions from construction activities

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Embodied emissions from infrastructure, primarily the solar PV modules	Increase in GHG emissions	**Moderate (8)**	Very Low (1)	High (4)	**Minor (4)**

8.1.2.2 *Operations phase*

Impacts of operational activities

The operation of the proposed development will result in GHG emissions savings because of the displacement of fossil-fuel derived electricity within the national electricity grid.

For all phases, the sensitivity of the receptor (the global climate) is considered **high**. The impact magnitude for the operation of the proposed development is anticipated to be **positive**, with the residual impact significance being **positive**.

Enhancement measures

No additional enhancement measures are proposed.

Table 8.8: Impact to GHG emissions from operational activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Operation of the PV power facility	GHG emissions savings	Positive (0)	High (4)	**Positive (0)**	N

8.1.2.3 Decommissioning phase

Impacts of decommissioning activities

The decommissioning process is likely to result in GHG emissions. Since the actual emissions from decommissioning will not occur until the decommissioning phase takes place approximately 35 years in the future, it is difficult to accurately predict the magnitude of emissions at this stage.

Even if up-to-date best practice measures were applied to maximum effect, there would still be a certain unavoidable amount of GHG emissions during the decommissioning phase. For all phases, the sensitivity of the receptor (the global climate) is considered **high**. The impact magnitude is assessed as **very low**, with the impact significance being **minor**.

Table 8.9: Impacts to GHG emissions from decommissioning activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
PV power facility decommissioning activities	Increase in GHG emissions	Very Low (1)	High (4)	**Minor (4)**	N

Mitigation measures

Due to the potential advancements in technology and best practice between the present and the time in which decommissioning will take place, no additional mitigation can be proposed at this time.

8.1.2.4 Net significance

Renewable energy developments such as the proposed development have a major role to play in the transition to a low carbon economy, and the decarbonisation of the national electricity grid within Azerbaijan.

Over the lifespan of the proposed development, the GHG emissions savings are expected to outweigh the output of emissions caused by the construction, maintenance, and eventual decommissioning of the proposed development.

Therefore, the proposed development overall is considered likely to have a **positive** effect on the climate.

8.1.3 Noise

This section provides a summary of the noise impact assessment that has been undertaken for the project. Vibration has been scoped out of the assessment due to the nature of the operations, the substantial separation distances between the proposed plant installations and the surrounding sensitive social receptors, and the construction methods to be adopted. Potential vibration impacts on ecological and cultural heritage features are assessed in Section 8.1.9 and Section 8.2.6 respectively.

8.1.3.1 Acoustic significance criteria

The sensitivity of receptors is presented in Table 8.10. It should be noted that the sensitivity of a receptor remains the same regardless of the location or activity.

Table 8.10: Receptor sensitivity – noise

Sensitivity	Receptor
High	Residential properties, educational establishments, hospitals, places of worship, hotels, children's nurseries, nursing homes
Medium	Commercial premises including offices, halls, public municipal areas, bars and restaurants
Low	Industrial premises
Very Low	All other areas such as those used primarily for agricultural purposes

Table 7.1 in Section 7 defines the levels of impact magnitude for noise.

The criteria in Table 8.11 have been adopted for the assessment of magnitude of impact. These have been derived from relevant guidance and standards detailed below. Where not stated, it has been assumed that the criteria should apply externally.

- IFC EHS Guidelines – General EHS Guideline: Environmental Noise Management
- British Standard BS 5228-1:2009+A1:2014 Part 1 Code of practice for noise and vibration control on construction and open sites - Noise

Unless otherwise stated, daytime refers to the hours between 07:00 and 22:00, with night-time between 22:00 and 07:00, as per the IFC EHS guidelines.

Table 8.11: Adopted significance criteria

Source	Period	Significance rating			
		Very Low	Low	Moderate	Major
Construction noise	Day	< 55 dB LAeq,T[23]	55 – 65 dB LAeq,T	65 – 75 dB LAeq,T	> 75 dB LAeq,T
	Night	< 40 dB LAeq,T	40 – 55 dB LAeq,T	45 – 55 dB LAeq,T	> 55 dB LAeq,T
Operational noise	Day	< 50 dB LAeq,T	50 – 55 dB LAeq,T	55 – 60 dB LAeq,T	> 60 dB LAeq,T
	Night	< 40 dB LAeq,T	40 – 45 dB LAeq,T	45 – 50 dB LAeq,T	> 50 dB LAeq,T

Table 8.12 presents the receptor sensitivity, and the separation distances between the various project facilities and the surrounding receptors. The distances shown in the table represent the closest setback distance in all instances. Receptor locations are presented within Appendix 4A.

[23] Equivalent, A-weighted continuous sound level, in decibels.

Table 8.12: Approximate separation distances to surrounding receptors

Receptor ID	Receptor Location	Receptor Description	Receptor sensitivity	Approximate separation distance to closest PV Power Facility Cluster (km)
R01	Not identified	Solid waste management area	Low	5.4
R02	Yanarkhaj	Industrial zone	Low	2.8
R03	Soltanli	Future settlement	High	2.9
R04	Not identified	Future Train station	Medium	3.6
R05	Not identified	Future settlement	High	4.0
R06	Not identified	Future settlement	High	4.2
R07	Emirvarli	Future settlement	High	4.3
R08	Sarijanli	Future settlement	High	4.3
R09	Sarijanli	Future Train station	Medium	4.8
R10	Sikhahagali	Former settlement	High	6.2
R11	Dejel	Former settlement	High	9.0
R12	Capand	Former settlement	High	8.9
R13	Safarsa	Former settlement	High	9.9
R14	Quycaq	Future settlement	High	13.1
R15	Imambagi	Former settlement	High	4.8
R16	Fuganli	Former settlement	High	4.7
R17	Heenqaydi	Former settlement	High	5.5

Receptor ID	Receptor Location	Receptor Description	Receptor sensitivity	Approximate separation distance to closest PV Power Facility Cluster (km)
R18	Papi	Future settlement	High	8.3
R19	Tulus	Former settlement	High	3.4
R20	Qurbantepe	Future settlement	High	6.4
R21	Das Veyselli	Industrial zone	Low	4.8
R22	Das Veyselli	Future Settlement	High	4.0
R23	Agtepe	Future Settlement	High	2.8
R24	Sedi	Former settlement	High	2.4
R25	Minbashili	Future settlement	High	1.4
R26	Hajili	Former settlement	High	2.0
R27	Huseynalilar	Former settlement	High	0.9
R28	Mirak	Former settlement	High	1.7
R29	Kavdar	Former settlement	High	1.4

8.1.3.2 Construction phase

PV power facility

The primary construction activities associated with the PV power facility that have the potential to be significant are presented in Table 8.13.

Table 8.13: Construction activities relevant to noise

Component	Construction activity
Enabling Works	Installation of security fencing
	Vegetation clearance
	Site welfare establishment
	Access route construction
	Site preparation and earthworks
Installation of PV modules and associated equipment	Installation of foundations (piling)
	Installation of foundations (concreting)
	Installation of PV frames
	Mechanical and electrical installations
	Cable trenching installation

Typical noise levels generated by the construction phase activities have been predicted to establish potential impacts at sensitive receptors in the surrounding area. This has been calculated in accordance BS 5228-1:2009+A1:2014 '*Code of Practice for Noise and Vibration Control on Construction and Open Sites*'.

For the purposes of this assessment, it has been assumed that the surrounding land is flat and acoustically reflective, i.e., no acoustic screening from the intervening topography, or attenuation due to ground absorption. This has the potential to overestimate the predicted noise levels, and therefore offers a robust assessment.

The anticipated plant items and cumulative sound pressure levels for the construction phase activities associated with site enabling works are presented in Table 8.14.

Table 8.14: Site enabling works – construction phase plant list and cumulative sound pressure levels

Activity	Plant	Plant Ref.	Noise at 10m, dB(A)	% time	No. of items in use	Total noise at 10 m, dB(A)
Installation of security fencing	Ramming Machine	Provided by Lightsource bp	89	20	3	**88**
	Excavator	Provided by Lightsource bp	82	10	2	
	Petrol hand-held circular saw	C4.70	91	10	1	
	Telehandler	Provided by Lightsource bp	71	10	2	
	Hand tools	--	--	--	--	
Vegetation clearance	Excavator	Provided by Lightsource bp	82	30	2	**81**
	Dozer	C2.10	80	20	1	
	Wheeled loader	C2.28	76	20	1	
	Dumper	Provided by Lightsource bp	69	20	3	
	Hand tools	--	--	--	--	
Site welfare establishment	Lorry with lifting boom	C4.53	77	70	1	**81**
	Lifting platform	C4.57	67	30	1	
	Excavator	Provided by Lightsource bp	82	20	2	
	Telehandler	Provided by Lightsource bp	71	15	2	
	Dumper	Provided by Lightsource bp	69	20	3	
Access route construction	Excavator	Provided by Lightsource bp	82	30	2	**82**
	Dumper	Provided by Lightsource bp	69	20	3	
	Grader	C6.31	86	15	1	
	Asphalt paver (+ tipper lorry)	C5.30	75	20	1	
	Vibratory roller	C5.21	80	10	1	
	Hand tools	--	--	--	--	

Activity	Plant	Plant Ref.	Noise at 10m, dB(A)	% time	No. of items in use	Total noise at 10 m, dB(A)
Site preparation and earthworks	Dumper	Provided by Lightsource bp	69	30	3	**85**
	Dozer	C2.10	80	30	1	
	Excavator	Provided by Lightsource bp	82	30	2	
	Wheeled loader	C2.28	76	30	1	
	Grader	C6.31	86	20	1	
	Water tanker extracting water (vacuum pump)	C4.89	79	50	1	
	Vibratory roller	C5.21	80	40	1	

It is understood that there are currently no occupied residential areas in the vicinity of the project location; the closest residential receptor location has been identified as a primarily military residential area situated in Jabrayil City, approximately 6 km north of the northern cluster of the proposed PV power facility. Given the distance between the receptor location and the planned construction activity, this receptor has been scoped out of the construction noise assessment.

It is not yet known whether temporary workforce accommodation facilities will be established for the project.

In order to assess the potential adverse impacts relating to noise disturbance from construction activity, approximate standoff distances for each construction activity are presented within Table 8.15. These distances are the minimum distance required from the proposed work extents to achieve a very low significance during daytime hours (<55 dB LAeq,T). As such, any temporary workforce accommodation facilities should not be located within this exclusion zone, unless internal noise levels can be suitably mitigated through design measures.

The distances provided are based upon unmitigated, free field noise levels, with predictions undertaken on the basis that all plant/equipment will be occurring at the closest point to offsite receptors i.e., at the nearest site boundary, and assumes point source propagation; on this basis, the predicted values represent a worse case.

Though it is anticipated that the total number of plant items used during the construction tasks will be larger than those specified in the plant lists above, it would be expected that the plant items be spread across the entire work extent, and not localised at the closest point to the receptor location. As such, the reduction in plant numbers considered in plant lists above would still be considered to represent a worst case scenario.

Noise relating to construction traffic has been scoped out of the assessment owing to the lack of existing receptors along the proposed construction routes.

Table 8.15: Approximate stand-off distances from construction activities

Construction phase	Construction activity	Required exclusion zone from work extents (metres[2])
Enabling works	Installation of security fencing	447
	Vegetation clearance	200
	Site welfare establishment	200
	Access route construction	224
	Site preparation and earthworks	316
Installation of solar PV modules and associated facilities	Installation of foundations (piling)	282
	Installation of foundations (concreting)	141
	Installation of PV frames	447
	Mechanical and electrical installations	224
	Cable trenching installation	282

On the basis that the construction works will take place during daytime hours only, the predicted noise levels associated with the construction of the PV power facility will be below 55 dB LAeq,1hr and therefore represent a **very low** magnitude. Based on a **very low** magnitude affecting **high** sensitivity receptors, this constitutes a **minor** negative impact significance. Management control measures will be implemented as part of routine construction activities to reduce the noise levels at source, including switching off engines of plant and equipment when idling.

It is understood that no night-time construction activities are currently scheduled. Should night-time working be required, noise impacts from construction activities should not preclude such works. It should be noted however, that the exclusion zone for any temporary workforce accommodation facilities would need to be increased accordingly to achieve noise levels below 40 dB LAeq,1hr, therefore corresponding to a **very low** magnitude.

The impacts of noise from solar PV power facility construction activities are presented in Table 8.16.

Table 8.16: Impacts of noise from PV power facility construction activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
PV power facility enabling works activities	Noise disturbance	Very Low (1)	High (4)	**Minor (4)**	N
Installation of solar PV modules and associated facilities	Noise disturbance	Very Low (1)	High (4)	**Minor (4)**	N

Mitigation measures

All impacts of noise from PV power facility construction activities are considered to be **minor**. Therefore, no further mitigation measures are deemed necessary, as the management control measures as part of routine construction activities will suffice.

8.1.3.3 *Operations phase*

During the operational phase, the PV power facility has the potential to generate noise emissions that may be perceptible at future sensitive receptors in the surrounding area. The key operational facilities are noted below:

- northern cluster
- southern cluster
- high voltage (HV) 33/330 kV substation (associated facility, AzerEnerji scope).

There are not predicted to be any significant noise emissions associated with the PV panels following their installation; these have therefore not been considered as part of the operational phase assessment. The sources of noise identified within the proposed development are as follows:

- string inverter
- MV central inverter
- MV transformer
- HV transformer.

Given the low number of medium and heavy vehicle movements associated with the proposed PV power facility once operational, the resultant noise levels on the public highway are not anticipated to be significant.

The noise levels generated from tracking motors for the solar panels have not been assessed, due to their intermittent and brief operation, and low sound power output (<50 LWA).

The noise levels generated by the operation of the proposed PV power facility have been calculated using the computational noise modelling software SoundPlan v8.2. The software calculates industrial noise from mobile and static sources in accordance with

International Standard ISO 9613-2:1996 'Acoustics, attenuation of sound during propagation outdoors. General method of calculation'.

The ISO 9613-2 method predicts noise levels under meteorological conditions favourable to noise propagation from the sound source to the receiver, such as downwind propagation. The methodology takes account of the following physical effects:

- geometrical divergence
- atmospheric absorption
- ground effect
- reflection from surfaces
- screening by obstacles.

The noise model has been configured based upon drawing number 'LP2-PDL' as per 'AZE_Project Sunrise_LP2-PDL_02(300 MW_P)', dated 09.10.2023. This has been included in Appendix 4B. Within this layout, the configuration for the MV central inverters and MV transformers have been defined, but the string inverters have not been indicated. For this element, the locations have been assumed in accordance with previous RSK solar PV project experience and positioned at the end of the solar array strings. This layout indicates two potential project collection HV substation locations; 'Project collection substation option 1' has been selected as this represents a worst-case scenario, being the closest of the two options to the identified receptors (project layout included in Appendix 4B).

The total number of each identified element of noise emitting plant items has been defined. Vendor datasheets are not available for the proposed plant installations. In the absence of this information, the noise emissions presented in Table 8.17 have been assumed for each item of plant, as quantified, in locations across the proposed development.

It is recommended that vendor/measurement data is obtained for all installations, sufficient to validate the predicted receptor noise levels.

Table 8.17: Operational phase noise emissions

Equipment	Approximate Quantity	Sound power level
HV Transformer	2	90 dB(A)
MV Transformer	53	80 dB(A)
Central Inverter	53	95 dB(A)
String Inverter	1020	85 dB(A)

Other assumptions made in respect of the proposed plant installations include dimensional data, height of the source emissions above ground level and the source directivity. The modelling parameters are presented in Table 8.18.

Table 8.18: Operational phase modelling parameters

Parameter	Setting
Algorithm	International Standard ISO 9613-2:1996 '*Acoustics, attenuation of sound during propagation outdoors. 'General method of calculation*'
Ground absorption	Acoustically hard surfaces typically have a coefficient up to 0 i.e., roads, hard standing areas etc. Acoustically soft surfaces typically have a coefficient of down to 1 i.e., grass or vegetated areas. The ground absorption in the noise model has been assumed at 0.5 coefficient.
Façade corrections	Not applied i.e., results represent free-field noise levels
Receptor height	A receptor height of 1.5 m above ground level has been assumed
Source modelling/ data	It is assumed that the proposed plant installations will operate continuously during both daytime and night-time periods. The substation noise emissions have been modelled as point sources, with a source height of 3 m above ground level for the HV transformers and 1.5 m above ground level for the MV transformers, and central inverters. String inverters have been assumed at a height of 1 metre, located towards the end of the solar array strings. 'Project collection substation option 1' has been assumed as the location of the HV transformer. This location has been selected as it represents a worst case scenario; it is the closest of the two proposed HV substation options to the identified future receptor locations. The noise emissions have been modelled using spectral data obtained from RSK's database of similar developments. No allowance has been made for directivity of the plant noise emissions i.e., model assumes omni-directional propagation.
Terrain	The noise prediction model has accounted for terrain through contour lines in 10 m intervals.
Barriers/structures	The model does not incorporate features on site which may provide partial screening (e.g., buildings and equipment items). Consequently, the contribution of certain sources may be overestimated.
Site layout	Noise sources have been modelled based upon the layout 'LP2-PDL' taken from 'AZE_Project Sunrise LP2-PDL_02(300 MW_P)', dated 09.10.23. This is shown in Appendix 4.

The predicted noise levels for the operation of the PV power facility at the closest surrounding sensitive receptors are presented in Table 8.19. The identified receptors are largely indicative of future settlement locations anticipated as part of the wider scheme of 'Resettlement and Reconstruction of the Liberated Areas'. The timescales of any resettlement or reconstruction are not known. It is anticipated that this scheme would commence after the commissioning of the proposed PV power facility.

Table 8.19: Predicted PV power facility operational phase noise levels

Receptor ID	Receptor Location	Receptor Description	Predicted noise level, dB LAeq, T [1]	
			Day	Night
R01	Not identified	Solid waste management area	10	10
R02	Yanarkhaj	Industrial zone	19	19
R03	Soltanli	Future settlement	18	18
R04	Not identified	Future Train station	16	16
R05	Not identified	Future settlement	15	15
R06	Not identified	Future settlement	15	15
R07	Emirvarli	Future settlement	14	14
R08	Sarijanli	Future settlement	13	13
R09	Sarijanli	Future Train station	12	12
R10	Sikhahagali	Former settlement	10	10
R11	Dejel	Former settlement	10	10
R12	Capand	Former settlement	10	10
R13	Safarsa	Former settlement	10	10
R14	Quycaq	Future settlement	10	10
R15	Imambagi	Former settlement	10	10
R16	Fuganli	Former settlement	10	10
R17	Heenqaydi	Former settlement	10	10
R18	Papi	Future settlement	10	10
R19	Tulus	Former settlement	14	14
R20	Qurbantepe	Future settlement	10	10
R21	Das Veyselli	Industrial zone	10	10
R22	Das Veyselli	Future Settlement	12	12
R23	Agtepe	Future Settlement	17	17
R24	Sedi	Former settlement	17	17
R25	Minbashili	Future settlement	24	24
R26	Hajili	Former settlement	19	19
R27	Huseynalilar	Former settlement	29	29
R28	Mirak	Former settlement	21	21
R29	Kavdar	Former settlement	23	23
[1] A minimum noise level of 10 dB LAeq,T has been presented. Noise levels below 10 dB(A) cannot be reliably measured or verified.				

The operational phase noise levels associated with the PV power facility will be below 40 dB LAeq,1hr and therefore represent a **very low** magnitude. On the basis of a **very low** magnitude, affecting **high** sensitivity receptors, this constitutes a **minor** negative impact significance.

The impacts of noise from the PV power facility during operation are presented in Table 8.20.

Table 8.20: Impacts of operational noise from the PV power facility

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Operation of the PV power facility	Noise disturbance	Very Low (1)	High (4)	**Minor (4)**	N

Mitigation Measures

Impacts of noise from the PV power facility during operation are considered to be **minor**. Therefore, no further mitigation measures are deemed necessary.

Overhead Transmission Lines

It is not yet known if the project will implement OHTL, or whether connections will be made via underground cabling. Should OHTL be the preferred option the noise impact associated with corona discharge has not been assessed. It is anticipated that this will be confirmed as part of the subsequent design stage, with measures introduced as necessary to reduce the corona effect when in the vicinity of sensitive receptors.

8.1.3.4 Decommissioning phase

The decommissioning of the PV power facility is not expected to occur for at least 35 years, therefore the specific activities associated are not yet known. Assuming the activities associated with the decommissioning of the PV power facility would be similar in nature to those associated with the construction activities, it would be expected that noise emissions would be of a similar magnitude. The works would be anticipated to be short term in duration, and would not be permanent.

It would be expected that at the time of the decommissioning works, future settlement locations, as anticipated as part of the wider scheme of ‘Resettlement and Reconstruction of the Liberated Areas’ would be populated within vicinity of the PV power facility. Details of specific settlement location areas, and respective timeframes are not currently known.

Assuming noise relating to decommissioning activities are consistent with those predicted during the construction phase, the required exclusion zone from work extents as presented above within Table 8.15 would be applicable. These distances are the minimum distance required from the proposed work extents to achieve a **minor** significance during daytime hours. It is understood that no settlements are currently planned within this exclusion zone, should this not be the case at the time decommissioning activities are due to commence, suitable mitigation measures should be employed on site to reduce noise levels appropriately.

On the basis that the decommissioning works will take place during daytime hours only, the predicted noise levels associated with the decommissioning of the solar PV power facility will be below 55 dB LAeq,1hr and therefore represent a **very low** magnitude. On the basis of a **very low** magnitude affecting **high** sensitivity receptors, this constitutes a **minor** negative impact significance. Management control measures will be implemented as part of routine construction activities to reduce the noise levels at source, including switching off engines of plant and equipment when idling.

The impacts of noise from the PV power facility during decommissioning are presented in Table 8.21.

Table 8.21: Impacts of noise from the decommissioning of the PV power facility

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
PV power facility decommissioning activities	Noise disturbance	Very Low (1)	High (4)	**Minor (4)**	N

Mitigation measures

Impacts of noise from the PV power facility during decommissioning activities are considered to be **minor**. Therefore, no further mitigation measures are deemed necessary.

8.1.4 Soils

This section discusses potential impacts on soils during construction and operations of Project Sunrise. Associated mitigation measures to be adopted are also discussed. This section also considers the need for the project to address some aspects of the baseline ground conditions (e.g., pre-existing contamination), as it has the potential to affect construction activities.

8.1.4.1 Construction phase

Compaction and changes to soil structure

Compaction of soils during construction may occur where the bearing strength is exceeded by the weight of construction vehicles. This is most likely on the access roads and heavily utilised areas such as storage areas or temporary workforce accommodation facilities, which will be subject to repeated vehicle movements.

Soil compaction can lead to alterations of drainage characteristics and may cause surface run-off and localised flooding. It also decreases the ability of vegetation to re-establish and may reduce aeration levels and cause anaerobic or waterlogged conditions to develop. The latter can cause secondary impacts on soil micro-organisms and plant growth, which could lead to reduced soil quality.

The soils present in the study area, have a potential for compressibility, especially during wet conditions. However, the site is in an arid region with modest rainfall and the project areas have experienced significant soil disturbance due to demining.

For these reasons, the receptor sensitivity has been assigned as **low**. The impact magnitude has been assessed as **low,** due to the short duration of the construction activities and the limited effects on the existing soil quality. The resulting impact significance is considered to be **minor.**

Table 8.22: Impact to soils from compaction and changes to soil structure

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Repeated vehicle movements	Compaction and changes to soil structure	Low (2)	Low (2)	**Minor (4)**	Y

Mitigation measures

Mitigation measures during the construction phase to avoid compaction impacts include:

- vehicle movements will be restricted to defined access routes and demarcated working areas (unless in the event of an emergency)
- driving and other work will not be permitted in excessively wet conditions
- topsoil will be stored outside the running track used by construction plant, equipment and vehicles
- load-bearing materials, such as bog mats and geotextile membranes, will be used to support heavy loads in areas of soft ground
- temporary drainage will be provided where necessary to prevent ponding or waterlogging of the working area
- back-fill material will be adequately (but not excessively) compacted to prevent future settlement.

Residual impact

Any impacts on soils associated with compression, during construction are considered minor, with the receptor sensitivity remaining **low**, the impact magnitude, after mitigation is reduced to **very low**, and the residual impact significance assessed as **negligible**.

Table 8.23: Residual impact to soils from compaction and changes to soil structure

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Repeated vehicle movements	Compaction and changes to soil structure	**Minor (4)**	Very Low (1)	Low (2)	**Negligible (2)**

Erosion, soil loss and direct disturbance of surface soil

Preparation of the site, construction camps, storage areas and access roads, including removal of vegetation, topsoil stripping and benching, will disturb soil structure and stability. This will increase the risk of erosion particularly in areas where soils have poor cohesion or are sloping. The erosion risk will be highest during wet weather, when runnels may develop, and will be exacerbated by vehicle movements. However, the site is located in an arid region with modest rainfall.

Stability in areas that already exhibit active erosion could be made worse by construction if not managed correctly. This may also lead to accelerated erosion following reinstatement.

Topsoil removed from the site will be stored at the edge of the working area pending replacement during reinstatement. Topsoil stacks are usually poorly consolidated and therefore prone to erosion and soil loss via wind erosion or wash out by rainfall. Erosion of the topsoil piles will reduce the availability of topsoil for reinstatement and as a secondary impact will reduce the effectiveness and success of revegetation.

Construction of the substation is likely to require the excavation of topsoil and subsoil. The footprint will be relatively small. Soils will be reused locally and will therefore be permanently lost from their point of origin.

For these reasons, the receptor sensitivity has been assigned as **low**. The impact magnitude has been assessed as **low,** due to the duration timeframe of the construction activities and the limited effects on the existing soils. The resulting impact significance is considered to be **minor.**

Table 8.24: Impact to soils from erosion, soil loss and direct disturbance of surface soil

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
PV power facility enabling works and construction activities	Erosion and soil loss	Low (2)	Low (2)	**Minor (4)**	Y

Mitigation measures

The following mitigation measures during the construction phase to avoid erosion and soil loss impacts will be implemented.

- An Erosion, Sediment Control and Reinstatement Plan will be produced within the ESMP and will describe measures to reduce and control erosion and sediment run-off during construction and reinstatement, soil handling, storage and replacement, seeding and revegetation, where appropriate.
- The site will be inspected regularly for signs of erosion and sediment run-off. The frequency of these inspections will be increased in sensitive areas.
- Where the ground is considered sufficiently steep (generally greater than 25%), topsoil stockpiles will be protected with silt fence or low berms to help reduce washout and loss of topsoil during heavy rains.
- The surface of topsoil and subsoil stockpiles will be compacted sufficiently with the aim of preventing erosion, without leading to the development of anaerobic conditions.
- Topsoil stockpiles will be regularly inspected for erosion; corrective measures will be implemented if compaction or erosion is identified.
- Sediment control fencing (or low berms), drainage channels and trench barriers will be installed where appropriate.
- In areas where machinery is not able to achieve the topsoil strip depth and there is a risk of subsoil mixing, stripping by other means, such as by using hand tools, will be implemented.
- Stripped topsoil in sensitive (thin) topsoil areas shall be stored separately in designated areas.
- Consideration will be given to covering topsoil piles where topsoil is very thin and at risk of wind and water erosion.
- If significant amounts of topsoil are lost due to poor topsoil handling, then it may be required to replace it with topsoil of similar chemical, biological and physical characteristics.
- Protection measures will be put in place to prevent any run-off water used for dust suppression from causing sedimentation in nearby watercourses.

Residual impact

Any impacts on soils associated with soil erosion, during construction are considered minor, with the receptor sensitivity remaining **low**, the impact magnitude, after mitigation is reduced to **very low**, and the residual impact significance assessed as **negligible**.

Table 8.25: Residual impact to soils from erosion, soil loss and direct disturbance of surface soil

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
PV power facility enabling works and construction activities	Erosion and soil loss	**Minor (4)**	Very Low (1)	Low (2)	**Negligible (2)**

Disturbance of contaminated soil

When contaminated land is disturbed, contaminants may be mobilised into the wider environment and could cause contamination of previously clean groundwater or surface water resources. Mobilisation of contaminated soil can also pose a health and safety risk for construction personnel.

Due to the previous agricultural use of the sites selected for the project, soil samples were analysed for pesticide. Test results indicated very low levels of pesticides present in the soil samples collected (see Section 5), below FAO limits for human contact. Therefore, there is no potential risk to construction workers or to the surrounding environment from the mobilisation of soil.

The receptor sensitivity has been assigned as **low**. The impact magnitude has been assessed as **low,** due to the short duration of the construction activities and the limited effects on the surrounding environment and construction personnel. The resulting impact significance is considered to be **minor.**

Table 8.26: Impact to receptors from disturbance of contaminated soil

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Disturbance of contaminated soil during construction	Mobilisation of contamination	Low (2)	Low (2)	**Minor (4)**	Y

Mitigation Measures

There is the potential for unknown contaminated soil being disturbed during construction and the following mitigations are therefore recommended.

- If contaminated soil is encountered during construction, the soil will be segregated from uncontaminated materials and stored at least 50 m away from any surface water or seasonal surface water beds. Any contaminated soil storage areas will be provided with containment measures (bunds ditches, impermeable base membranes, covers) to help minimise run off and airborne soil loss.
- The project workforce involved in soil handling and earthworks will be provided with gloves and goggles to reduce direct contact with the soil.
- Training will be provided to the EPC contractor on soil contamination as part of the HSSE Plan.
- Dust suppression measures, such as fine water misting, will be implemented to reduce dust generation and preventing inhalation and ingestion of soil dust by the project workforce.

Residual Impact

The receptor sensitivity remains **low**, the impact magnitude, after mitigation is reduced to **very low**, and the residual impact significance assessed as **negligible**.

Table 8.27: Residual impact to receptors from disturbance of contaminated soil

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Disturbance of contaminated soil during construction	Mobilisation of contamination	**Minor (4)**	Very Low (1)	Low (2)	**Negligible (2)**

Impacts on soil quality as a result of accidental loss of containment or spills during project activities are assessed as unplanned events in Section 8.4.

8.1.4.2 Operations phase

There are no planned activities during the operational phase that are expected to have an impact on soil and geology.

8.1.4.3 Decommissioning

Similar impacts to those assessed during the construction phase are forecast for the decommissioning phase. The Decommissioning Plan will cover measures to mitigate the potential environmental impacts related to soils for the decommissioning phase.

8.1.5 Groundwater

The groundwater in the project area is thought to be of potable quality. However, groundwater was not encountered in any of the trial pits (located within the project area) at depths of up to 3 m. Furthermore, the resistivity data indicated that groundwater was not present at depths down to approximately 16 m, indicating that any groundwater within the project area is relatively deep. No evidence has been identified that suggests groundwater is used by the local community (e.g., for human consumption, industrial purposes or agriculture) or provides essential baseflow to a watercourse.

There is potentially a kahriz system[24] close to or underlying parts of the northern cluster. The full extent of this system, depth and functionality is not known and further studies are being conducted by an experienced surveyor. For the purposes of this ESIA, the kahriz system is considered to be a potential groundwater feature.

8.1.5.1 Construction phase

Groundwater abstraction

During construction, water will be sourced offsite from an existing source that has adequate capacity to accommodate the project's water needs. No groundwater abstraction is anticipated however it is possible that construction activities may lead to localised dewatering in the project area (i.e., during trenching or foundation construction for transformers or the HV substation).

Receptor sensitivity has been assigned as **low** as a result of the quality, quantity, use and value of groundwater in the project area. The impact magnitude arising from groundwater abstraction has been assessed as **very low** due to the localised and short-term impact of potential dewatering. The resulting impact significance is considered to be **negligible**.

Table 8.28: Impact to groundwater from abstraction

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
PV power facility construction activities	Localised dewatering of groundwater	Very Low (1)	Low (2)	**Negligible (2)**	N

[24] Kahrizes were first developed in ancient Iran (3,000 years ago) to transfer underground water to the surface through simple gravity flow. Throughout the southern Azerbaijan region, well maintained kahrizes previously provided a year-round water supply through a system of interconnected wells and underground tunnels that collect water from the hills. Many fell into disrepair or collapsed following the drilling of deep sub-artesian wells equipped with electric pumps to provide water during the Soviet era. Kahriz tunnels can extend for kilometres, are usually 1.2 metres high and 60 cm wide, large enough for people to enter and maintain them. In areas with soft ground, vaulted kahrizes are strengthened with stone walls.

Management of solid and liquid waste

There is a potential for groundwater contamination from the poor management of hazardous and non-hazardous waste, black water (sewage) and grey water (from kitchen and washing facilities) during the construction period. The production, handling, storage and disposal of waste, including wastewater, could result in groundwater contamination. For example, leachate from the storage of hazardous waste, or the production and improper disposal of black and grey water from the kitchen and toilet facilities, could result in groundwater contamination. The kitchen and toilet facilities are likely to be used daily throughout the approximate 18-month construction period and wastewater will temporarily be stored on site before regular transportation to an approved off-site treatment facility. It should be noted that no on-site treatment and waste discharge are planned. Furthermore, the volumes of hazardous and non-hazardous waste generated are expected to be negligible and most of the waste generated throughout the project is expected to be recyclable or reusable packaging materials.

Receptor sensitivity has been assigned as **low**. The impact magnitude arising from the management of waste has been assessed as **low**, depending on the type of waste and volume, equipment used, location of spill/leak, location of kahriz, aquifer thickness and attenuation properties, depth of the water table and soil type. The resulting impact significance is considered to be **minor**.

Table 8.29: Impact to groundwater from management of solid and liquid waste during construction

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Management of solid and liquid waste	Groundwater contamination	Low (2)	Low (2)	**Minor (4)**	Y

Mitigation measures

Mitigation measures during the construction phase to avoid groundwater contamination because of the poor management of solid and liquid waste are as follows:

- develop a project Waste Management Plan within the ESMP and manage waste in accordance with this plan
- include emergency response procedures for spills or releases of hazardous waste within the Waste Management Plan
- share the Waste Management Plan with MENR in advance of project commencement
- apply good pollution prevention practices across the project sites.

Residual impact

Following the implementation of the proposed mitigation measures, the receptor sensitivity remains **low**, the impact magnitude is reduced to **very low** and the residual impact significance assessed as **negligible**.

Table 8.30: Residual impact to groundwater from management of solid and liquid waste during construction

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Management of solid and liquid waste	Groundwater contamination	**Minor (4)**	Very Low (1)	Low (2)	**Negligible (2)**

8.1.5.2 *Operations phase*

Groundwater abstraction

During operations, the intention is that water will be sourced from an existing source/supplier with the necessary permits/authorisations to supply water. No local groundwater abstraction is anticipated, therefore there is no potential impact anticipated on the quantity of groundwater available in the project area during the operational period.

Management of solid and liquid waste

There is a potential for groundwater contamination from the management of hazardous and non-hazardous waste, black water (sewage) and grey water (from kitchen and toilet facilities) during the operational period. The types of potential impacts during operations are the same as those described for construction in Section 8.1.5.1. However, waste generation is expected to be minimal, and the volumes of hazardous and non-hazardous waste generated will be less than those generated during the construction phase.

Receptor sensitivity has been assigned as **low**. The impact magnitude, has been assessed as **very low**, depending on the type of waste and volume, equipment used, location of spill/leak, location of kahriz, aquifer thickness and attenuation properties, depth of the water table and soil type. The resulting impact significance is considered to be **negligible**.

Table 8.31: Impact to groundwater from management of solid and liquid waste during operations

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Management of solid and liquid waste	Groundwater contamination	Very Low (1)	Low (2)	**Negligible (2)**	N

Mitigation measures

No mitigation measures are proposed for the operational phase of this impact given its negligible significance.

8.1.5.3 Decommissioning phase

Similar impacts to those assessed during the construction phase are forecast for the decommissioning phase. The Decommissioning Plan will cover measures to mitigate the potential environmental impact related to groundwater for the decommissioning phase.

8.1.6 Surface Water

Short and seasonal streams flow onto both the northern and southern clusters. Most of the northern cluster lies on a floodplain terrace of a small ephemeral river which eventually joins the Araz River. There is no evidence suggesting that the stream channels are polluted or that they are used by the local community as a water resource. However, the Araz River is used as a water resource by other communities in Azerbaijan and Iran.

8.1.6.1 Construction phase

Surface water abstraction

During construction, water will be sourced off-site from an existing source that has adequate capacity to accommodate the project's water needs and with the necessary permits/authorisations to supply water. No local surface water abstraction is anticipated, therefore there no potential impact anticipated on the quantity of surface water available in the project area.

Management of solid and liquid waste

There is a potential for surface water contamination from the management of hazardous and non-hazardous waste, black water (sewage) and grey water (from kitchen and toilet facilities) during the construction period. The production, handling, storage and disposal of waste, including wastewater, could result in surface water contamination. For example, leachate from the storage of hazardous waste, or the production and improper disposal of black and grey water from the kitchen and toilet facilities, could result in surface water contamination. The kitchen and toilet facilities are likely to be used daily throughout the approximate 18-month construction period and associated wastewater will temporarily be stored on site before transportation to an approved off-site treatment facility. It should be noted that no on-site treatment and waste discharge are planned. Furthermore, the volumes of hazardous and non-hazardous waste generated are expected to be negligible and most of the waste generated throughout the project is expected to be recyclable or reusable packaging materials.

Receptor sensitivity is considered to be **medium**. The impact magnitude has been assessed as **medium** given the potential for regional extent depending on the type of waste and volume, equipment used, location of spill/leak and the surface water flow rate. The resulting impact significance is considered to be **moderate**.

Table 8.32: Impact to surface water from management of solid and liquid waste during construction

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Management of solid and liquid waste	Surface water contamination	Medium (3)	Medium (3)	**Moderate (9)**	Y

Mitigation measures

Mitigation measures during the construction phase to avoid surface water contamination because of the management of solid and liquid waste include those listed in Section 8.1.5.1.

Additionally, a Groundwater and Surface Water Management Plan will be developed and implemented within the ESMP, which includes measures to mitigate surface water contamination following the mitigation hierarchy, must be developed and implemented.

Residual impact

Following the implementation of the proposed mitigation measures, the receptor sensitivity remains **medium**, the impact magnitude is reduced to **low** and the residual impact significance assessed as **moderate**.

Table 8.33: Residual impact to surface water from management of solid and liquid waste during construction

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Management of solid and liquid waste	Surface water contamination	**Moderate (9)**	Low (2)	Medium (3)	**Moderate (6)**

Release of sediment to surface water bodies

There is a potential for an indirect impact of increased input of sediment into surface water bodies in the project area because of construction activities increasing soil erosion. As noted in Section 8.1.4.1, the preparation of the site, temporary workforce accommodation, storage areas and access roads, including the removal of vegetation, topsoil stripping and benching, is likely to increase the risk of soil erosion, which may increase the sediment load in nearby surface water bodies and impact water quality downstream.

The potential for increased sediment load is increased during periods of intense rainfall, when stormwater runoff is likely to transport any eroded sediment. It should be noted however, that infiltration seems to be the dominant response to normal levels of rainfall, with run-off being very low, and the site is located within an arid region with modest rainfall.

Receptor sensitivity has been assigned as **medium**. The impact magnitude arising from the release of sediment to surface water bodies has been assessed as **low**, depending on soil erosion rate, soil contamination risk and surface water flow rates. The resulting impact significance is considered to be **moderate**.

Table 8.34: Impact to surface water from release of sediment to surface water bodies during construction

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
PV power facility enabling works and construction activities	Surface water contamination	Low (2)	Medium (3)	**Moderate (6)**	Y

Mitigation measures

Mitigation measures during the construction phase to avoid increased sediment load in surface water bodies include those listed in Section 8.1.4.1 for the impact of erosion, soil loss and direct disturbance of surface soil.

Additionally, an Erosion, Sediment Control and Reinstatement Plan will be developed and implemented within the ESMP, that includes sediment control measures such as diversion berms, sediment ponds/basins, must be developed and implemented.

Residual impact

Following the implementation of the proposed mitigation measures, the receptor sensitivity remains **medium**, the impact magnitude is reduced to **very low** and the residual impact significance assessed as **minor**.

Table 8.35: Residual impact to surface water from release of sediment to surface water bodies during construction

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
PV power facility enabling works and construction activities	Surface water contamination	**Moderate (6)**	Very Low (1)	Medium (3)	**Minor (3)**

Changes in surface water drainage

There is a potential for changes in surface water drainage within the project area as a result of construction activities. Preparation of the site, temporary workforce accommodation, storage areas and access roads, including the removal of vegetation, ground levelling and trenching could affect the flow (direction and rate) of existing surface water drainage channels.

It is important to note that, as mentioned in Section 3.2.13, a drainage system is planned to be constructed to ensure that drainage of the land is maintained without affecting areas outside of the project boundary. Additionally, bridges or culverts may be installed in some locations over existing drainage channels. This system is expected to reduce the potential magnitude of the impact of changes in surface water drainage and prevent the impact from spreading outside of the project area.

Receptor sensitivity has been assigned as **medium**. The impact magnitude arising from changes in surface water drainage has been assessed as **very low**, due to the existing plans for a drainage system which is expected to reduce the spatial extent and frequency of the impact. The resulting impact significance is considered to be **minor** and no further mitigation is needed.

Table 8.36: Impact to surface water drainage from construction activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
PV power facility enabling works and construction activities	Changes in surface water drainage	Very Low (1)	Mediu m (3)	**Minor (3)**	N

Mitigation measures

No mitigation measures are proposed for the operational phase of this impact given its minor significance.

8.1.6.2 *Operations phase*

Surface water abstraction

During operations, the intention is that water will be sourced from an existing source/supplier with the necessary permits/authorisations to supply water. No surface water abstraction is anticipated, therefore there is likely to be no impact on the quantity of surface water in the project area during the operational period.

Management of solid and liquid waste

There is a potential for surface water contamination from the management of hazardous and non-hazardous waste, black water (sewage) and grey water (from kitchen and washing facilities) during the operational period. The types of potential impacts during operations are the same as those described in Section 8.1.6.1. However, waste generation is expected to be minimal, and the volumes of hazardous and non-hazardous waste generated will be less than those generated during the construction phase.

Receptor sensitivity has been assigned as **medium**. The impact magnitude, has been assessed as **very low**, depending on the type of waste and volume, equipment used, location of spill/leak and surface water flow rates. The resulting impact significance is considered to be **minor**.

Table 8.37: Impact to surface water from management of solid and liquid waste during operations

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Management of solid and liquid waste	Surface water contamination	Very Low (1)	Medium (3)	**Minor (3)**	N

Mitigation measures

No mitigation measures are proposed for the operational phase of this impact given its minor significance.

8.1.6.3 *Decommissioning phase*

Similar impacts to those assessed during the construction phase are forecast for the decommissioning phase. The Decommissioning Plan will cover measures to mitigate the potential environmental impacts related to surface water for the decommissioning phase.

8.1.7 Landscape

In relation to landscape, landscape character refers to the components of the landscape, its degree of naturalness, historical interest, and visual amenity which refers to the part of a person's well-being that is dependent on their visual perception of the environment. A change to the current landscape may cause a reduction in visual amenity for receptors such as community members close to the project site. Impacts to visual amenity will depend largely on the sensitivity of the social receptors which varies, their perceptions and the degree of change.

8.1.7.1 *Construction phase*

Impacts on visual amenity and changes in landscape character

There is the potential for direct impacts on visual amenity and landscape character caused by visual disturbance during the period of construction caused by:

- clearance of vegetation (it should be noted that the project sites are sparsely vegetated and felling mature trees will be avoided where possible)
- enabling works (including ground levelling, installation of drainage ditches, trenching for cables and construction of internal site roads)
- use of plant and equipment generating dust
- presence of heavy and light vehicles
- installation of perimeter fencing
- introduction of both temporary and permanent buildings, such as office facilities and control buildings
- presence of people at the site during day-light hours.

These effects on landscape character will be localised and temporary. The project is located in a remote area approximately 6 km from the closest settlement Jabrayil City, which has a population of predominantly military personnel and is situated in a highly modified landscape characterised by its recent history. For these reasons, the construction works will only be detectable to road users travelling past the project sites for a short period of time.

Receptor sensitivity has been assigned as **very low**. The impact magnitude has been assessed as **very low,** due to the short length of the construction activities and the limited effects on existing visual amenity. The resulting impact significance is considered to be **negligible.**

Table 8.38: Impacts to visual amenity and changes in landscape character from construction activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Visual disturbance during construction activities e.g., vegetation clearance, enabling works, presence of people, equipment and vehicles	Visual amenity and changes in landscape character	Very Low (1)	Very Low (1)	**Negligible (1)**	N

Mitigation measures

No mitigation measures are proposed for the operational phase of this impact given its negligible significance.

8.1.7.2 Operations phase

Impacts on visual amenity and changes in landscape character

Similar to the construction phase, there is a potential for impacts on both visual amenity and landscape character at operational stage. The impacts will be associated with the following, (but are not limited to):

- presence of the PV panel arrays in the northern and southern clusters
- presence of a permanent sub-station building in the southern cluster (associated facility, AzerEnerji scope)
- presence of permanent control and monitoring buildings in the northern and southern clusters
- security fencing around the northern and southern cluster perimeters, with access gates.

During the operational phase the landscape will have changed from a rural setting to an industrial one with visible facilities and PV panel arrays. These changes are likely to impact the visual amenity of the landscape however, due to its location and setting, the receptor sensitivity has been assigned as **very low**. The impact magnitude has been assessed as **low,** due to the extent of the PV power facility, the site setting and the limited effects of the project site on existing visual amenity. The resulting impact significance is considered **negligible**.

Table 8.39: Impacts to visual amenity and changes in landscape character from operations activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Visual disturbance during operations (e.g., presence of site infrastructure)	Visual amenity and changes in landscape character	Low (2)	Very Low (1)	**Negligible (2)**	N

Mitigation measures

No mitigation measures are proposed for the operational phase of this impact given its negligible significance.

8.1.7.3 Decommissioning phase

Similar impacts to those assessed during the construction phase are forecast for the decommissioning phase as an increased number of personnel, machinery and equipment is used on site to decommission and remove the PV power facility structures, together with an increased number of traffic movements to and from the project sites. The Decommissioning Plan will cover measures to mitigate the potential environmental impacts related to the landscape for the decommissioning phase.

8.1.8 Traffic and Transport

In respect to traffic and transport, impacts whether perceived or actual are understood in the context of the locality of the site. Receptor sensitivity is considered with respect to vehicular movements, and their impact on local residents and road users.

8.1.8.1 Construction phase

Impacts associated with traffic and transport

There is potential for direct impacts associated with construction vehicular traffic on the local highway network where there are currently a low number of baseline trips, or on new roads/routes.

During construction, traffic is likely to comprise worker (personnel) transportation, fuel and water delivery, waste collections, sewage and greywater collection, and materials, plant and component deliveries. Except for worker transportation, most trips will be made by HGV. During the peak period of construction, vehicle movements are anticipated to be up to:

- 146 two-way all vehicle (HGV+LGV) movements
- 68 two-way HGV only movements.

On average, across the project construction period build-out, this is estimated to be:

- 65 two-way all vehicle movements
- 26 two-way HGV only movements.

The site is remote from villages and effects will be temporary.

Receptor sensitivity and magnitude of impact have been assessed as **very low** so impact significance is considered to be **negligible**.

Table 8.40: Impacts associated with traffic and transport during construction

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Transport of people and equipment	Increased construction vehicular traffic	Very Low (1)	Very Low (1)	**Negligible (1)**	N

Mitigation measures

No specific mitigation measures are proposed for the construction phase of this impact given its negligible significance.

Mitigation measures during the construction phase will be in line with standard industry practice, including dust control/vehicle wash-down stations at access/egress points and limiting HGV traffic to daytime hours.

8.1.8.2 Operations phase

Impacts associated with traffic and transport

Following the construction phase of the proposed development, operational traffic is anticipated to be limited to servicing and maintenance only. As such, no significant impact is anticipated.

8.1.8.3 Decommissioning phase

Any impacts associated with the decommissioning phase in respect to traffic and transport are considered not significant, with the receptor sensitivity remaining **very low,** the impact magnitude **very low** after mitigation, and the impact significance assessed as **negligible**. Impacts are not anticipated to be any worse than the construction phase. The Decommissioning Plan will cover measures to mitigate the potential environmental impacts related to traffic and transport for the decommissioning phase.

8.1.9 Biological Environment

This section discusses potential impacts to terrestrial ecology receptors during construction, operation and decommissioning activities of Project Sunrise. Associated mitigation measures to be adopted are also discussed.

8.1.9.1 Construction phase

The construction phase of the project is expectedly the most labour and activity intensive and will result in the majority of impacts associated with the project and its development.

Legally protected areas and internationally recognised areas for biodiversity conservation

The site is in relatively close proximity to one notable area of recognised biodiversity conservation (the Arasbaran KBA/IBA, in Iran) with the other identified sites all further than 10 km from the project site. As the construction activities are limited to the project footprint, and will occur within a fenced boundary, it is not expected that any direct impacts will occur to nearby protected areas. Where necessary, temporary workforce accommodation will be arranged by the EPC contractor and, even in the event that off-site accommodation is required, selection of said accommodation will be expected to consider existing environmental and biodiversity constraints and will avoid impingement on protected areas. Should temporary accommodation for construction workforce be developed within the site boundary, site inductions for all work force will be expected to include training on potential biodiversity receptors within and surrounding the project site.

Looking at indirect impacts beyond the project boundary, the development is similarly not expected to contribute to any increased potential for exploitation or illegal logging pressures on protected areas within Azerbaijan or neighbouring Iran. Nonetheless, measures will be put in place to protect biodiversity receptors from the effects of the temporary increase in local population during the construction phase.

Receptor sensitivity has been assigned as **medium** and the impact magnitude arising from the projects interaction with protected areas has been assessed as **very low**, given that the interaction is expected to be marginal. The resulting impact significance is considered to be **minor**.

Table 8.41: Impacts to legally protected areas and internationally recognised areas for biodiversity conservation from construction activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
PV power facility construction activities	Exploitation or illegal logging pressures on protected areas	Very Low (1)	Medium (3)	**Minor (3)**	Y

Mitigation measures

Mitigation measures during the construction phase to avoid impacts to these valuable biodiversity receptors will be implemented as follows.

- Prohibit construction site staff and contractors from hunting, fishing, buying, or trading of wildlife as well as the collection of aquatic resources, timber, and other resources to help conserve existing fauna and forestry resources.
- Conduct environmental education and awareness programmes for all project staff and contractors (e.g., through staff inductions). This will aim to ensure understanding of the importance of natural resources, and ensure that the prohibitions and penalties regarding hunting, wildlife trade and the collection of other natural resources are widely known.

Residual impact

Any impacts on protected or recognised areas, during construction are considered minor, with the receptor sensitivity remaining **medium**, the impact magnitude, after mitigation is further reduced but remains as **very low**, and the residual impact significance assessed as **minor**.

Table 8.42: Residual impacts to legally protected areas and internationally recognised areas for biodiversity conservation from construction activities

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
PV power facility construction activities	Exploitation or illegal logging pressures on protected areas	**Minor (3)**	Very Low (1)	Medium (3)	**Minor (3)**

Waste and litter accumulation in nearby habitats

Should temporary workforce accommodation or catering services be required on site, generation of litter on site during the construction phase would expectedly be limited to construction wastes and waste streams associated with preparation of food for workers.

Packaging and food waste will typically be generated in a single location at the kitchens or dining facilities. If not properly managed, such wastes will likely enter the environment and surrounding habitats where such accumulation may result in generalised degradation of habitats as well as choking hazards to fauna species mistaking waste as food. This impact is easily prevented and managed through application of simple housekeeping procedures and good waste management processes.

The rate of waste generation is expectedly relatively small for a construction project of this type and the magnitude of this impact is conservatively assessed as **medium**. The receptor sensitivity has been assessed as **low**, as it is expected that such an impact would be limited to the local area immediately adjacent to the Project Sunrise site. The resulting impact significance is therefore considered to be **moderate**.

Table 8.43: Impact to nearby habitats from waste and litter accumulation during construction activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Construction of temporary workforce accommodation or catering services	Generalised degradation of surrounding habitats as well as choking hazards to fauna species mistaking waste as food	Medium (3)	Low (2)	**Moderate (6)**	Y

Mitigation measures

The following mitigation measures will be implemented during the construction phase to avoid and reduce wind-blown litter impacts to surrounding fauna.

- All waste should be managed in accordance with the Waste Management Plan which should include the following requirements and will be shared with MENR in advance of project commencement:
    - segregation and storage in appropriate and labelled bins/skips
    - disposal of food and plastic waste in an appropriate organic waste/recycling facility or removal from site by a registered waste management contractor
    - recording waste generated and transported according to cradle-to-grave and duty of care principles
    - waste management self-verification (site inspections)
    - waste management training for staff and contractors.
- Bins and skips shall be covered to prevent wind-blown litter, odours, and to limit access by native fauna and pest species.

Residual impact

Following application of mitigation measures, it is expected that the effect of waste accumulation and wind-blown litter can be minimised. With application of mitigations, the impact magnitude is expectedly reduced to **very low**, while the receptor sensitivity remains **low**, and the residual impact significance therefore assessed as **negligible**.

Table 8.44: Residual impact to nearby habitats from waste and litter accumulation during construction activities

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Construction of temporary workforce accommodation or catering services	Generalised degradation of surrounding habitats as well as choking hazards to fauna species mistaking waste as food	**Moderate (6)**	Very Low (1)	Low (2)	**Negligible (2)**

Loss of surface vegetation due to clearance of land for construction of the PV power facility

Clearance of both natural and modified habitats will occur during the construction of the PV power facility as well as for temporary laydown/storage areas, temporary workforce accommodation and offices within the footprint of the site. These activities will result in the permanent destruction of native vegetation across the site. The flora of the project area is known to include several specimens of conservation value and which are listed in the Azerbaijan Red Book of protected species (nəşr, 2023), in particular *Ficus carica* (LC) and *Punica granatum* (LC) as well as several clumps of an unidentified Iris (presumably *Iris lycotis* or *I. acutiloba*). The steppe habitats of the area are also considered intact and unique, but are known to be shifting towards semi-deserts (UNEP-WCMC, 2023) as a result of erosion and land degradation, and are therefore considered to be of conservation general importance.

The clearance of vegetation is however expected to be limited to the footprint of the northern and southern clusters and includes less than 900 ha of the approximately 6.4 million ha which form the Azerbaijan Shrub Desert and Steppe ecoregion.

Receptor sensitivity has been assigned as **medium**, while the impact magnitude arising from clearance of the site has been assessed as **medium**. The resulting impact significance is considered to be **moderate**.

Table 8.45: Impact to surface vegetation and native flora from land clearance during construction activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Clearance of land for construction of the PV power facility	Loss of surface vegetation and native flora	Medium (3)	Medium (3)	**Moderate (9)**	Y

Mitigation measures

The following mitigation measures will be implemented during the construction phase to avoid and reduce impacts to habitats.

- Avoid removal of vegetation and sections/patches which will not be directly replaced by project infrastructure, where feasible.
- Areas to be cleared will be delineated and vegetation removal will be restricted to these designated areas only.
- Avoid the use of pesticides and fire to clear vegetation.
- Limit access and disturbance to any additional natural areas outside of demarcated clearance zones.
- Identify, retain and/or relocate mature specimens of conservation importance, such as *Ficus carica* and *Punica granatum.*
- Conduct a botanical survey in the optimum period (March) immediately prior to site preparation works to identify and record the location of *Iris spp.* bulbs present within the northern and southern clusters. Retain those that will not be disturbed during construction and protect with permanent fencing. Engage with botany specialists to plan the translocation of bulbs from within construction areas to the closest fenced protected zones within the project footprint during the optimum period for translocation (January/February).
- Engage an ecologist to clearly mark protected vegetation (e.g., using flagging tape or fencing) and instruct personnel and contractors in the requirement to protect vegetation that has been marked.
- Engage an ecologist to conduct pre-clearance surveys to check for the presence of priority flora within habitats to be cleared and identify and relocate young specimens during land clearance.
- Where feasible, avoid areas of native vegetation with large numbers of threatened flora during land clearance.
- Replanting of native flora following construction in cleared areas which still exhibit suitable conditions (sunlight, rainfall etc.) to sustain the original vegetative communities.
- Minimise access, disturbance to land and clearing of vegetation to prevent unnecessary ground disturbance and to protect areas of known high biodiversity conservation.

Residual impact

Impacts to the vegetation and native flora of the project site during construction are considered permanent, with the receptor sensitivity remaining **medium**, the impact magnitude, after mitigation is applied is expectedly reduced to **low**, and the residual impact significance assessed as **moderate** due to the permanence of the effect within the site and footprint of the PV power facility.

Table 8.46: Residual impact to surface vegetation and native flora from land clearance during construction activities

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Clearance of land for construction of the PV power facility	Loss of surface vegetation and native flora	**Moderate (9)**	Low (2)	Medium (3)	**Moderate (6)**

Reduction in water quality in waterways due to increased siltation

Clearance of surface vegetation increases the likelihood of soil erosion and resultant siltation impacts occurring in local waterways. The site itself lies directly above several headwaters of minor tributaries which flow southwards, away from the site and towards the Araz River. During periods of heavy rain, there is a potential for sedimentation impacts to arise in areas of ongoing enabling works or areas cleared of vegetation and not yet replanted.

Runoff water from construction sites may be laden with soil or spoil materials and may obstruct natural drainage systems, watercourses, and natural sedimentation regimes. Such changes in hydrology and drainage regimes may result in impacts to downstream aquatic species and habitats, both within the water column and benthos. The potential use of the Araz River by significant proportions of the global populations of various migratory fish species (including *Luciobarbus capito*, *Luciobarbus caspius* and *Rutilus frisii)* results in this watercourse being considered to be of conservation importance for the survival of these species.

Receptor sensitivity has been assigned as **high**, while the impact magnitude arising from the loss of water quality and potential siltation of this watercourse has been assessed as **low**, given that such impacts will expectedly occur for a relatively short period, and on a local scale. The resulting impact significance is considered to be **moderate**.

Table 8.47: Impact to water quality in waterways due to increased siltation from construction activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
PV power facility construction activities including clearance of surface vegetation	Reduction in water quality in waterways, soil erosion and increased siltation	Low (2)	High (4)	**Moderate (8)**	Y

Mitigation measures

The following mitigation measures will be implemented during the construction phase to avoid and reduce impacts to habitats.

- Retention of natural sediment traps.
- Retention of wetlands and existing drainage channels.
- Stabilise landforms and implement erosion control and prevention measures during construction.
- Enabling works will be conducted during the dry season, thus reducing the pathway for impact to the Araz River.
- All enabling works in riverbeds will be confined to the smallest area possible.
- Maintain root systems (wherever practical) to maintain soil stability by cutting vegetation at ground level, thereby minimising soil erosion.
- Install sediment traps to capture suspended sediments in drainage systems or channels susceptible to erosion.
- Areas to be cleared will be delineated and vegetation removal will be restricted to these designated areas only.

Additional measures to be implemented to minimise soil erosion are included in Section 8.1.4.

Residual impact

Following application of mitigation measures, impacts to the water quality of the Araz River and its tributaries during construction are expectedly significantly reduced. With the receptor sensitivity remaining **high**, the impact magnitude, after mitigation is applied is expectedly reduced to **very low**, and the residual impact significance assessed as **minor**.

Table 8.48: Residual impact to water quality in waterways due to increased siltation from construction activities

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
PV power facility construction activities including clearance of surface vegetation	Loss of surface vegetation and native flora	**Moderate (8)**	Very Low (1)	High (4)	**Minor (4)**

Reduction in water quality in waterways due to construction waste and hazardous materials

Mobilisation and construction activities involves collection, transportation, handling, storage, and disposal of various types of materials some of them containing pollutants. Planned or accidental discharges will involve various types and quantities of both hazardous and non-hazardous solid and liquid wastes. Even small quantities if not properly managed may have impacts on the receiving environment and may degrade the habitat in which they accumulate. In particular, pollution entering watercourses and downstream wetland areas is potentially detrimental to the habitat and its ability to support the fauna and flora that utilise them. The project is not however expected to require usage or storage of large quantities of any liquid pollutants with the exception of fuel.

The potential use of the Araz River by significant proportions of the global populations of various migratory fish species (including *Luciobarbus capito*, *Luciobarbus caspius* and *Rutilus frisii*) results in this watercourse being considered to be of conservation importance for the survival of these species.

Receptor sensitivity has been assigned as **high**, while the impact magnitude arising from the potential introduction of waste and pollutant materials to the Araz River has been assessed as **low**, given that such impacts will expectedly occur for a relatively short period, and on a local scale. The resulting impact significance is considered to be **moderate**.

Table 8.49: Impact to water quality in waterways due to construction waste and hazardous materials

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
PV power facility mobilisation and construction activities – collection, transportation, handling, storage, and disposal of various types of materials	Reduction in water quality in waterways and habitat degradation	Low (2)	High (4)	**Moderate (8)**	Y

Mitigation measures

The following mitigation measures will be implemented during the construction phase to avoid and reduce impacts to habitats.

- Waste natural materials (i.e., soil/rock) from the construction process to be utilised as fill where feasible, with a zero dumping policy for catchment areas and waterways.
- All liquid pollutants and wastes stored within secondary containment and hard stand flooring, a minimum of 100 m from open water bodies and surface water courses (ephemeral streams).
- All solid and liquid fuel stores placed within secondary containment and hard stand flooring, a minimum of 100 m from open water bodies and surface water courses (ephemeral streams).
- All liquid hazardous material and waste storage facilities to be equipped with appropriate spill kits and containment instructions for unplanned spills.
- The EPC contractor will develop a fit-for-purpose Emergency Response Plan and Spill Response Plan, including training for all on-site personnel, as part of the project's ESMP.
- All solid waste stores to have appropriate covers to prevent windblown materials entering the environment.

Residual impact

Following application of mitigation measures, the potential for impacts to the water quality of the Araz River and its tributaries during construction are expectedly significantly reduced. With the receptor sensitivity remaining **high**, the impact magnitude, after mitigation is applied is expectedly reduced to **very low**, and the residual impact significance assessed as **minor**.

Table 8.50: Residual impact to water quality in waterways due to construction waste and hazardous materials

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
PV power facility mobilisation and construction activities – collection, transportation, handling, storage, and disposal of various types of materials	Reduction in water quality in waterways and habitat degradation	**Moderate (8)**	Very Low (1)	High (4)	**Minor (4)**

Introduction of invasive species

Mobilisation and construction activities involve collection, transportation, handling, storage, and disposal of various types of materials some of which may cause introduction of invasive or non-native floral or faunal species, more commonly termed as alien invasive species (AIS). These AIS may out-compete or predate upon the native species, resulting in a shift of ecological structure in the area. Such an introduction would be considered an unintended impact but may occur as a result of planned activities and have far-reaching consequences if left unmitigated.

As the terrestrial project area is largely within natural habitats and closely surrounded by sensitive steppe and semi-desert floral assemblages, the areas immediately surrounding the site would be susceptible to significant impact from the introduction of AIS to the area. Introduction of pest species such as rats or feral cats via mobilisation of construction workforce and equipment may also significantly impact native fauna and avifauna populations. Similarly, the potential introduction of AIS to the Araz River may significantly impact the native fish populations, fisheries and use of the river by migratory species which travel upstream to spawn.

The potential introduction of a flora or fauna AIS would be considered potentially significant, as the spread of any AIS into either grassland or freshwater habitats may result in similarly damaging results. Receptor sensitivity has been assigned as **high**, while the impact magnitude arising from the potential introduction of AIS has been assessed as **medium**, given that such impacts may cause generational reduction in populations and genetic diversity. The resulting impact significance is considered to be **major**.

Table 8.51: Impact to native species population from introduction of invasive species during construction activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
PV power facility mobilisation and construction activities – collection, transportation, handling, storage, and disposal of various types of materials	Generational reduction in populations and genetic diversity	Medium (3)	High (4)	**Major (12)**	Y

Mitigation measures

The following mitigation measures will be implemented during the construction phase to avoid and reduce impacts to habitats.

- Implement an eradication programme to remove existing and new introduced and/or invasive species, particularly along roadsides and construction sites within the project footprint area.
    - This includes non-native species in the northern cluster, introduced through historical agricultural practices in the wider area.
- Regular inspections within new and existing disturbed areas and newly disturbed areas for seedlings of AIS species.
- Control measures for weed management will include wash down facilities, controlled access to designated areas, ongoing monitoring, and personnel training.
- Eradication programmes will be considered with regards to pest fauna species.
    - Where pest management has been identified as required (e.g., feral cats, rats etc.), control measures will be considered include trapping, eradication, relocation, and baiting. These programmes will be supported by relevant training and awareness of employees and contractors.
- Waste storage bins/skips shall be routinely covered to prevent wind-blown litter, odours, and to limit access by native fauna and pest species.
- Project waste will be covered and removed regularly to limit the exposure to fauna and potential of diseases being spread.
- Waste should only be collected in receptacles in designated areas, which will be emptied regularly and waste transported to the final disposal location.
- Continuous awareness raising, training and site inspections regarding introduction and invasion of alien fauna and spread of diseases.

Residual impact

Following application of mitigation measures, pathways for introduction of AIS can be significantly reduced and the risk of such an introduction well managed. By quickly containing the spread of an introduction, the receptor sensitivity is expectedly reduced to **medium**, and the impact magnitude, after mitigation is applied is expectedly reduced to **low**, and the residual impact significance assessed as **moderate**.

Table 8.52: Residual impact to native species population from introduction of invasive species during construction activities

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
PV power facility mobilisation and construction activities – collection, transportation, handling, storage, and disposal of various types of materials	Generational reduction in flora/fauna populations and genetic diversity	**Major (12)**	Low (2)	Medium (3)	**Moderate (6)**

Smothering impact from dust rise during construction activities

Construction activities will result in indirect localised impacts from fugitive dust emissions arising from construction vehicle and heavy machinery movements as well as clearing, levelling, grading, backfilling, and other earth moving activities and construction processes. It is noted that any one of these impacts will expectedly occur over a relatively short duration as the construction progresses through the site.

In cases where continuous dusts emissions may settle in a given area, this may result in localised damage to flora due to smothering of stomata on the surface of leaves until removed by rains or strong winds. Given the expectedly highly localised extent of this effect as well as its generally short-term nature, the impact magnitude has been assessed as **low**. The receptor sensitivity is also assessed as **low**. The resulting impact significance is therefore considered to be **minor**.

Table 8.53: Impact to flora from smothering impact from dust rise during construction activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Construction vehicle and heavy machinery movements	Localised damage to flora	Low (2)	Low (2)	**Minor (4)**	Y

Mitigation measures

The following mitigation measures will be implemented during the construction phase to avoid and reduce dust impacts to surrounding flora and habitats.

- Confine vehicle movement to designated access routes and roads.
- Minimise dust and pollution emission using equipment with industry standard reduction systems and comply with applicable standards, where practicable.
- Minimise dust lift through watering roads and cleared areas, especially during the dry season.

Residual impact

Following application of mitigation measures, fugitive dust lift and smothering effects can be expectedly well managed. While the receptor sensitivity remains as **low**, the impact magnitude, after mitigation is applied is expectedly reduced to **very low**, and the residual impact significance assessed as **negligible**.

Table 8.54: Residual impact to flora from smothering impact from dust rise during construction activities

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Construction vehicle and heavy machinery movements	Localised damage to flora	**Minor (4)**	Very Low (1)	Low (2)	**Negligible (2)**

Loss of fertile topsoil to support vegetation recovery

Enabling works will result in removal of topsoil across the site in preparation for construction of the PV power facility. This process may also have secondary impacts associated with it, including increased potential for erosion and loss of primary and secondary seedbanks. It is expected that the loss of topsoil layers both beneath the PV panel arrays and associated infrastructure will likely occur as an unavoidable consequence of the construction phase.

Given the permanence and expectedly highly localised extent of this effect, the magnitude has been assessed as **medium**. Similarly, the receptor sensitivity has been assessed as **medium**. The resulting impact significance is therefore considered to be **moderate**.

Table 8.55: Impact to fertile topsoil from construction activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Clearance and earthworks removing topsoil layer	Loss of fertile topsoil	Medium (3)	Medium (3)	**Moderate (9)**	Y

Mitigation measures

The following mitigation measures will be implemented during the construction phase to avoid and reduce dust impacts to surrounding flora and habitats.

- Preservation and translocation of topsoil and seed bank as part of site rehabilitation/revegetation process.
- All topsoil removed to be stockpiled and maintained for use in re-vegetation of undeveloped areas, fringes, embankments and surrounds.

Residual impact

Following application of mitigation measures, it is expected that the effect of this removal can be minimised in the long term. With correct storage and replacement of the topsoil following construction, the receptor sensitivity is expectedly reduced to **low**, while the impact magnitude, after mitigation is applied is also expectedly reduced to **low**, and the residual impact significance therefore assessed as **minor**.

Table 8.56: Residual impact to fertile topsoil from construction activities

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Clearance and earthworks removing topsoil layer	Loss of fertile topsoil	**Moderate (9)**	Low (2)	Low (2)	**Minor (4)**

Impact from dust, noise and vibrations on terrestrial fauna

Construction activities will result in indirect localised impacts from dust lift, noise and vibrations arising from construction vehicle and heavy machinery movements as well as piling, and other required construction processes. These emissions may result in avoidance and other behavioural changes by mobile fauna. From the perspective of project fauna receptors, such impact will expectedly be highly localised and transient in keeping with the nature of the corresponding construction activities.

Given the temporary nature and expectedly highly localised extent of this effect, the magnitude has been assessed as **low**. Similarly, the receptor sensitivity has been assessed as **low**. The resulting impact significance is therefore considered to be **minor**.

Table 8.57: Impact to terrestrial fauna from dust, noise and vibrations during construction activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Construction activities and HGV movements	Dust, noise and vibrations resulting in avoidance or behavioural changes by mobile fauna species	Low (2)	Low (2)	**Minor (4)**	Y

Mitigation measures

The following mitigation measures will be implemented during the construction phase to avoid and reduce dust and noise impacts to surrounding fauna.

- Avoid works during particularly windy conditions.
- Confine vehicle movement to designated access routes and roads.
- Minimise dust and pollution emissions using equipment with industry standard reduction systems and comply with applicable standards, where practicable.
- Minimise dust through watering roads and cleared areas, especially during the dry season.
- Maintain all machinery to ensure both air and noise emissions are minimised and below health safety levels.

Residual impact

Following application of mitigation measures, it is expected that the effect of these temporary emissions on the surrounding native fauna can be minimised. With correct applications and adherence to emission standards for air quality and noise, the impact magnitude is expectedly reduced to **very low**, while the receptor sensitivity remains **low**, and the residual impact significance therefore assessed as **negligible**.

Table 8.58: Residual impact to terrestrial fauna from dust, noise and vibrations during construction activities

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Construction activities and HGV movements	Dust, noise and vibrations resulting in avoidance or behavioural changes by mobile fauna species	**Minor (4)**	Very Low (1)	Low (2)	**Negligible (2)**

Loss of habitat and associated fauna species

Clearance and modification of both natural and modified habitats are required to make way for construction of the PV power facility, with the majority of vegetation expected to be removed from the site itself. These activities result in the permanent destruction of habitats and subsequent loss or displacement their native fauna, particularly those species not able to move out of the area quickly at the onset of clearance activities.

In addition, the loss of these habitats will result in loss of available breeding habitat for both avifauna and other species such as Spur-thighed Tortoise (*Testudo graeca*, VU) which has been recorded as breeding on the site.

Given the highly localised extent of this effect, the magnitude has been assessed as **low**. Similarly, the receptor sensitivity has been assessed as **medium**, given that none of the fauna species on the site itself are expected to trigger Critical Habitat, but in some cases are locally or regionally vulnerable. The resulting impact significance is therefore considered to be **moderate**.

Table 8.59: Impact to habitat and associated fauna species from construction activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Clearance and modification of both natural and modified habitats	Permanent destruction of habitats and subsequent loss or displacement of their native fauna	Low (2)	Medium (3)	**Moderate (6)**	Y

Mitigation measures

The following mitigation measures will be implemented during the construction phase to avoid and reduce impacts to fauna on the site.

- Clearance to be conducted under supervision by a trained and qualified ecologist who can capture, remove and relocate individual specimens of Spur-thighed Tortoise (*Testudo graeca*) when identified ahead of the active enabling works.
- Engage an ecologist to supervise vegetation clearance, where possible, outside of the breeding season for Black Francolin (*Francolinus francolinus*) March to July (Cornell BOTW, 2023). During the breeding season, any nest sites identified by the ecologist should be given a 50 m buffer and only cleared once the chicks have fledged.
- Engage an ecologist to conduct pre-clearance checks for any other non-mobile species, with capture and relocation of individuals to adjacent suitable habitats where feasible.

- Sensitive, and soft-start, approach to vegetation clearance will be employed to enable fauna to disperse into surrounding habitats, starting at one end and working in a single direction.
- Avoid removal of large sections/patches, where feasible.

Residual impact

Following application of mitigation measures, it is expected that many native fauna species and specimens can be retained and relocated. With correct application of ecological supervision, the impact magnitude is expectedly reduced to **very low**, while the receptor sensitivity reduced to **low**, and the residual impact significance therefore assessed as **negligible**.

Table 8.60: Residual impact to habitat and associated fauna species from construction activities

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Clearance and modification of both natural and modified habitats	Permanent destruction of habitats and subsequent loss or displacement of their native fauna	**Moderate (6)**	Very Low (1)	Low (2)	**Negligible (2)**

Fragmentation of habitats and fauna communities

Construction of any man-made infrastructure on greenfield sites requires the removal of habitats and refugia, thus breaking the continuity of habitat available for animals to move through. This process will segment and fragment the continuity of habitat on either side, resulting separation of previously homogenous habitat and genetic resources. The site itself is expected to be fenced using a chain-link fence, making it a relatively impermeable barrier for many species, thus creating resistance to the natural movement patterns of species across any intersected habitats.

The magnitude of this impact is assessed as **medium**, while the receptor sensitivity has been assessed as **low** as it is still possible for fauna to move around the boundaries of the northern and southern cluster without needing to venture into completely modified habitats. The resulting impact significance is therefore considered to be **moderate**.

Table 8.61: Impact to habitats and fauna communities from habitat fragmentation

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Construction of any man-made infrastructure	Habitat fragmentation	Medium (3)	Low (2)	**Moderate (6)**	Y

Mitigation measures

The following mitigation measures will be implemented during the construction phase to avoid and reduce habitat fragmentation.

- Minimise clearance of natural vegetation and habitats at the fringe of the sites, to allow for greater connectivity of habitat.
- Design of fencing to allow for passage of small mammals and reptiles through the site where possible.
- Use of native flora of local providence to replant any denuded areas which are not directly beneath the footprint of the PV power facility (i.e., PV modules).

Residual impact

Following application of mitigation measures, it is expected that the effect of fragmentation can be minimised. With application of mitigations, the impact magnitude is expectedly reduced to **low**, while the receptor sensitivity remains **low** and the residual impact significance therefore assessed as **minor**.

Table 8.62: Residual impact on habitats and fauna communities from habitat fragmentation

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Construction of any man-made infrastructure	Habitat fragmentation	**Moderate (6)**	Low (2)	Low (2)	**Minor (4)**

8.1.9.2 *Operations phase*

Operations phase activities are expectedly limited to maintenance of the PV modules, cleaning and general housekeeping of the project site. As such, impacts arising from this stage of the project lifecycle are expectedly minimal.

Creation of artificial nesting structures in man-made infrastructure

Once operational, it is expected that the standing superstructure associated with the PV modules will create opportunities for artificial nesting, roosting and foraging habitat. One study in the UK (RSPB, 2020) identified that in comparison to the surrounding grassland and farmland, the use of solar power plant areas by avifauna was increased due to the variation in vegetation height and aspect offered by the PV panels themselves, however Visser et al. (2019), noted that such an increase may be less species diverse. Some bird species are also known to nest and shelter under the PV panels themselves which offer protection from predators and rain, as well as radiating warmth underneath the steel structures.

While considered a positive byproduct impact, it is unclear which species would most utilise the artificial habitats of the PV power facility and the receptor sensitivity has therefore been conservatively assessed as **low**, as it is expected that such an impact would be limited to the area within the Project Sunrise site. The resulting impact significance is considered to be a **positive impact**.

Table 8.63: Impact on species habitat from operational activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Construction of the standing superstructure for PV modules	Opportunities for artificial nesting, roosting and foraging habitat	Positive (0)	Low (2)	**Positive (0)**	N

Enhancement measures

No additional enhancement measures are proposed.

Creation of artificial refugia for terrestrial flora and fauna

Should the project fence be developed to allow for in-migration of small mammals and similar-sizes species, it is expected that the varied habitats and artificial structures offered by the developed site may provide potential refugia for terrestrial fauna. This positive impact could be enhanced through the application of a robust habitat management plan and native floral rehabilitation within the developed site through the Biodiversity Management Plan. Similarly, management of the flora within the site has been proven effective in other solar developments where rare flora (and other species) have colonised within the site as a result of proactive habitat enhancement measures (Science for Environment Policy, 2015).

While considered a positive byproduct impact it is unclear which species would most utilise the modified/enhanced habitats of the developed site. Receptor sensitivity has conservatively been assessed as **low**, as it is expected that such an impact would be limited to the area within the Project Sunrise site. The resulting impact significance is considered to be a **positive impact**.

Table 8.64: Impact on terrestrial flora and fauna from operational activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Construction of a fence around the project sites	Habitats and artificial structures within the fenced site providing refugia for terrestrial fauna.	Positive (0)	Low (2)	**Positive (0)**	N

Enhancement measures

There is the opportunity for targeted habitat creation, including the creation of artificial refugia for small mammals and reptiles, during the reinstatement of the site and during ongoing maintenance, and appropriate methods could be detailed further in the Biodiversity Management Plan developed for the project.

Wind-blown litter accumulation in nearby habitats

While generation of litter on site during the operations phase is expectedly minimal, packaging and food waste may still be generated in small quantities and if not properly managed, will enter the environment and surrounding habitats. Such accumulation is easily prevented and managed through application of simple housekeeping procedures and good waste management processes.

Given that the site will be large unmanned during operations, the rate of waste generation is expectedly small and the magnitude of this impact is conservatively assessed as **low**. The receptor sensitivity has been assessed as **low**, as it is expected that such an impact would be limited to the local area immediately adjacent to the Project Sunrise site. The resulting impact significance is therefore considered to be **minor**.

Table 8.65: Impact to nearby habitats from wind-blown litter accumulation during operational activities

Activity	Potential impact	Impact significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Generation of packaging and food waste	Accumulation of wind-blown litter	Low (2)	Low (2)	**Minor (4)**	Y

Mitigation measures

The following mitigation measures will be implemented during the operation phase to avoid and reduce wind-blown litter impacts to surrounding fauna.

- Disposable food and plastic waste should be temporarily stored in labelled, secure bins and skips before being disposed of at an approved location.
- Bins and skips shall be covered to prevent wind-blown litter, odours, and to limit access by native fauna and pest species.
- Operational waste disposal protocols should be kept in line with the requirements of the Waste Management Plan.

Residual impact

Following application of mitigation measures, it is expected that the effect of wind-blown litter can be minimised. With application of mitigations, the impact magnitude is expectedly reduced to **very low**, while the receptor sensitivity remains **low**, and the residual impact significance therefore assessed as **negligible**.

Table 8.66: Residual impact to nearby habitats from wind-blown litter accumulation during operational activities

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Generation of packaging and food waste	Accumulation of wind-blown litter	**Minor (4)**	Very Low (1)	Low (2)	**Negligible (2)**

8.1.9.3 *Decommissioning phase*

Similar impacts to those assessed during the construction phase are forecast for the decommissioning phase for biodiversity features within and surrounding the project sites. The Decommissioning Plan will cover measures to mitigate the potential environmental impact related to biodiversity for the decommissioning phase, including a pre-decommissioning walkover survey to check for sensitive biodiversity features such as nesting birds.

8.1.10 Environmental Impact Assessment Summary

Table 8.67 provides a summary of the environmental impact assessment.

Table 8.67: Pre-mitigation impact scoring and post mitigation residual impact significance for environmental impacts

No.	Project activity	Description of impact	Pre-mitigation scoring			Mitigation measure(s) proposed[25]	Residual impact scoring		
			Magnitude of impact	Receptor sensitivity	Impact significance		Magnitude of impact	Receptor sensitivity	Impact significance
Construction phase									
1	PV power facility enabling works activities	Increased dust emissions	High (4)	Low (2)	Moderate (8)	Y	No significant residual impacts		
2	PV power facility construction activities	Increased dust emissions	Low (2)	Low (2)	Minor (4)	N			
3	Track-out activities	Increased dust emissions	High (4)	Low (2)	Moderate (8)	Y	No significant residual impacts		
4	Use of construction equipment, vehicles and diesel generators	Increased exhaust emissions	Low (2)	Low (2)	Minor (4)	N			
5	Embodied emissions from infrastructure, primarily the solar PV modules	Increase in GHG emissions	Low (2)	High (4)	Moderate (8)	Y	Very Low (1)	High (4)	Minor (4)
6	PV power facility enabling works activities	Noise disturbance	Very Low (1)	High (4)	Minor (4)	N			
7	Installation of solar PV modules and associated facilities	Noise disturbance	Very Low (1)	High (4)	Minor (4)	N			
8	Repeated vehicle movements	Compaction and changes to soil structure	Low (2)	Low (2)	Minor (4)	Y	Very Low (1)	Low (2)	Negligible (2)
9	PV power facility enabling works and construction activities	Erosion and soil loss	Low (2)	Low (2)	Minor (4)	Y	Very Low (1)	Low (2)	Negligible (2)
10	Disturbance of contaminated soil during construction	Mobilisation of contamination	Low (2)	Low (2)	Minor (4)	Y	Very Low (1)	Low (2)	Negligible (2)
11	PV power facility construction activities	Localised dewatering of groundwater	Very Low (1)	Low (2)	Negligible (2)	N			
12	Management of solid and liquid waste	Groundwater contamination	Low (2)	Low (2)	Minor (4)	Y	Very Low (1)	Low (2)	Negligible (2)
13	Management of solid and liquid waste	Surface water contamination	Medium (3)	Medium (3)	Moderate (9)	Y	Low (2)	Medium (3)	Moderate (6)
14	PV power facility enabling works and construction activities	Surface water contamination	Low (2)	Medium (3)	Moderate (6)	Y	Very Low (1)	Medium (3)	Minor (3)
15	PV power facility enabling works and construction activities	Changes in surface water drainage	Very Low (1)	Medium (3)	Minor (3)	N			
16	Visual disturbance during construction activities e.g.., vegetation clearance, enabling works, presence of people, equipment and vehicles	Visual amenity and changes in landscape character	Very Low (1)	Very Low (1)	Negligible (1)	N			
17	Transport of people and equipment	Increased construction vehicular traffic	Very Low (1)	Very Low (1)	Negligible (1)	N			
18	PV power facility construction activities	Exploitation or illegal logging pressures on protected areas	Very Low (1)	Medium (3)	Minor (3)	Y	Very Low (1)	Medium (3)	Minor (3)
19	Construction of temporary workforce accommodation or catering services	Generalised degradation of surrounding habitats as well as choking hazards to fauna species mistaking waste as food	Medium (3)	Low (2)	Moderate (6)	Y	Very Low (1)	Low (2)	Negligible (2)
20	Clearance of land for construction of the PV power facility	Loss of surface vegetation and native flora	Medium (3)	Medium (3)	Moderate (9)	Y	Low (2)	Medium (3)	Moderate (6)
21	PV power facility construction activities including clearance of surface vegetation	Reduction in water quality in waterways, soil erosion and increased siltation	Low (2)	High (4)	Moderate (8)	Y	Very Low (1)	High (4)	Minor (4)
22	PV power facility mobilisation and construction activities – collection, transportation, handling, storage, and disposal of various types of materials	Reduction in water quality in waterways and habitat degradation	Low (2)	High (4)	Moderate (8)	Y	Very Low (1)	High (4)	Minor (4)

No.	Project activity	Description of impact	Pre-mitigation scoring			Mitigation measure(s) proposed[25]	Residual impact scoring		
			Magnitude of impact	Receptor sensitivity	Impact significance		Magnitude of impact	Receptor sensitivity	Impact significance
23	PV power facility mobilisation and construction activities – collection, transportation, handling, storage, and disposal of various types of materials	Generational reduction in flora/fauna populations and genetic diversity	Medium (3)	High (4)	Major (12)	Y	Low (2)	Medium (3)	Moderate (6)
24	Construction vehicle and heavy machinery movements	Localised damage to flora	Low (2)	Low (2)	Minor (4)	Y	Very Low (1)	Low (2)	Negligible (2)
25	Clearance and earthworks removing topsoil layer	Loss of fertile topsoil	Medium (3)	Medium (3)	Moderate (9)	Y	Low (2)	Low (2)	Minor (4)
26	Construction activities and HGV movements	Dust, noise and vibrations resulting in avoidance or behavioural changes by mobile fauna species	Low (2)	Low (2)	Minor (4)	Y	Very Low (1)	Low (2)	Negligible (2)
27	Clearance and modification of both natural and modified habitats	Permanent destruction of habitats and subsequent loss or displacement of their native fauna	Low (2)	Medium (3)	Moderate (6)	Y	Very Low (1)	Low (2)	Negligible (2)
28	Construction of any man-made infrastructure	Habitat fragmentation	Medium (3)	Low (2)	Moderate (6)	Y	Low (2)	Low (2)	Minor (4)
Operation phase									
29	Operation of the PV power facility	GHG emissions savings	Positive (0)	High (4)	Positive (0)	N			
30	Operation of the PV power facility	Noise disturbance	Very Low (1)	High (4)	Minor (4)	N			
31	Management of solid and liquid waste	Groundwater contamination	Very Low (1)	Low (2)	Negligible (2)	N			
32	Management of solid and liquid waste	Surface water contamination	Very Low (1)	Medium (3)	Minor (3)	N			
33	Visual disturbance during operations (e.g., presence of site infrastructure)	Visual amenity and changes in landscape character	Low (2)	Very Low (1)	Negligible (2)	N			
34	Transport of people and equipment	Increased construction vehicular traffic	Very Low (1)	Very Low (1)	Negligible (1)	N			
35	Construction of the standing superstructure for PV modules	Opportunities for artificial nesting, roosting and foraging habitat	Positive (0)	Low (2)	Positive (0)	N			
36	Construction of a fence around the project sites	Habitats and artificial structures within the fenced site providing refugia for terrestrial fauna.	Positive (0)	Low (2)	Positive (0)	N			
37	Generation of packaging and food waste	Accumulation of wind-blown litter	Low (2)	Low (2)	Minor (4)	Y	Very Low (1)	Low (2)	Negligible (2)
Decommissioning phase									
38	PV power facility decommissioning activities	Increase in GHG emissions	Very Low (1)	High (4)	Minor (4)	N			
39	PV power facility decommissioning activities	Noise disturbance	Very Low (1)	High (4)	Minor (4)	N			
40	Transport of people and equipment	Increased construction vehicular traffic	Very Low (1)	Very Low (1)	Negligible (1)	N			

8.2 Social Impact Assessment for Planned Events

As outlined in Section 5, the project area is almost entirely unoccupied. The aftermath of the Armenian occupation in Garabagh resulted in extensive infrastructure damage and a landmine threat, factors that complicates a rapid return of the population to the region.

Many of the towns and villages within the districts of Fuzuli, Jabrayil, Zangilan, Qubadli, Agdam, Kalbajar, and Lachin were expelled during the first Garabagh war (1988-1994). The districts were liberated from Armenian occupation by Azerbaijan in 2020, in the wake of the second Garabagh war. However at the time of writing, there is no civilian population in most towns, villages and areas within the districts, including Jabrayil City, which is the closest settlement to the project site.

Land in the project area has not been cultivated during occupation, and all former agricultural land has been abandoned. There are no residential, commercial or public buildings in the area.

The closest settlement with a civilian resident population is Horadiz (liberated during the first Garabagh war by Azerbaijani armed forces on 17 October 2020), which is located in the neighbouring Fuzuli district approximately 40 km from the project site. At the time of writing, the population of Horadiz is approximately 7,000 people. Horadiz has functioning social infrastructure and services, including a healthcare facility, a school and various commercial enterprises. It is likely that some of the project workforce will be accommodated in guesthouses (or similar) in Horadiz.

This section outlines potential impacts on the following socioeconomic receptors: economy, employment and skills development, labour and working conditions, and safety, security and welfare.

8.2.1 Economy

8.2.1.1 Construction phase

Economic benefits to local businesses as a result of the purchase of goods and services

Due to the decades of Armenian occupation of the districts around the project site, the area is predominantly unoccupied with little economic activity. Nonetheless, a small number of artisanal businesses were identified in the wider AOI (see Section 5).

Local enterprises in Horadiz include supermarkets or food and household goods shops, a pharmacy, electrical hardware and tool shops. All business owners source their products from other regions of Azerbaijan. Some larger businesses and industrial zones also operate in the AOI. Though in its infancy, the Araz Valley Economic Zone Industrial Park is currently being developed and houses service companies (e.g., Improtex Azerbaijan, and Holcim) who have their offices/warehouses/yards or workforce accommodation in the area. In the future, it is anticipated that many more companies will move to the area (as part of the PCCP[25], Government of Azerbaijan).

Provision of raw materials takes place in the region, with asphalt and concrete reportedly produced locally in 17 factories (KII with Kaylon, 2023). However, the extent to which these materials are produced by companies that could offer services to the project is unclear at this stage. The industrial park is a key part of the regions' future economic plans to develop the mining and quarrying, manufacturing, public utilities, construction, and agriculture sectors, however at the time of writing, the park is not yet fully established.

Although limited interaction is expected with the project, there may be opportunities for local and national companies to provide goods and services required for the construction of the project. Likely materials/services include:

- diesel (1,950 L/day for generators and construction vehicles during peak construction), lubricating oils (5-10 L) and hydraulic oils (5-10 L)
- paint (5-10 L)
- steel (10,000 MT)
- cement, sand and gravel
- fencing (18,650 m)
- water (105 m^3/day at peak construction)
- food and catering services
- office supplies
- cleaning supplies/services.

During engagement activities, stakeholders reported an interest in providing services to the project, such as provision of workforce accommodation owned and operated by Kalyon, for project construction workforce.

It is unlikely that much procurement will take place from businesses in Horadiz, given these businesses are geared towards supplying local households. However, for businesses associated with the Araz Valley Economic Zone Industrial Park, and companies such as Kalyon, plus others in the secondary AOI (e.g., service providers and suppliers in Azerbaijan more broadly), there will be opportunities for provision of goods and services.

Project procurement of goods and services from small, medium, and large enterprises will benefit not only the business itself, but also generate an economic multiplier effect across the economy within the districts and beyond, the receptor sensitivity is therefore **high**.

This is a **positive** impact, the magnitude of which will be dependent on the value of the local procurement activity.

[25] Following extensive mine-clearing operations, the Government of Azerbaijan has developed a Post-Conflict Construction Plan (PCCP) for the EZER. At present, plans are underway to transform the region into a SMART zone; restore and redevelop settlements; revitalise the economy and build physical and social infrastructure in the region. The aim is to return and resettle populations to Jabrayil City, and other villages in the district that were abandoned during the occupation of the region.

Table 8.68: Economic benefits to local businesses due to the purchase of goods and services

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Procurement of goods and services	Benefits to local businesses	Positive (0)	High (4)	**Positive (0)**	N

Enhancement measures

To enhance the positive impacts of construction phase procurement, the following measures will be adopted.

- Development of a Labour Management Plan within the ESMP which will includes the following:
  - commitment to work with appropriate local business networks/systems/governorate procurement bodies to ensure information about business opportunities is shared
  - support training and development programmes to build capacity of Azerbaijani companies, including initial training on procurement information processes, HSE standards and requirements.
- All contractors, including sub-contractors, to develop a Labour Management Plan for approval by Lightsource bp.
- Specific local content reporting requirements (procurement, recruitment and capacity building) for contractors will be embedded in contracts, covering both workforce and procurement, and requirements will be regularly monitored and audited as necessary.

It should be noted that even with commitments to prioritise local procurement wherever possible, it is expected that purchasing will inevitably be conducted internationally, for example for high specification products not available locally, or where quality and quantity cannot be assured with a locally available product.

The procurement of goods and services from local and national suppliers will be in competition with other companies and Azerbaijani businesses that need to purchase similar goods and services. At the time of writing, the Government of Azerbaijan is implementing its PCCP (see Section 5), and several large infrastructure projects are being developed. Local businesses may be more price sensitive and have less leveraging ability. The increase in demand by project procurement may push prices higher, causing inflation. This may extend beyond construction related industries and include food and water, which in turn may place inflationary or supply pressures on local households as well as businesses who also rely on these local providers.

Inflationary pressure due to project procurement

Further inflationary pressure on local households will stem from the employment of local people in the supply chain and from the migration of workers to Horadiz. This is likely to increase competition, and therefore prices, for housing, food, and other household goods. If workers move into smaller communities within the AOI, their presence may have more of a direct local impact.

Receptor sensitivity has been assigned as **low** due to the small number of existing businesses, local households and economic activities. The impact magnitude has been assessed as **low,** due to the duration timeframe of the construction activities and the limited scale of project procurement. The resulting impact significance is considered to be **minor.**

Table 8.69: Inflationary pressures due to project procurement

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Procurement of goods and services	Local inflation	Low (2)	Low (2)	**Minor (4)**	Y

Mitigation measures

Development of a Social Management Plan which will include:

- monitoring of socioeconomic changes in the district, including population size of communities and arrival of economic migrants
- price survey/market monitoring that will be undertaken at least once during the project implementation and at businesses that reflect the markets/businesses that communities (including vulnerable groups) within the AOI purchase from.

To mitigate the potential adverse impact of inflationary pressure on prices of goods and services, the following mitigation measure will be adopted:

- develop a Labour Management Plan to include measures to support mitigation of inflationary pressure.

Residual impacts

With the above mitigation measures, the impact magnitude is expected to reduce to **very low**. The sensitivity of the receptor remains **low**. Residual impact significance is anticipated to be **negligible.**

Table 8.70: Residual inflationary pressures due to project procurement

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Procurement of goods and services	Local inflation	**Minor (4)**	Very Low (1)	Low (2)	**Negligible (2)**

Escalating potential local corruption

Azerbaijan has a low corruption perceptions index (CPI) score of 23/100[26] (Transparency International, 2022). Corruption may therefore be an issue in the locality and local sub-contracting, and the purchasing of goods and services by both Lightsource bp and its contractor(s) could re-enforce dishonest practices if not managed appropriately.

Existing management control measures are embedded in Lightsource bp's Code of Conduct which sets out expectations and commitments regarding human rights, anti-bribery and corruption and ethical business practices.

Receptor sensitivity has been assigned as **medium** given the potentially expected pressure towards corrupt practices. The impact magnitude has been assessed as **low,** in recognition of Lightsource bp's existing procedures. The resulting impact significance is considered to be **moderate.**

Table 8.71: Escalating potential local corruption

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Local sub-contracting, and the purchasing of goods and services	Escalation of potential local corruption	Low (2)	Medium (3)	**Moderate (6)**	Y

Mitigation measures

In addition to the existing management control measures the following mitigation measures will be adopted, dependant on local workforce skills and availability.

[26] A country's score is the perceived level of public sector corruption on a scale of 0-100, where 0 means highly corrupt and 100 means very clean (Transparency International, 2022).

- Contractor(s) will develop and implement a Labour Management Plan that incorporates measures to promote non-discrimination and equal opportunities and ensure clear, transparent, and fair recruitment procedures that prioritise local workers and their employment, especially for unskilled labour within the AOI. The recruitment process will include:
    - review of the applicants' CVs
    - holding local employment events
    - identifying the applicants' skills, experiences, and qualifications
    - measures to ensure no payment will be needed or accepted as part of the recruitment process.
- The Labour Management Plan will include a separate procedure to ensure fair distribution of opportunities especially for semi-skilled and unskilled labour within the AOI.
- Lightsource bp will implement contractor/sub-contractor pre-qualification and due diligence processes. Lightsource bp will retain the right to audit high value subcontracts held by all or any of the subcontractors or contractors as part of due diligence procedures.
- Auditing contractors and suppliers for compliance with Lightsource bp Code of Conduct requirements.
- Communication of these procedures widely with potential contractors, suppliers, job applicants and other affected or interested stakeholders.
- Implementation of a Community Grievance Management Procedure.
- If a review of the Community Grievance Management Procedure indicates there have been claims of corruption in recruitment processes, Lightsource bp will consider the option to engage a third-party observer to monitor and audit the recruitment processes, procurement of goods and services, and applications for any permits as appropriate.

Residual impacts

After the application of mitigation measures, the impact magnitude is **very low**. The sensitivity of the receptor remains **medium.** Residual impact significance is therefore assessed as **minor**.

Table 8.72: Residual escalation of potential local corruption

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Local sub-contracting, and the purchasing of goods and services	Escalation of potential local corruption	**Moderate (6)**	Very Low (1)	Medium (3)	**Minor (3)**

8.2.1.2 Operations phase

Power generation and supply to the local grid (benefit)

Two-thirds of energy in Azerbaijan comes from gas and almost a third from oil. Azerbaijan is a major exporter and producer of both oil and gas, and most of its domestic electricity is generated by gas-fired power plants.

Demand for petroleum in Azerbaijan is driven by growth in the construction and transportation sectors. As set out in Section 5, the Government of Azerbaijan has developed a PCCP for the EZER. At present, plans are underway to transform the region into a SMART zone and several large infrastructure-related projects are being developed.

Up to 288 MW_P of additional electricity will be generated by the project and transmitted to the national grid. Power supply will be during daylight hours only. Management of the transmission of electricity beyond the sub-stations to end users will be the responsibility of AzerEnerji in the role of Transmission Operator.

Electricity supplied by the project to the national grid will help to fulfil the infrastructure projects as part of the PCCP and ultimately contribute to the economic development in the AOI.

Table 8.73: Power generation and supply to national grid

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Project operation	Power generation and supply to national grid	**Positive**			N

Enhancement measures

No additional enhancement measures are proposed.

8.2.2 Employment and Skills Development

8.2.2.1 Construction phase

Generation of employment opportunities

Construction activities will provide temporary employment opportunities for varying lengths of time according to the nature of the work required. In summary, the construction workforce is expected to be 300 persons on average across 6-8 months, reaching 700 persons at peak times.

It is expected that Azerbaijani national personnel will hold positions such as labourers, technicians, engineers, security, service personnel etc., whilst expatriate and qualified Azerbaijani personnel will hold management positions such as project management and administrative affairs. Lightsource bp aims to maximise the employment of construction workforce from the local population[27], subject to final technology selection and skills availability.

The construction of the project will have a **positive** short-term impact by providing additional employment opportunities for Azerbaijani nationals, and to some extent for people from within the AOI, likely to be in the unskilled and lower skill sectors. Employment may lead to a short-term improvement in living standards and well-being at household level of those employed, with some spill-over effect into the surrounding communities. The sensitivity of the receptor is **medium**. The overall impact significance is **positive**.

Table 8.74: Generation of employment opportunities

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Employment opportunities	Generation of local employment opportunities	Positive (0)	Medium (3)	**Positive (0)**	N

Enhancement measures

- Lightsource bp's requirement that all jobs, skilled and unskilled, company or contractor, have well defined and clear job descriptions that include skills or qualification requirements and clear terms and conditions in line with national labour laws, with remuneration consistent with the level of expertise and experience.
- Development and implementation of a Labour Management Plan that incorporates measures to promote non-discrimination and equal opportunities and ensure clear, transparent, and fair recruitment procedures that prioritise local workers and their employment, especially for unskilled labour within the AOI. This will be subject to skills availability.
- The Labour Management Plan will include the following commitments:
    - Separate procedure to ensure fair distribution of opportunities especially for semi-skilled and unskilled labour within the AOI.
    - Communication of these procedures widely with potential applicants and other affected or interested stakeholders.
    - Information about the recruitment process, which will include:
        - the review of the applicants' CVs
        - holding local employment events
        - identifying the applicants' skills, experiences, and qualifications
        - measures to ensure no payment will be needed or accepted as part of the recruitment process.

[27] Local populations will be repatriated to Jabrayil as part of the Government of Azerbaijan's PCCP and The State Program on the Great Return. The aim is to return and resettle populations to Jabrayil City, and other villages in the district that were abandoned during the occupation of the region.

- Implementation of a Community Grievance Management Procedure.
- Contractor(s) will be required to justify how they have attempted to fill positions with Azerbaijani citizens before recruiting expatriate staff.

Provision of training and skills development

Various levels of training and skills development opportunities will be provided to the workforce throughout the project lifecycle to ensure they are able to fulfil their roles and promote ongoing learning and capacity building. This includes basic training on HSE, labour management and, where required for specific job profiles, vocational training.

Lightsource bp will require adherence with and/or a staged process of improvement towards its Occupational Health and Safety Policy and Plan (which are in line with international standards). As a result, all staff will continue to benefit from health and safety training as a minimum, thereby continuing to increase the knowledge and experience of the local worker resource pool, whilst over time improving occupational health and safety standards within both the local oil and gas sector as well as more broadly, should workers take this experience with them into other sectors.

As a management control measure to help ensure the positive aspects of training are captured, job specific skills and competency training is a requirement that contractors must include within their Local Training Plan, supporting an overall upskilling both for individual workers and local industry.

The impact significance of the provision of training and skills building is assessed as **positive.**

Table 8.75: Training and skills development

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Employment opportunities	Training and skills development	Positive (0)	Medium (3)	**Positive (0)**	N

Enhancement measures

To further enhance positive impacts of the provision of training opportunities, the following enhancement measures will be adopted.

- Coordination with Ministry of Labour and Social Protection to understand vocational training centres next to the district to understand training courses, skills and opportunities for Persons with disabilities
- To support skills development and skills/experience recognition, the Labour Management Plan of both Lightsource bp and contractors will require all workers receive end of labour certificates and/or references, as appropriate.
- Specific targets for contractor worker training programmes to be agreed between Lightsource bp and contractors.
- Contractors will be required to set out worker demobilisation planning within the Labour Management Plan for approval by Lightsource bp that includes the use

of references and handover processes to identify well performing personnel from construction so that they may market themselves to future projects in the region.

- Requirement for all contractors training records to be passed onto Lightsource bp.

Demobilisation and the termination of employment contracts

Almost all workers during the construction phase will be on temporary, fixed-term contracts. These may vary in duration. The termination of each contract will result in a loss of household income with a flow-on negative impact on the affected household. It is often the case that the demobilisation of construction crews leads to an increase in grievances and potentially a loss of support leading to protests, roadblocks, or demonstrations, though this is unlikely considering the nature and location of the project in an uninhabited area.

Receptor sensitivity has been assigned as **low**. The impact magnitude has been assessed as **medium,** given the number of roles that will be demobilised in a short time frame. The impact significance is therefore **moderate.**

Table 8.76: Demobilisation and the termination of employment contracts

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Completion of construction activities	Termination of employment contracts	Medium (3)	Low (2)	**Moderate (6)**	Y

Mitigation measures

Mitigation measures to manage the adverse impact of demobilisation will be adopted by Lightsource bp and contractors within the Local Recruitment Plan.

- All contractors will provide end of contract documentation to workers that reflects the skills used and training provided during their employment period to assist them with future job opportunities.
- The Labour Management Plan will include a requirement for contractors to ensure clear terms (including contract duration) and conditions for workers are provided at the onset of employment. In addition, it will require contractors to include worker demobilisation planning within the Labour Management Plan.
- Under both Lightsource bp's SEP and the contractors' SEP there will be on-going communication around employment needs and the short-term nature of the work to ensure workers have realistic expectations.
- Lightsource bp will require the implementation of a Worker Grievance Management Procedure by contractor(s). The grievance procedure will allow workers hired by contractors and sub-contractors to raise issues that cause problems during the demobilisation process.

Residual impacts

With the implementation of the above mitigation measures, the residual impact magnitude is assessed as being **very low**. The receptor sensitivity remains as **low** The residual impact significance is therefore **negligible.**

Table 8.77: Residual impact of demobilisation and the termination of employment contracts

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Completion of construction activities	Termination of employment contracts	**Moderate (6)**	Very Low (1)	Low (2)	**Negligible (2)**

8.2.2.2 *Operations phase*

Generation of employment opportunities

The project will continue to provide employment opportunities for Azerbaijani nationals during the operations phase, though the labour requirements will be lower than during the construction phase. Employment will also provide an opportunity for continued training and skills development, improving the future employability and economic prospects of staff.

Employment with the project will benefit workers', leading to an increase in household income and overall living standards.

The sensitivity of the receptor is **medium** and the overall impact significance is **positive**.

Table 8.78: Generation of employment opportunities

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Employment opportunities	Generation of local employment opportunities	Positive (0)	Medium (3)	**Positive (0)**	N

8.2.3 Labour and Working Conditions

8.2.3.1 Construction phase

Violation of labour rights by contractors and subcontractors

The bulk of the workforce will be employed through the primary contractor and their sub-contractors. This is likely to be a mix of Azerbaijani and international companies.

There is potential for the violation of both national labour legislation and international labour standards, with particular risk associated with sub-contractors used by Lightsource bp and contractor(s). This includes aspects such as working hours, pay and working conditions, forced labour, freedom of association, freedom of movement, child labour, equal treatment in the workplace and health and safety. Workplace injuries may therefore occur, especially amongst labourers.

Local and/or smaller enterprises are more likely to have limited international experience and limited human resource management capacity and hence associated with the greatest risk of such violations. Unskilled workers are most at risk, given the historically poor conditions for unskilled workers and because they have less ability to advocate for improved conditions. This is also a human rights issue, the right to just and favourable conditions at work.

Existing management control measures include Lightsource bp's requirement that all contractors meet national legal requirements and international standards, including those listed in Lightsource bp's Code of Conduct and the project owner's commitment to upholding labour rights and improve peoples' lives.

Health and well-being minimum requirements are set within the Occupational Health and Safety Policy and Plan.

Contractor(s) will also develop and implement a Worker Grievance Management Procedure open to both contractor and sub-contractor staff.

Receptor sensitivity has been assigned as **low**. The impact magnitude has been assessed as **low,** due to the existing management control measures. The resulting impact significance is considered to be **minor.**

Table 8.79: Violation of labour rights

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Project employment	Violation of labour rights by contractors and sub-contractors and in supply chain	Low (2)	Low (2)	**Minor (4)**	Y

Mitigation measures

The following mitigation measures to minimise the likelihood of the violation of labour rights will be adopted by the Contractor(s).

- Provide training for all contractor and sub-contractor workers during the induction process on basic worker rights and the Worker Grievance Management Procedure, with emphasis on no disciplinary action for reporting credible grievances, including those specific to gender-based violence and harassment.
- Provide periodic refresher training on the above topics through toolbox talks, documenting attendance and topics discussed.
- Ensure all jobs, skilled and unskilled, have well defined and clear job descriptions that include skills or qualification requirements and clear terms and conditions in line with national labour laws, with remuneration consistent with the level of expertise and experience provide training for all contractor and sub-contractor workers on basic health and safety requirements that must be met within the workplace.

To support women's health and safety, contractor(s) will be required to establish gender awareness training for all workers that includes information on gender related policies (e.g., Worker Code of Conduct, Labour Management Plan, Gender Policy, and others), gender-specific project risks, impacts and mitigation measures, as well as gender based violence and harassment (GBVH) prevention and response.

Residual impacts

It is expected that if any contractor/sub-contractor is not meeting the appropriate standards in relation to labour rights and working conditions, this will be identified quickly, either through Lightsource bp monitoring activities and/or through the Worker or Community Grievance Management Procedures. While it may take some time to work with them to make the requirement improvements, it is expected that over time, the residual impact magnitude will reduce to **very low**. The overall impact significance will reduce to **negligible**.

Table 8.80: Residual impact of violation of labour rights

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Project employment	Violation of labour rights by contractors and sub-contractors and in supply chain	Minor (4)	Very Low (1)	Low (2)	**Negligible (2)**

Failure of contractors and sub-contractors to provide adequate accommodation

A failure to provide safe and healthy workforce accommodation that also allows for the recreation and/or relaxation of workers after work, could cause both high levels of tension and reduced worker well-being and serious health issues (for example, if cramped conditions facilitate the spread of contagious disease). This impact is also a human rights impact, the right to health, and the right to just and favourable conditions at work.

Prior to the application of mitigation measures, the receptor sensitivity is assessed as **medium** and the impact magnitude of potential failure of contractors and sub-contractors to provide adequate accommodation is assessed as **low.** The impact significance is assessed to be **moderate.**

Table 8.81: Failure to provide adequate accommodation

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Project employment	Failure of contractors and sub-contractors to provide adequate accommodation	Low (2)	Medium (3)	**Moderate (6)**	Y

Mitigation measures

The Contractor(s) will be required to implement the following mitigation measures.

- Provide training for all contractor and sub-contractor workers during the induction process on basic worker rights and the Worker Grievance Management Procedure, with emphasis on no disciplinary action for reporting credible grievances, including those specific to gender-based violence and harassment.
- Lightsource bp will require contractors to provide temporary workforce accommodation that meets the requirements of the IFC and EBRD guidance note, ‘Workers’ accommodation: processes and standards’ (IFC & EBRD, 2009), which includes provisions for female staff.
- Design leisure areas to be attractive to all workers (male or female).

Residual impacts

With the implementation of mitigation, the impact magnitude is expected to fall to **very low**. The receptor sensitivity remains **medium**. The residual impact is reduced to **minor**.

Table 8.82: Residual impact of failure to provide adequate accommodation

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Project employment	Failure of contractors and sub-contractors to provide adequate accommodation	**Moderate (6)**	Very Low (1)	Medium (3)	**Minor (3)**

8.2.4 Community Safety, Security and Welfare

8.2.4.1 Construction phase

Interaction with security personnel

During the construction period of Project Sunrise, members of the public (i.e., from any resettled communities or from other projects in the district) may approach work sites in search of employment or for other reasons. This may lead to negative interactions between security personnel responsible for protecting work sites and the members of the public.

The HSSE Management Plan will include training for security personnel on rules of engagement, human rights and conflict management

The Grievance Management Procedure will be implemented to ensure stakeholders have the opportunity to raise concerns and grievances related to the project.

The magnitude of the impact is **very low** as security provisions in line with national and international requirements will be implemented on site. The sensitivity of the receptor is **low** given the absence of communities surrounding the project area. The significance of the impact is **negligible**.

Table 8.83: Interaction with security personnel

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Project security personnel actions and behaviour.	Negative interactions between members of the public and project security personnel.	Very Low (1)	Low (2)	**Negligible (2)**	N

Mitigation measures

No mitigation measures are proposed for this impact given its negligible significance.

Due to the lack of populated PAC surrounding the project site, no other community health, safety or security impacts have been identified. Traffic accidents and potential ERW incidents are assessed as unplanned events in Section 8.4.

8.2.5 Decommissioning phase social impacts

Decommissioning is not expected to occur for at least 35 years.

As is outlined in the Government of Azerbaijan PCCP and the State Program on the Great Return, it is expected that in the coming years, Jabrayil district and the towns within it (such as Jabrayil City) will establish and develop their civilian populations. It is likely that at the time of decommissioning, communities will reside in the vicinity of the project.

These communities may experience the following potential impacts associated with decommissioning.

- Provision of local employment opportunities for semi-skilled and low-skilled workers (benefit).
- Dissatisfaction and unmet expectations over the scale and duration of opportunities. NB: demand is likely to be higher due to larger populations.
- Resentment between those who are employed and applicants who are unsuccessful.
- Noise emissions from decommissioning activities leading to nuisance, anxiety, irritation and impaired cognitive performance.
- Air and dust emissions from decommissioning activities leading to nuisance and a worsening of existing respiratory conditions.

The magnitude, sensitivity and significance of these impacts is outlined in Table 8.84 below.

Table 8.84: Socioeconomic impacts from decommissioning

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Project employment	Provision of local employment opportunities	Positive (0)	Medium (3)	**Positive (0)**	N
Project employment	Unmet expectations regarding scale of local employment opportunities	Low (2)	Medium (3)	**Moderate (6)**	Y
Project employment	Resentment between those who are employed and those who's applications are unsuccessful	Low (2)	Medium (3)	**Moderate (6)**	Y

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Decommissioning activities	Noise emissions causing nuisance	Low (2)	Low (2)	**Minor (4)**	Y
Decommissioning activities	Increase in air emissions leading to nuisance and worsening of existing conditions	Low (2)	Low (2)	**Minor (4)**	Y

Mitigation measures

For project employment impacts, the same mitigation measures outlined for construction and operation will be applied for decommissioning.

Impacts from dust and exhaust emissions will be mitigated as described in Section 8.1.1.1.

Residual impacts

With the implementation of mitigation, the impact magnitude for the socioeconomic aspect of these impacts is expected to reduce to **very low.** The residual impacts are therefore also reduced to **minor or negligible**.

Table 8.85: Residual socioeconomic impacts from decommissioning

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Project employment	Provision of local employment opportunities	**Positive (0)**	Positive (0)	Medium (3)	**Positive (0)**
Project employment	Unmet expectations regarding scale of local employment opportunities	**Moderate (6)**	Very Low (1)	Medium (3)	**Minor (3)**
Project employment	Resentment between those who are employed and those who's applications are unsuccessful	**Moderate (6)**	Very Low (1)	Medium (3)	**Minor (3)**

Activity	Potential impact	Impact significance before mitigation measures	Impact significance after mitigation measures		
			Magnitude	Sensitivity	Significance
Decommissioning activities	Noise emissions causing nuisance	**Minor (4)**	Very Low (1)	Low (2)	**Negligible (2)**
Decommissioning activities	Increase in air emissions leading to nuisance and worsening of existing conditions	**Minor (4)**	Very Low (1)	Low (2)	**Negligible (2)**

8.2.6 Cultural Heritage Impact Assessment

8.2.6.1 Construction phase

Impacts to known tangible and intangible cultural heritage

The following activities have the potential to impact cultural heritage:

- clearance of vegetation within the project footprint
- ground disturbance
- dust and vibration from groundworks and construction traffic
- noise from operation of equipment and construction traffic.

The potential impacts during construction are:

- direct physical impacts on sites, including from noise, vibration and dust generated by plant, equipment and vehicles to all, or part of:
  - known TCH
  - tangible elements of ICH
- the effects of noise and visual intrusion on people's appreciation of cultural heritage.

The known cultural heritage sites within and surrounding the project site have different sensitivities depending on their location relative to the project site (and therefore susceptibility to disturbance). The locations of cultural heritage sites (CHS) are shown in Figure 5.30**Figure 5.33**.

The magnitude of impact on cultural heritage sites CHS01, CHS02, CHS03, CHS05, CHS06 and CHS14 is assessed as **low**, the sensitivity of the sites is **very low**, resulting in a **negligible** impact significance.

The magnitude of impact on cultural heritage sites CHS04 and CHS13 is assessed as **low**, the sensitivity of the sites is **medium**, resulting in a **moderate** impact significance.

The magnitude of impact on sites CHS07, CHS08, CHS09, CHS10, CHS11 and CHS12 is assessed as **very low**, the sensitivity of the sites is **low**, resulting in a **negligible** impact significance.

Impacts on unknown tangible cultural heritage

Ground disturbing activity during enabling and construction works has the potential to result in an archaeological or cultural heritage find within the northern or southern clusters. The likelihood of discovering a chance find is high around the cemeteries within the southern cluster as the surface extent of the graves was unclear during the baseline survey due to the age of the graves and previous disturbance. Due to the ancient history of the region there is the potential to find archaeological artefacts or cultural heritage similar to those identified within and surrounding the project sites during the baseline survey.

The magnitude of impact on sites of unknown tangible cultural heritage is assessed as **low**, the sensitivity of the receptor is **low**, resulting in a **minor** impact significance.

Loss of access to known tangible cultural heritage sites

Enabling works and construction activities has the potential to disrupt access to known tangible cultural heritage sites. While it is assumed that cultural heritage sites within the Jabrayil district are largely inaccessible due to the occupation of the Garabagh region by Armenia and the presence of landmines and ERW, any sites (i.e., mosques, shrines, historic wells) that may be located near main transport routes could be affected during construction.

The magnitude of impact of loss of access to known tangible cultural heritage sites is assessed as **low**, the sensitivity of the receptor is **low**, resulting in a **minor** impact significance.

Table 8.86: Impacts to cultural heritage from construction activities

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Physical disturbance during construction	Sites CHS01, CHS02, CHS03, CHS05, CHS06 and CHS14 lie within or close to the boundary of the project footprint	Low (2)	Very Low (1)	**Negligible (2)**	Y
	Sites CHS04 and CHS13 lie within the boundary of the southern cluster	Low (2)	Medium (3)	**Moderate (6)**	Y
	Sites CHS07, CHS08, CHS09, CHS10, CHS11 and CHS12 lie outside of the boundary of the project footprint	Very Low (1)	Low (2)	**Negligible (2)**	Y

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Ground disturbing activities during enabling and construction works	Archaeological or cultural heritage chance find	Low (2)	Low (2)	**Minor (4)**	Y
Enabling works and construction activities	Elements of enabling works and construction (i.e., transportation) may disrupt access to known cultural heritage sites	Low (2)	Low (2)	**Minor (4)**	Y

Mitigation measures

The intention of all mitigation measures is to avoid damage to known and unknown tangible or intangible cultural heritage features. The preferred measure is to avoid impact by avoidance and excluding the cultural heritage feature from the project site.

The two cemeteries (CHS04 and CHS13) lie on the boundary of and within the southern cluster. Lightsource bp has established an exclusion zone around the cemeteries within the project design and excluded the sites from the built area. A 300 m buffer zone around the known graves be fenced to prohibit enabling works and construction plant working in the cemetery areas.

Sites CHS01, CHS02, CHS03, CHS05, CHS06, CHS14 lie within or close to the project sites. It is recommended that active observations are made during earthworks in the vicinity of these sites (an archaeological watching brief[28]) so that works can be stopped or diverted quickly should potential cultural heritage be exposed, and the Chance Finds Procedure implemented (see below).

The Contractor will develop and implement a Cultural Heritage Management Plan (CHMP) within the ESMP that will include the measures to protect cultural heritage features that are known (and access to those sites) and those that may be discovered during enabling works and construction activities. All findings will be reported to the Ministry of Culture, and any archaeologists or experts will be engaged through the Ministry. The Contractor will prepare a Chance Finds Procedure (CFP) as part of the CHMP for implementation throughout the construction programme in case any cultural heritage assets or archaeological artefacts are discovered.

[28] An archaeological watching brief is a formal programme of observation and investigation conducted during any operation carried out for non-archaeological reasons where there is a possibility that archaeological deposits may be disturbed (CIfA, 2014)

All cultural heritage artefacts are the property of the government. Collection of cultural heritage artefacts by workers for their own use is prohibited. Any cultural heritage artefacts found by workers will be left in situ and reported to the worksite supervisor, the site environmental manager and Lightsource bp as required by the CFP.

Residual impacts

No construction phase residual impacts have been identified.

8.2.6.2 Operations phase

There is a potential for disturbance to known cultural heritage sites within the project footprint during routine maintenance or emergency repairs. Receptor sensitivity has been assigned as **medium**. The impact magnitude has been assessed as **very low** and the resulting impact significance is therefore considered to be **negligible**.

Table 8.87: Impacts to cultural heritage from operational activities

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Disturbance during maintenance works during the operations phase	Sites CHS04 and CHS13 lie within the boundary of the southern cluster	Very Low (1)	Medium (3)	**Negligible (3)**	Y

Mitigation measures

The operation and maintenance (O&M) contractor will develop and implement an operations phase CHMP within the ESMP. The plan will include details of all known cultural heritage features identified and managed before and during construction. The CHMP and its associated GIS files will inform any cultural heritage management measures that are required during project operation (i.e., maintain fencing around the cemeteries in the southern cluster).

Residual impacts

No operational residual impacts have been identified.

8.2.6.3 Decommissioning phase

Similar impacts to those assessed during the construction phase are forecast for the decommissioning phase.

Table 8.88: Impacts to cultural heritage from decommissioning activities

Activity	Potential impact	Significance			Mitigation needed
		Magnitude	Sensitivity	Significance	
Disturbance during decommissioning works	Sites CHS04 and CHS13 lie within the boundary of the southern cluster	Very Low (1)	Medium (3)	**Negligible (3)**	Y

Mitigation measures

The decommissioning contractor will ensure protection of all known cultural heritage features and development and implementation of a decommissioning phase CHMP. The plan will include details of all known cultural heritage features identified and managed before and during construction and operations. The CHMP and its associated GIS files will inform any cultural heritage management measures that are required during project decommissioning (i.e., maintain fencing around the cemeteries in the southern cluster).

Residual impacts

No decommissioning residual impacts have been identified.

8.2.7 Social Impact Assessment Summary

Table 8.89 provides a summary of the social impact assessment.

Table 8.89: Pre-mitigation impact scoring and post mitigation residual impact significance for social impacts

No.	Project activity	Description of impact	Pre-mitigation scoring			Mitigation measure(s) proposed[30]	Residual impact scoring		
			Receptor sensitivity	Magnitude of impact	Impact significance		Receptor sensitivity	Magnitude of impact	Impact significance
Construction phase									
1	Procurement of goods and services	Benefits to local businesses	Positive (0)	High (4)	Positive (0)	N			
2	Procurement of goods and services	Local inflation	Low (2)	Low (2)	Minor (4)	Y	Very Low (1)	Low (2)	Negligible (2)
3	Local sub-contracting, and the purchasing of goods and services	Escalation of potential local corruption	Low (2)	Medium (3)	Moderate (6)	Y	Very Low (1)	Medium (3)	Minor (3)
4	Employment opportunities	Generation of local employment opportunities	Positive (0)	Medium (3)	Positive (0)	N			
5	Employment opportunities	Training and skills development	Positive (0)	Medium (3)	Positive (0)	N			
6	Completion of construction activities	Termination of employment contracts	Medium (3)	Low (2)	Moderate (6)	Y	Very Low (1)	Low (2)	Negligible (2)
7	Project employment	Violation of labour rights by contractors and sub-contractors and in supply chain	Low (2)	Low (2)	Minor (4)	Y	Very Low (1)	Low (2)	Negligible (2)
8	Project employment	Failure of contractors and sub-contractors to provide adequate accommodation	Low (2)	Medium (3)	Moderate (6)	Y	Very Low (1)	Medium (3)	Minor (3)
9	Project security personnel actions and behaviour	Negative interactions between members of the public and project security personnel.	Very Low (1)	Low (2)	Negligible (2)	N			
10	Physical disturbance during construction	Sites CHS01, CHS02, CHS03, CHS05, CHS06 and CHS14 lie within or close to the boundary of the project footprint	Low (2)	Very Low (1)	Negligible (2)	Y			
11	Physical disturbance during construction	Sites CHS04 and CHS13 lie within the boundary of the southern cluster	Low (2)	Medium (3)	Moderate (6)	Y			
12	Physical disturbance during construction	Sites CHS07, CHS08, CHS09, CHS10, CHS11 and CHS12 lie outside of the boundary of the project footprint	Very Low (1)	Low (2)	Negligible (2)	Y			
13	Ground disturbing activities during enabling and construction works	Archaeological or cultural heritage chance find	Low (2)	Low (2)	Minor (4)	Y			
14	Enabling works and construction activities	Elements of enabling works and construction (i.e., transportation) may disrupt access to known cultural heritage sites	Low (2)	Low (2)	Minor (4)	Y			
Operation phase									
15	Project operation	Power generation and supply to national grid	Positive			N			
16	Employment opportunities	Generation of local employment opportunities	Positive (0)	Medium (3)	Positive (0)	N			
17	Disturbance during maintenance works during the operations phase	Sites CHS04 and CHS13 lie within the boundary of the southern cluster	Very Low (1)	Medium (3)	Negligible (3)	Y			
Decommissioning phase									
18	Project employment	Provision of local employment opportunities	Positive (0)	Medium (3)	Positive (0)	N			
19	Project employment	Unmet expectations regarding scale of local employment opportunities	Low (2)	Medium (3)	Moderate (6)	Y	Very low (1)	Medium (3)	Minor (3)
20	Project employment	Resentment between those who are employed and those who's applications are unsuccessful	Low (2)	Medium (3)	Moderate (6)	Y	Very Low (1)	Medium (3)	Minor (3)
21	Decommissioning activities	Noise emissions causing nuisance	Low (2)	Low (2)	Minor (4)	Y	Very Low (1)	Low (2)	Negligible (2)
22	Decommissioning activities	Increase in air emissions leading to nuisance and worsening of existing conditions	Low (2)	Low (2)	Minor (4)	Y	Very Low (1)	Low (2)	Negligible (2)
23	Disturbance during decommissioning works	Sites CHS04 and CHS13 lie within the boundary of the southern cluster	Very Low (1)	Medium (3)	Negligible (3)	Y			

8.3 Ecosystem Services Impact Assessment

Results of the ES analysis is presented in Table 8.90 and results of the ES impact assessment are presented in Table 8.91. For this project, due to the absence of a resident population within the AOI a different approach has been taken in that the analysis of ES considered the potential future PAC to align with the State Program on the Great Return (President of the Republic of Azerbaijan, 2022a). Therefore, any future PAC within and near the project AOI are considered to be beneficiaries of the ES analysed in Table 8.90. While there may be no immediate impact due to the absence of beneficiaries of ES during the construction and early years of operation of the PV power facility, best practice mitigation measures are proposed to protect the identified ES for any future beneficiaries.

Coverage of habitats and vegetation (used as a proxy for ecosystem) for the northern and southern clusters is presented in Table 5.18. The habitat and vegetation complexes within the northern and southern clusters are lowland meadow, saltwort small-shrub semi-desert, secondary vegetation, steppe and wormwood semi-desert.

Table 8.90: Ecosystem services analysis

Ecosystem/habitat associated with ES	Description of identified ES	ES Type	Viable ES alternatives	ES importance to beneficiaries	ES replaceability	ES rating	ES priority
Provisioning services							
Surface water bodies e.g., Araz River, seasonal stream channels	Fishing: Provision of a source of nutrition and income	Type 1	Potential viable alternatives include: • Fishing in other areas. These areas should be accessible, not show signs of overfishing, and fishermen should have the right to fish in such areas. • Purchasing fish for nutrition from other sources.	Moderate	Moderate (some alternatives)	Medium	Non-priority
Surface water bodies e.g., Araz River, seasonal stream channels	Freshwater resources: Agricultural or domestic use of freshwater resources (i.e., crop irrigation, household use, sanitation and cleaning)	Type 1	There are no viable alternatives for this ES	Moderate	Low/not replaceable (few to no alternatives)	High	Priority
Grassy steppe habitats, lowland meadow, wormwood and saltwort small shrub semi-desert	Wild plant and natural resource collection: Collection of wild plants and other natural resources (e.g., herbs, honey, mushrooms, vegetation) for a source of income, food, fodder)	Type 1	Potential viable alternatives include: • Foraging in other areas where access to land is restricted (e.g., due to construction of the PV power facility). • Provide employment opportunities to generate income and replace dependence on agriculture. • Purchasing wild plants and other natural resources from other sources.	Moderate	Moderate (some alternatives)	Medium	Non-priority
Cultural services							
Grassy steppe habitats (lowland meadow, wormwood and saltwort small shrub semi-desert)	Cultural connection to the land and aesthetic value of the landscape	Type 1	There are no viable alternatives for this ES	Moderate	Low/not replaceable (few to no alternatives	High	Priority
Grassy steppe habitats (lowland meadow, wormwood and saltwort small shrub semi-desert)	Traditional knowledge and livelihoods	Type 1	There are no viable alternatives for this ES	Moderate	Low/not replaceable (few to no alternatives	High	Priority
Regulating/supporting services							
Grassy steppe habitats (lowland meadow, wormwood and saltwort small shrub semi-desert)	Pollination	Type 1	There are no viable alternatives for this ES	Moderate	Low/not replaceable (few to no alternatives	Medium	Non-priority
Grassy steppe habitats (lowland meadow, wormwood and saltwort small shrub semi-desert)	Erosion control	Type 1	Erosion control measures included in Section 8.1.4	Moderate	Moderate (some alternatives)	Medium	Non-priority
Grassy steppe habitats (lowland meadow, wormwood and saltwort small shrub semi-desert)	Regulation of soil quality	Type 1	There are no viable alternatives for this ES	Moderate	Low/not replaceable (few to no alternatives	Medium	Non-priority
Grassy steppe habitats (lowland meadow, wormwood and saltwort small shrub semi-desert)	Regulation of air quality	Type 1	There are no viable alternatives for this ES	Moderate	Low/not replaceable (few to no alternatives	Medium	Non-priority
Grassy steppe habitats (lowland meadow, wormwood and saltwort small shrub semi-desert)	Regulation of climate	Type 1	Some options include: • Soil conservation practices • Afforestation and reforestation (e.g., planting trees).	Moderate	Moderate (some alternatives)	Medium	Non-priority

Table 8.91: Ecosystem services impact assessment

<table>
<tr><th rowspan="2">ES name, type and priority</th><th rowspan="2">Project related activities with the potential to impact ES</th><th rowspan="2">Summary of the potential adverse impacts on ES</th><th rowspan="2">Project phase</th><th colspan="3">Impact significance</th><th rowspan="2">Mitigation needed</th><th rowspan="2">Residual impact significance</th></tr>
<tr><th>Magnitude</th><th>Sensitivity</th><th>Significance</th></tr>
<tr><td colspan="9">Provisioning services</td></tr>
<tr><td rowspan="2">Fishing – provision of a source of nutrition and income.
(Non-priority: Type 1)</td><td>• Construction of PV power facility
• Use, handling and storage of hazardous materials/substances.
Refer to Sections 8.1.6 and 8.4</td><td><u>Reduction in surface water quantity and quality:</u>
• Surface water contamination
• Increased sediment load
• Changes in surface water drainage.</td><td>All phases</td><td>Medium (3)</td><td>Low (2)</td><td>Moderate (6)</td><td>Yes, refer to Sections 8.1.6 and 8.4</td><td>Minor (4)</td></tr>
<tr><td>• Collection, transportation, handling, storage, and disposal of various types of materials.
Refer to Section 8.1.9</td><td><u>Introduction of AIS to the Araz River:</u>
• Reduction in native fish populations.</td><td>Construction
Decommissioning</td><td>Medium (3)</td><td>Low (2)</td><td>Moderate (6)</td><td>Yes, refer to Section 8.1.9</td><td>Minor (4)</td></tr>
<tr><td>Freshwater resources – agricultural or domestic use of surface water resources (i.e., crop irrigation, household use, sanitation and cleaning).
(Priority: Type 2)</td><td>• Construction of PV power facility
• Use, handling and storage of hazardous materials/substances.
Refer to Sections 8.1.6 and 8.4</td><td><u>Reduction in surface water quantity and quality:</u>
• Surface water contamination
• Increased sediment load
• Changes in surface water drainage.</td><td>All phases</td><td>Medium (3)</td><td>Low (2)</td><td>Moderate (6)</td><td>Yes, refer to Sections 8.1.6 and 8.4</td><td>Minor (4)</td></tr>
<tr><td rowspan="3">Wild plant and natural resource collection – collection of wild plants and other natural resources (e.g., herbs, honey, mushrooms, vegetation) for a source of income, food and fodder.
(Non-priority: Type 1)</td><td>• Construction of PV power facility.
Refer to Section 8.1.9</td><td><u>Permanent loss of access to land:</u>
• Reduction in available resources
• Requirement for individuals to travel further from their households to find alternative resources
• Loss of primary and secondary seedbanks
• Soil erosion and loss of topsoil layers.</td><td>Construction</td><td>Low (2)</td><td>Very Low (1)</td><td>Negligible (2)</td><td>No (no significant impact on ES anticipated) – no resident population in project area during construction phase</td><td>Negligible (2)</td></tr>
<tr><td>• Long-term uptake of natural land for the project.</td><td><u>Permanent loss of access to land:</u>
• Reduction in available resources
• Requirement for individuals to travel further from their households to find alternative resources.</td><td>Operation</td><td>Low (2)</td><td>Low (2)</td><td>Minor (4)</td><td>No (no significant impact on ES anticipated)</td><td>Minor (4)</td></tr>
<tr><td>• Use, handling and storage of hazardous materials/substances.
Refer to Sections 8.1.6, 8.4 and 8.1.9</td><td><u>Habitat contamination:</u>
• Accidental/unplanned spillages of hazardous materials
• Contamination with solid and liquid waste
• Waste and litter accumulation
• Increased siltation
• Smothering impact from dust rise.</td><td>All phases</td><td>Medium (3)</td><td>Low (2)</td><td>Moderate (6)</td><td>Yes, refer to Sections 8.1.6, 8.4 and 8.1.9</td><td>Minor (4)</td></tr>
</table>

ES name, type and priority	Project related activities with the potential to impact ES	Summary of the potential adverse impacts on ES	Project phase	Impact significance			Mitigation needed	Residual impact significance
				Magnitude	Sensitivity	Significance		
Cultural services								
Cultural connection to the land and aesthetic value of the landscape. (Priority: Type 1)	• Long-term uptake of natural land for the project.	Permanent loss of natural habitats: • Loss of access to sacred or culturally important locations/intangible cultural heritage • Disconnecting PAC from cultural heritage and reducing the aesthetic value of the landscape. • Reduced visual amenity of land.	All phases	Low (2)	Medium (3)	**Moderate (6)**	Refer to Section 8.2.6	**Minor (3)**
	• Construction of PV power facility. Refer to Section 8.1.7	Cultural heritage impact: • Damage to a cultural heritage or archaeological site (e.g., cemeteries). Note: The sensitivity of the receptor is reduced by the existing management control measure of including a 300 m buffer around the known cemeteries.	Construction	Low (2)	Low (2)	**Minor (4)**	Refer to Section 8.2.6	**Negligible (2)**
Traditional knowledge and livelihoods. (Priority: Type 1)	• Construction of PV power facility • Long-term uptake of natural land for the project. Refer to Section 8.2.6	Permanent loss natural habitats: • Loss of access to or damage to kahriz structures – traditional way of life.	All phases	Medium (3)	Medium (3)	**Moderate (9)**	Refer to Section 8.2.6	**Moderate (6)**
Regulating/supporting services								
Pollination (Non-priority: Type 1)	• Noise emissions, exhaust gases and fugitive emissions from the use of plant, equipment, and vehicles for project activities. Refer to Sections 8.1.1, 8.1.3 and 8.1.9	Increased noise and air pollution: • Reduced fitness of flora and fauna • Displacement of pollinator species • Reduction in plants that are pollinated.	Construction Decommissioning	Low (2)	Medium (3)	**Moderate (6)**	Yes, refer to Sections 8.1.1, 8.1.3 and 8.1.9	**Minor (3)**
	• Construction of PV power facility e.g., removal of vegetation, topsoil stripping. Refer to Sections 8.1.4 and 8.1.9	Soil erosion and vegetation clearance: • Loss of primary and secondary seedbanks and topsoil • Loss of topsoil layers • Reduction in plants that are pollinated.	Construction	Low (2)	Medium (3)	**Moderate (6)**	Yes, refer to Sections 8.1.4 and 8.1.9	**Minor (3)**
	• Long-term uptake of natural land for the project.	Permanent loss of natural habitat: • Reduction in plants that are pollinated.	All phases	Low (2)	Low (2)	**Minor (4)**	No (no significant impact on ES anticipated)	**Minor (4)**

ES name, type and priority	Project related activities with the potential to impact ES	Summary of the potential adverse impacts on ES	Project phase	Impact significance			Mitigation needed	Residual impact significance
				Magnitude	Sensitivity	Significance		
Erosion control (Non-priority: Type 1)	• Construction of PV power facility (e.g., vegetation removal, topsoil stripping and benching). • Maintenance and operation of the site drainage system during the operational phase. • Decommissioning (e.g., ground disturbance, vegetation removal). Refer to Sections 8.1.4 and 8.1.9	<u>Soil erosion:</u> • Poor re-establishment of native flora following vegetation clearance and/or soil erosion/compaction • Inadequate site drainage system increasing rates of erosion • Decreased surface water quality downstream.	All phases	Medium (3)	Low (2)	**Moderate (6)**	Yes, refer to Sections 8.1.4 and 8.1.9	**Minor (4)**
Soil formation and nutrient cycling (Non-priority: Type 1)	• Construction of PV power facility e.g., removal of vegetation. • Decommissioning (e.g., ground disturbance, vegetation removal). Refer to Sections 8.1.4 and 8.1.9	<u>Soil erosion and vegetation clearance:</u> • Increased rates of erosion • Reduction in the amount of nutrients that become incorporated into soil • Reduced soil formation.	Construction Decommissioning	Low (2)	Low (2)	**Minor (4)**	No (no significant impact on ES anticipated)	**Minor (4)**
	• Long-term uptake of natural land for the project.	<u>Permanent loss of natural habitat:</u> • Reduction in the amount of nutrients that become incorporated into soil • Reduced soil formation.	All phases	Low (2)	Low (2)	**Minor (4)**	No (no significant impact on ES anticipated)	**Minor (4)**
Air quality regulation (Non-priority: Type 1)	• Long-term uptake of natural land for the project.	<u>Permanent loss of natural habitat:</u> • Loss of natural vegetation that is responsible for primary production and CO_2/O_2 cycling and water exchange/photorespiration.	All phases	Low (2)	Low (2)	**Minor (4)**	No (no significant impact on ES anticipated)	**Minor (4)**
Carbon storage and sequestration (Non-priority: Type 1)	• Construction of PV power facility e.g., removal of vegetation, topsoil stripping. • Decommissioning (e.g., ground disturbance, vegetation removal). Refer to Sections 8.1.4 and 8.1.9	<u>Temporary loss of natural habitat:</u> • Loss of natural vegetation and soil that store and sequester carbon.	Construction Decommissioning	Low (2)	Low (2)	**Minor (4)**	No (no significant impact on ES anticipated)	**Minor (4)**

8.4 Impact Assessment for Unplanned Events

'Credible' unplanned events during the construction phase and operation phase activities leading to environmental or social impacts were identified during the impact assessment process.

A summary of unplanned events associated with the PV power facility is presented in Table 8.92. This includes an overview of the project activity, receptor, potential impact, project phase event could occur, severity of impact, likelihood of impact, overall risk ranking and mitigation measures.

Table 8.92: Potential impacts during unplanned events

Project activity	Environmental or social aspect	Description of potential impact	Project phase	Impact significance			Mitigation measure(s)
				Severity	Likelihood	Risk ranking	
Potential environmental impacts from unplanned events							
Management of hazardous materials	• Soil quality • Surface water quality • Groundwater quality	Accidental loss of containment or spillage of hazardous materials during storage, handling or use results in contamination of soil and/or water resources.	• Construction • Operation • Decommissioning	Low (2)	Unlikely (2)	**Small**	• Regularly inspect and maintain plant, equipment, and vehicles for leaks of diesel or chemicals. • Hazardous materials storage areas shall have secondary containment within a berm perimeter able to contain 110% of the largest tank volume. • Regularly inspect storage areas for any leakage or spillage of diesel or chemicals. • Locate drip collection trays at refuelling areas. • Locate spill clean-up kits at strategic locations and replace/replenish as required. • Develop and implement a Hazardous Materials Management Plan within the ESMP. • Develop and implement a Spill Response Plan within the ESMP.
Storage of hazardous materials and equipment containing hazardous materials (i.e., vehicles and machinery) and hazardous waste	Surface water quality	Flooding events could result in the accidental release of hazardous materials from storage areas, vehicles and machinery and hazardous waste areas should these areas be damaged or submerged by floodwaters resulting in contamination of surface water bodies.	• Construction • Operation • Decommissioning	Medium (3)	Unlikely (2)	**Material**	• Design project site layouts taking into consideration the flood risk assessment study conducted for the project and location storage areas for hazardous materials, hazardous waste and vehicle and machinery outside of flood risk zones. • Regularly review weather forecasts and move vehicles, machinery and any hazardous materials to safe areas should heavy rainfall or storm events be forecast. • Do not store hazardous materials, hazardous wastes, vehicles or machinery on bridges or culvert crossings. • Develop and implement a Hazardous Materials Management Plan within the ESMP. • Develop and implement a Spill Response Plan within the ESMP.
Use of vehicles and machinery for project activities	Terrestrial biodiversity	Direct mortality of fauna from collisions with vehicles and machinery.	• Construction • Operation • Decommissioning	Low (2)	Unlikely (2)	**Small**	• Construct barriers around work sites to prevent the entry of fauna prior to construction activities. • Vehicle movements should be restricted to designated roads and approved routes. • Drivers will be trained in and comply with the established road rules and speed limits for the project. • Develop and implement a Biodiversity Management Plan within the ESMP that includes fauna protection measures and an injured wildlife procedure.

Project activity	Environmental or social aspect	Description of potential impact	Project phase	Impact significance			Mitigation measure(s)
				Severity	Likelihood	Risk ranking	
Potential social impacts from unplanned events							
Use of vehicles and machinery for project activities	• Other road users • Pedestrians	Traffic accidents resulting in material damage, injury or fatality of another road user or pedestrian.	• Construction • Operation • Decommissioning	High (4)	Probable (4)	**Severe**	• Develop and implement a Traffic Management Plan within the ESMP. • Lightsource bp and contractor(s) will develop and implement public safety communications protocols (including awareness building and emergency response) to mitigate risks to communities from accidents such as those related to traffic and unauthorised access. • Contractor(s) will undertake a pre-construction survey of the roads to be used by project traffic and identify community hazards. Actions will then be taken to minimise community safety risks at these locations (i.e., post signs and notices, reduced speed limits close to highly sensitive location such as schools, identification of alternative routes etc.). • Lightsource bp and the contractor will monitor Community Grievance Management Procedure for issues and concerns related to traffic management. • Postage of culturally appropriate safety signage and information in communities near project roads. This includes information for communities on incident investigations processes and lessons learned where appropriate.
Use of vehicles and machinery for project activities	Project affected communities	Traffic accidents resulting in material damage to third party property or injury or fatality of livestock.	• Construction • Operation • Decommissioning	Medium (3)	Possible (3)	**Material**	• Develop and implement a Traffic Management Plan within the ESMP. • Lightsource bp and the contractor will monitor Community Grievance Management Procedure to ensure any credible and verified injury or death of livestock or damage to property as a result of a project accident is reported and appropriate redress provided to livestock/property owner. • Postage of culturally appropriate safety signage and information in communities near project roads. This includes information for communities on incident investigations processes and lessons learned where appropriate.
Project activities	Workforce health and safety	The potential failure of the contractor(s) and sub-contractors working on the PV power facility to meet requisite occupational health and safety standards increases the risk of unsafe workplaces and conditions that could lead to workplace injuries and/or fatalities.	• Construction • Operation • Decommissioning	Medium (3)	Probable (4)	**Severe**	• Robust contractor pre-qualification and due diligence process that includes a review of contractor's health and safety policies to ascertain whether prospective contractors meet required standards. • Occupational health and safety training will be provided to the entire workforce as part of the induction process. • Lightsource bp and contractor(s) will develop and implement comprehensive Health and Safety Plans.
Mobilisation and construction phase site activities	Workforce and community health and safety	Although the project sites have been surveyed and cleared of ERW and mines by ANAMA there remains a risk that unknown ERW maybe accidently unearthed which could lead to an explosion and cause injury or death to a worker or third party.	• Construction	High (4)	Unlikely (2)	**Material**	• Lightsource bp and contractor(s) will develop and implement an ERW accidental risk mitigation procedure when unidentified ERW is found. • ERW hazard and risk training will be provided to the entire workforce as part of the induction process.

8.5 Cumulative Impacts

This section assesses cumulative impacts. Cumulative impacts result from the successive, incremental and/or combined effects of a project or activity, when added to other past, existing, planned and/or reasonably anticipated future ones (IFC, 2013).

8.5.1 Sources of Cumulative Impact

8.5.1.1 Introduction

A source of potential cumulative impact is something that affects the condition of the identified VECs.

Cumulative impacts in the study area, as defined in Section 7.5.7.1, potentially occur from the combined impacts of Project Sunrise activities with other activities. These include:

- associated facilities
- past and existing third-party projects that continue to affect the current and predicted future of the receptor
- reasonably defined/foreseeable third-party projects
- developments or activities induced by Project Sunrise
- other sources of human and natural stressors on the receptors.

These are discussed in more detail below.

8.5.1.2 Associated facilities

One associated facility has been identified in consultation with Lightsource bp. This is the step-up MV/HV substation that will be constructed, maintained and operated by AzerEnerji, subject to execution of final agreements. The purpose of the substation is to collect energy produced at 33 kV by the PV power facility and step up to 330 kV. It will include two power transformers and 33 kV MV switchgears. The substation will be constructed within the boundary of the southern cluster. The project will be connected to the MV/HV substation via MV underground transmission lines, which are considered a project component. The AzerEnerji substation will tie into the national grid; however, information on the connection to the national grid is not yet available.

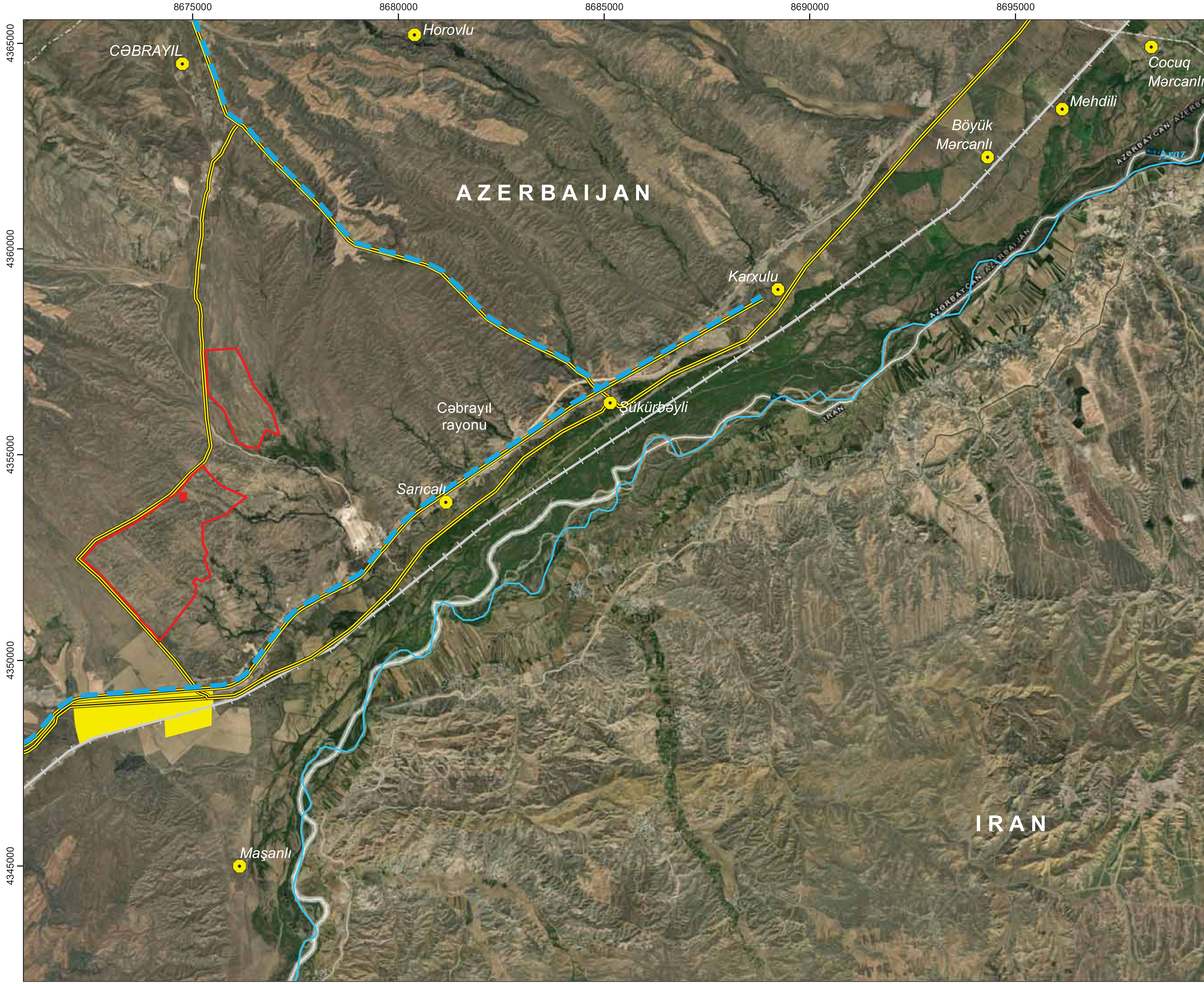
8.5.1.3 Past and present activities

Populations in the Garabagh region of Azerbaijan, where the project site is located, have been subject to occupation-induced displacement. As a result, years of abandonment and ruin have left infrastructure in and around settlements requiring significant rehabilitation. Prior to the first Garabagh war, the project sites were used for viticulture, livestock grazing and other agricultural activities. The project site is currently unoccupied and devoid of infrastructure, apart from unpaved tracks (Section 3.1.2). Further information is provided in the socioeconomic baseline (Section 5.4).

8.5.1.4 Reasonably defined or foreseeable third party projects

The State Program on the Great Return, Decree of the President of the Republic of Azerbaijan (President of the Republic of Azerbaijan, 2022a), presents several large infrastructure-related target projects between 2022 and 2026, a number of which are already under way. For example, the Horadiz–Jabrayil–Zangilan–Aghband (Zangezur Corridor) highway, to be completed by 2025; housing, public buildings, educational institutions and electricity and internet infrastructure in the Jabrayil district; villages along the new railway line, and irrigation infrastructure for agricultural activities. At the time of writing, the “priority directions” presented in the State Program on the Great Return have not been taken into consideration in the CIA due to lack of project detail provided.

It is understood that the Master Plan for the Development of Azerbaijan's Jabrayil City until 2040 has been approved, but is not available publicly at the time of writing (BNN, 2023).



Legend:

- Towns and settlements to be resettled by 2026
- "Azerenerji" Substation
- Major rivers
- State border
- Road network
- Railway
- Gas pipeline
- Project Area
- Araz Valley Economic Zone Industrial Park

Notes:
This map contains data from the following sources:
DATA SOURCE (DATE)

Coordinate System: Pulkovo 1942 GK Zone 8
Projection: Gauss Kruger
Datum: Pulkovo 1942
Units: Meter

Rev	Date	Description	Drn	Chk	App
01	01/02/2024	Final	USeid	HON	FG
00	07/11/2023	Draft A	USeid	HON	FG

Project Sunrise

RSK

Figure 8.1:

Location of third projects and associated facilities screened into the CIA

0 1,500 3,000
Meters

SCALE: 1:85,000 @ A3

REV 01

Document Path: P81137\P81137 - Figure 8.1.mxd

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Figure 8.1 and Table 8.93 present the projects that have been screened into the CIA, and provides justification for screening out other identified projects. A brief description of projects that have been screened in is provided below.

- Gas energy infrastructure is planned to be constructed by 2026, including a pipeline to be constructed by the State Oil Company of the Republic of Azerbaijan (SOCAR) connecting Horadiz to Lachin, contributing to a total length of 416 km of pipelines in the region.
- The Araz Valley Economic Zone Industrial Park has already been constructed and is being used by a few organisations, mainly for warehouse storage, although it is largely unoccupied at present. It is the operation of the Industrial Park that will be considered in the CIA.
- Reconstruction work and the resettlement of Jabrayil City and the villages of Shukurbayli, Horovlu, Sarijanli, Mashanli, Boyuk Marcanli, Karkhulu, Cocuq Marcanli and Mehdili before 2026.

Table 8.93: Identified associated facilities and third party projects

Project	Proponent	Location (Ward, District)	Description (including timescale)	Source	Screening
Project Sunrise associated facilities					
Step-up MV/HV substation	AzerEnerji	Southern cluster of Project Sunrise footprint	AzerEnerji step-up MV/HV substation to be constructed and operated by AzerEnerji within the boundary of the Project Sunrise southern cluster. The AzerEnerji substation will be connected to the Project Sunrise LV/MV substation via underground MV transmission lines (these transmission lines are a Project Sunrise component). AzerEnerji substation to tie into the national grid; further information on the connection to the national grid is currently unavailable.[29]	Project description (Section 3)	Screened in
Third party projects – screened into CIA					
Gas energy infrastructure	SOCAR	Horadiz and Jabrayil district	Gas energy infrastructure to be constructed by 2026 (including pipeline to be constructed by SOCAR connecting Horadiz to Lachin (President of the Republic of Azerbaijan, 2022). SOCAR is planning to construct gas pipelines with a total length of 416 km in the region (Aircenter, 2021). An exact pipeline route was not publicly available at the time of writing, an assumed route has been assessed – see Figure 8.1).	President of the Republic of Azerbaijan (2022a) Aircenter (2021)	Screened in

[29] Transmission line(s) from the AzerEnerji MV/HV substation to the national grid will be assessed at a later date in an addendum to the ESIA, after the location/route is confirmed.

Project	Proponent	Location (Ward, District)	Description (including timescale)	Source	Screening
Araz Valley Economic Zone Industrial Park	Araz Vadisi İqtisadi Zonası Sənaye Parkı	Jabrayil district	The park will include agricultural processing, industrial, social, and technical zones, as well as logistics and trade centres, warehouse complexes, wholesale and retail facilities, customs checkpoints, and filling stations etc. The park covers a 200-ha area (Caspian News, 2023). In October 2022, the construction of an electrical substation with a capacity of 40 MVA and an administrative building had begun in the Industrial Park (Ministry of Economy of the Republic of Azerbaijan, 2022).	President of the Republic of Azerbaijan (2022a) Caspian News (2023) Ministry of Economy of the Republic of Azerbaijan (2022)	Screened in Already constructed, but largely unoccupied. Therefore, it is the operation of the Industrial Park that will be considered in the CIA
Reconstruction work and resettlement in to Jabrayil City and other villages	Government of Azerbaijan	Jabrayil district	The Urban Development and Architecture Committee's (ArxKom) general plan for development of Jabrayil district includes an initial stage of development (up to 2026). During this stage, reconstruction works and the resettlement of Jabrayil City and the villages of Shukurbayli, Horovlu, Sarijanli, Mashanli, Boyuk Marcanli, Karkhulu, Cocuq Marcanli and Mehdili is planned.	The Urban Development and Architecture Committee's (ArxKom) general plan for development of Jabrayil district	Screened in
Third party projects – screened out of the CIA					
Upgrade to fibre of the broadband infrastructure, Project number 50973	Aztelekom LLC	Regions of Azerbaijan, particularly in rural areas	The project aims to improve the quality and coverage of fibre broadband services, particularly in rural areas, to replace outdated technology with modern multiservice platforms, deploy new backbone infrastructure and fixed wireless communication bases in remote settlements.	EBRD (2022)	Project screened out as not reasonably defined as per IFC definition

Project	Proponent	Location (Ward, District)	Description (including timescale)	Source	Screening
Agricultural land and industrial estate development	TBC	Jabrayil district	Agricultural industrial estates are being established in Jabrayil district (Trend, 2022a). Potential for the development of agriculture in Jabrayil district (President of the Republic of Azerbaijan, 2022), such as production of grain, feed crops and the livestock, development of cotton growing and viticulture (Trend, 2022b).	Trend (2022a, b) President of the Republic of Azerbaijan (2022a).	Project screened out as not reasonably defined as per IFC definition
Social infrastructure developments in Jabrayil district	TBC	Jabrayil district	Construction of the network related to the creation of the Jabrayil energy junction and the integration of the Nakhchivan Autonomous Republic into the country's electricity grid (Construction of 2 units of 330 kV YS, reconstruction of 2 units of 330 kV YS, construction of 3 units of 330 kV EVX (517 km), construction of 4 units of 110 kV (EVX 64 km)), AzerEnerji	President of the Republic of Azerbaijan (2022a)	Project screened out as not reasonably defined as per IFC definition
Horadiz – Fuzuli – Shusha railway	TBC	Horadiz – Fuzuli – Shusha	Proposed construction of Horadiz – Fuzuli – Shusha railway. Construction of this railway was expected to start in 2021.	Aircenter (2021)	Project screened out as nearing completion/already completed and therefore covered in the baseline
Shukurbayli – Jabrayil – Hadrut highway	TBC	Jabrayil district	Continuation of the construction of Shukurbayli – Jabrayil – Hadrut highway	President of the Republic of Azerbaijan (2022a)	Project screened out as nearing completion/already completed and therefore covered in the baseline

Project	Proponent	Location (Ward, District)	Description (including timescale)	Source	Screening
Horadiz – Jabrayil – Zangilan – Aghband highway	State Agency of Azerbaijan Automobile Roads	Horadiz – Jabrayil	The Horadiz–Jabrayil–Zangilan–Aghband (Zangezur Corridor) highway with a length of 123.6 kilometres (km) is under construction. The road starts from Fuzuli's Ahmadbayli village. The first 77.5 km of the road has six lanes, while the remaining 46.1 km has four lanes. The roadway width corresponding to the traffic lanes is 29.5 and 21.5 meters, respectively. The completion of the project was estimated at 57 percent in August 2022. Scheduled completion is in 2024 (AZERNEWS, 2022). The State Program on the Great Return suggests this project will be completed by 2025 (President of the Republic of Azerbaijan, 2022a).	AZERNEWS (2022) President of the Republic of Azerbaijan (2022a)	Project screened out as nearing completion/already completed and therefore covered in the baseline
Horadiz-Aghband railway line	Azerbaijan Railways JSC	Horadiz – Aghband	Construction of the Horadiz-Aghband railway line of the Zangezur corridor. The railway design is 110.4 km long, as of August 2023, 80% complete. The sleeper bed has been laid up to 64.3 km, construction of 334 engineering structures has been completed, including 20 bridges. In August 2023, land, engineering and construction works were underway on the 68-84 km of the railway line.	AZERNEWS (2023)	Project screened out as nearing completion/already completed and therefore covered in the baseline

Project	Proponent	Location (Ward, District)	Description (including timescale)	Source	Screening
"Azerbaijan-Türkiye International Forestry Training Center," "Smart Seedlings" and "Friendship Forest" Complex	TBC	Jabrayil district	"Azerbaijan-Türkiye International Forestry Training Center," "Smart Seedlings" and "Friendship Forest" Complex will be established in Jabrayil district (President of the Republic of Azerbaijan (2022b).	President of the Republic of Azerbaijan (2022a, b)	Project scale not considered to produce significant cumulative impacts
Social infrastructure developments in Jabrayil district	TBC	Jabrayil district	23 schools to be constructed or restored in Fuzuli district and 25 to be constructed or restored in Jabrayil	President of the Republic of Azerbaijan (2022a)	Project scale not considered to produce significant cumulative impacts
Social infrastructure developments in Jabrayil district	TBC	Jabrayil district	Restoration and development of reclamation and water management complex of Jabrayil region (irrigation for more than 12,000 ha land), Azmelsu-taserrufat	President of the Republic of Azerbaijan (2022a)	Project scale not considered to produce significant cumulative impacts

8.5.1.5 *Induced development of facilities and services*

Induced development are impacts from non-project activities that are encouraged to happen because of the project and that would not occur in the absence of the project, for example new businesses established to cater for increased number of construction workers in the area. This is covered in Section 8.2.1.

8.5.1.6 *Other sources of human and natural stressors*

Receptors are exposed to stresses, threats and pressures that are not directly connected with formal development. Consequently, they have not been considered as a source of cumulative impact and are assumed to be part of baseline and covered by the trends sections in Section 5.

8.5.2 Cumulative Impact Assessment

8.5.2.1 *Introduction*

Cumulative impacts are those from activities or events which individually may not be significant but may produce significant impacts on the same receptor(s) when combined with impacts arising from different sources that have an overlapping sphere of influence to the activities and events under consideration. Such effects may arise due to their proximity in space or time, or because a certain receptor is particularly sensitive.

To determine the cumulative impacts which could occur as a result of the proposed project it is necessary to identify interactions between project aspects and VECs, see Table 8.94. Once interactions have been identified, literature sources and professional judgement have been used to understand the potential impacts on VECs and how these impacts may change with the inclusion of future projects. The current condition of each VEC is taken into account, as well as any potential natural stresses and events.

Analysis of cumulative impacts on VECs focusses on estimating the future state of the VECs that may result from the impacts they experience from predictable third-party future developments. Past and existing third-party projects that continue to affect the current and predicted future of the receptor are also discussed in certain cases where it is important that trends are considered. The objective is to estimate the state of VECs from the aggregated stresses that affect them.

In CIA, impacts are measured not in terms of the intensity of the stress added by a given development but in terms of the VEC’s response and ultimately, any significant changes to its condition.

Table 8.94: Cumulative impacts interaction table

VEC	Third party development			
	AzerEnerji MV/HV substation	SOCAR gas pipeline	Araz Valley Economic Zone Industrial Park	Reconstruction and resettlement of villages in Jabrayil district
Air quality	X	X	X	X
Climate	X	X	X	X
Noise	-	X	X	X
Soils	X	-	-	-
Habitats of conservation importance	-	-	X	X
Fauna species of conservation importance	-	-	X	X
Economy	**X**	**X**	**X**	**X**
Employment and skills development	**X**	**X**	**X**	**X**
Labour and working conditions	**X**	**X**	**X**	**X**
Infrastructure and services	**X**	**X**	**X**	**X**
Community safety, security and welfare	**X**	**X**	**X**	**X**
Tangible and intangible cultural heritage	X	-	-	-

Note: X = interaction between Project Sunrise and other project; **X** = significant impact.

Ecosystem services area assessed in Section 0, due to the limited impact significance they have not been considered within the CIA.

8.5.2.2 Physical environment

Air quality

Potential cumulative impacts are predicted between the construction and operation of Project Sunrise and the following projects (see Table 8.94):

- MV/HV substation
- gas pipeline
- Araz Valley Economic Zone Industrial Park
- reconstruction and resettlement of villages in Jabrayil district.

The baseline of the air quality in the AOI is provided in Section 5.2.4. The project area is within a rural, non-developed area with limited receptors to air quality. It is assumed that pollutant levels would be typical for this environment.

The limit of acceptable change is that the IFC Performance Standards and the WHO air quality guidelines are not exceeded from the combined effects of the project and other developments.

Impacts to air quality from the project are only expected during the construction phase. During construction, two sources of emissions have the potential for environmental effects, which are the dust emissions from site activities and release of gases, exhausts and vapours to atmosphere from combustion of fuel in construction equipment and vehicles. Overall, the impacts associated with these emissions are considered not significant, localised and short term.

Construction timeframes for the third-party developments are not known at the time of writing, a worst-case scenario has therefore been assumed that the construction activities are conducted concurrently generating emissions to air. This could lead to potential direct cumulative impacts on the ambient air quality and indirect impacts on communities. The Project Sunrise and the third-party development construction activities will be transient therefore the overlap with third-party projects in construction schedules would be for a short period of time. To manage its contribution to this cumulative impact, the project will:

- use vehicles, plant and equipment will be in good condition, regularly maintained and appropriate for the task being undertaken
- manage dust where necessary by means such as covering fine materials and wetting roads where appropriate and, project speed driving limits will be enforced; awareness training will be provided to project personnel.

The Araz Valley Economic Zone Industrial Park and the new villages are located beyond 250 m from the project boundary and the SOCAR gas pipeline is assumed to be over 1 km from the project boundary at its closest point. AOIs are therefore unlikely to overlap. Cumulative impacts are predicted to be not significant.

There are no operational cumulative impacts anticipated, indeed the operation of a solar power plant in preference to fossil fuel technologies will improve air quality.

GHG emissions

Potential cumulative impacts are predicted between the construction and operation of Project Sunrise and the following projects (see Table 8.94):

- MV/HV substation
- gas pipeline
- Araz Valley Economic Zone Industrial Park
- reconstruction and resettlement of villages in Jabrayil district.

The limit of acceptable change is that Azerbaijan's ability to meet its emission reduction target published as part of the UNFCCC's Paris Agreement is not impacted. Based on the latest update to Azerbaijan's nationally declared contributions (NDC), this would this equates to a 40% reduction in Azerbaijan's GHG emissions by 2050, compared to a 1990 baseline.

GHG emissions are a unique type of impact that demands consideration in a different manner to the other types of impact. GHG emissions are inherently cumulative; no specific impact location or magnitude can be attributed to a particular emission and all emissions have the same impact on the same ultimate receptor. The impact is climate change, or global warming, caused by the radiative forcing effects of GHGs in the atmosphere. The affected receptor is the global climate and all the ecosystems and biomes that depend on it.

Emissions from nearby third party projects and associated facilities will have a cumulative effect with those from any GHG-emitting activity both nationally, and indeed globally.

The transmission line associated facility, which allows the energy generated by Project Sunrise to be incorporated into the national grid, is required for the operational phase of the Proposed Development to produce any GHG savings benefit.

The third party gas pipeline project and Araz Valley Economic Zone Industrial Park project will cause emissions during all phases of development (construction, operation, and decommissioning). The reconstruction and resettlement of villages in Jabrayil district will also lead to increased emissions. As the overall effect of GHG emissions is cumulative in nature (in that all emissions act on the same receptor – the global climate), these developments will have an additional negative effect on the global climate, and are therefore considered to be significant.

However, solar power plants provide an important mechanism for the reduction of CO_2 and other GHG emissions into the atmosphere by reducing the consumption of fossil fuel generated mains electricity.

Noise

Potential cumulative impacts between the construction and operation of Project Sunrise and the following projects have been assessed (see Table 8.94):

- MV/HV substation
- gas pipeline
- Araz Valley Economic Zone Industrial Park
- reconstruction and resettlement of villages in Jabrayil district.

The baseline in the AOI is provided in Section 5.2.5. The project area is within a rural, non-developed area with limited noise receptors. The background noise levels are therefore assumed to be typical for rural areas, with the main noise sources expected to be wind, wildlife, and possibly traffic and/or noise from the quarry. It should be noted that the baseline noise levels would not be representative of the completed and operational Horadiz – Fuzuli – Shusha railway, nor the Shukurbayli – Jabrayil – Hadrut highway. However, given the distances between Project Sunrise and the aforementioned railway and highway projects, there is not anticipated to be cumulative impact in respect to operational noise.

The limit of acceptable change for this VEC is determined by compliance with the environmental standards, as per Section 8.1.3:

- Construction Day - 55 dB LAeq,T
- Construction Night - 40 dB LAeq,T
- Operation Day 50 dB LAeq,T
- Operational Night - 40 dB LAeq,T.

Construction

It is understood that the Araz Valley Economic Zone Industrial Park has already been constructed, and as such, the cumulative impacts from construction noise, in respect to this third-party development, has not been assessed.

Construction timeframes for the other developments are not known at the time of writing (both at a macro and a micro level), a worst-case scenario has therefore been assumed that the construction activities are conducted concurrently generating airborne noise emissions.

Cumulative impacts will not occur for vibration (breaking, piling or compaction activities) because the impacts are based on a single event rather than a combination of events. Therefore, the highest levels of possible vibration (measured and assessed in this case as a maximum event Peak Particle Velocity – PPV) will not be cumulative.

The noise associated with the developments are likely to be similar based on assumed construction activities, but these activities would need to occur closer than 2.5 km to each other and occur concurrently to have cumulative noise impacts (i.e., to notice an increase above background levels).

Information regarding mitigation measures for both associated facility and third-party projects is not available at the time of writing. It is assumed that any other permitted developments are expected to follow good industry practice mitigation measures to minimise noise impacts. This would be confirmed through detailed design and updates to noise management plans once construction methodologies are detailed and confirmed (on a micro level).

However, given the distances between the third-party developments, Project Sunrise, and the scarcity of existing noise receptors in the AOI, cumulative impacts in respect to construction noise are expected to be not significant.

Operation

It has been assumed the proposed gas infrastructure will run via underground pipelines. There would be no expected noise emissions associated with the operation of underground gas pipelines. Therefore, cumulative impacts are expected to be not significant.

The specific locations for proposed operational activities, the proposed operational hours, and the specific fixed plant installations associated with the Araz Valley Economic Zone Industrial Park are not yet known.

Operational noise levels from the industrial park have been assessed assuming basic point source propagation from the closest boundary location to the closest identified residential receptor location, approximately 1.3 km in distance. In order to achieve the worst case, night-time operational noise limit of 40 dB LAeq,T at the closest identified residential receptor (R03 – Future Settlement – Soltanli) to the Araz Valley Economic Zone Industrial Park, the free field sound pressure level measured at 1 metre from the industrial park boundary must not exceed 102 dB LAeq,T In reality, it would be expected that noise emissions at the boundary of the industrial park would be much lower than 102 dB LAeq,T, and it would be expected that noise sources would be distributed across the extents of the industrial park, rather than localised at a single point located on the site boundary. Additionally, the calculation method does not consider ground absorption effects, nor does it incorporate any features that would provide screening, or partial screening (such as barriers or buildings), as such this likely an overestimation of noise levels, and this therefore represents a worst-case scenario.

Given the predicted noise levels from the operation of Project Sunrise are below 30 dB LAeq,T at all identified receptor locations. Cumulative noise levels from operations would be expected to remain below 40 dB LAeq,T, and therefore cumulative impacts are expected to be not significant.

Soils

Potential cumulative impacts are predicted between the construction and operation of Project Sunrise and the following project (see Table 8.94):

- MV/HV substation.

The baseline in the AOI is provided in Section 5.2.9. Soil erosion is a prominent issue in in the Jabrayil region where surface and ravine erosion are caused by water, wind and the reduction of forest.

During construction, compaction of soil from construction of the access roads may cause soil particles to be compressed together, which reduces the soil's porosity and increases its bulk density. The indirect impacts of soil compaction are the alteration of drainage characteristics, which may cause surface runoff and localised flooding. Compaction can also have indirect impacts on ecology by restricting root zone growth, thus affecting vegetation re-establishment, agricultural productivity and associated livelihoods.

Preparation of the access road, including removing vegetation, topsoil stripping and benching, will affect soil structure and stability which may increase the risk of erosion, particularly where the soil has poor cohesion or there are steep slopes. The erosion risk is expected to be highest during wet weather, when runnels may develop, and it will be exacerbated by vehicle movements.

Construction activities have the potential to cause soil contamination (fuels, lubricating oils and chemicals, hazardous wastes). Potential indirect impacts from contamination of soil include impacts on the viability of terrestrial flora and fauna.

The construction of Project Sunrise and the associated facility MV/HV substation is likely to exacerbate some of these impacts as they have overlapping AOIs.

To manage its contribution to the cumulative impacts of soil compaction, the project will

- implement a Pollution Prevention Management Plan and Erosion, Sediment Control and Reinstatement Plan which will include procedures to reduce and control compaction. Stockpiled topsoil will be monitored for compaction and

corrective action implemented if required; stockpiled topsoil areas will be free draining and include gaps to allow passage of floodwater
- install ground protection such as bogmats and geotextile fabric to support heavy loads where ground is soft.

To manage the impacts of soil contamination, the project will implement their Emergency Response Plan, Pollution Prevention Plan and Waste Management Plan which will include measures to respond to accidental spills, and measures that contribute to the management of impacts from waste management and accidental substance releases.

With the implementation of these mitigation measures, cumulative impacts are predicted to be not significant. However, liaison between Lightsource bp and AzerEnerji is recommended to ensure good international industry practices and mitigation measures are implemented to prevent impacts on soil.

During operations no further cumulative impacts on soils are predicted.

8.5.2.3 Biological environment

Habitats and species of conservation concern

Potential cumulative impacts are predicted between the construction and operation of Project Sunrise and the following projects (see Table 8.94):

- Araz Valley Economic Zone Industrial Park.

The baseline in the AOI is provided in Section 5.3.

The preferred condition is that the number of species remains stable or increases, relative to the background changes in population levels. The limit of acceptable change is a short-term decrease followed by recovery to pre-construction numbers.

The interaction between Project Sunrise, the operation of the Industrial Park and the reconstruction and resettlement of villages in the district may lead to cumulative impacts for the Araz River which is functionally downstream of both developments.

At the time of writing, it is unclear what type of effluents may be discharged from the Industrial Park, or what environmental standards will be applied for businesses operating therein. It is however expected that such effluents would include typical agricultural and industrial discharges, which may potentially be discharged into the Araz River or its tributaries. No further details of the drainage systems to be installed at the villages was available at the time of writing.

During construction, the only potential discharges to the Araz catchment would be unplanned. In the event of an accidental discharge or loss of containment of any harmful substance or hazardous chemicals, emergency spill response protocols would expectedly come into effect to mitigate and manage the event and clean-up. These are considered to be beyond the scope of cumulative impact assessment as they are, by their nature, not expected to occur and certainly not simultaneously.

Project Sunrise is not expected to have any significant effluent streams discharged to the environment with the exception of stormwater drainage from the developed project site. It is similarly not expected to contribute significantly to the flow of pollutants into surface or groundwater systems and is therefore considered to have minimal impact to the sensitive riparian habitats, even when considered cumulatively with the Araz Valley Economic Zone Industrial Park. The cumulative impact is considered not significant.

8.5.2.4 *Socioeconomic environment*

Economy

Potential cumulative impacts are predicted from the construction and operation of Project Sunrise and the following third party projects (see Table 8.94):

- MV/HV substation
- gas pipeline
- operation of the Araz Valley Economic Zone Industrial Park
- reconstruction and resettlement of villages in Jabrayil district.

The baseline condition is provided in Section 5.4.

The preferred condition is for the standards of living of the impacted individuals and households of the affected communities in the AOI to be equal to, or better than, before construction.

The Government of Azerbaijan has developed a PCCP for the EZER. The aim is to return and resettle populations to Jabrayil City, and other villages in the district that were abandoned during the occupation of the region.

Local businesses, including those residing at the Araz Valley Industrial Park, plus others in the secondary AOI (e.g., service providers and suppliers in the Eastern Zangezur region) will have opportunities to provide goods and services to Project Sunrise and to the other projects. Procurement of goods and services from small, medium, and large enterprises will benefit not only from the businesses themselves (boosting revenues and profit margins) but will also generate an economic multiplier effect across the economy within the districts of Jabrayil, Fuzuli and beyond.

Together with the other large-scale sources of cumulative impact projects, Project Sunrise will contribute to the economic growth of the country.

The following beneficial cumulative impact is anticipated:

Procurement opportunities for provision of goods and services

During operation, businesses in the Araz Valley Industrial Park and in the region more broadly will be able to provide goods and services such as construction materials, provision of accommodation, both in existing guesthouses and in purpose-built temporary accommodation facilities (such as those operated by Kaylon), food, medical supplies and recreational materials to workers. This will enable local businesses to boost their earnings and increase their profit margins during the operation period, causing local economic growth.

Lightsource bp plans to enhance benefits to local communities by working with local businesses and procurement bodies, and will ensure that information about business opportunities are shared.

The following potentially adverse cumulative impacts are anticipated:

Procurement: local inflation

There is likely to be competition across the region for procurement of goods and services from local and national suppliers; Azerbaijani businesses that need to purchase similar goods and services (who may be more sensitive to price changes and have less leveraging ability) could be impacted by this, resulting inflation. This impact may extend beyond construction supplies to food and/or water.

Lightsource bp will manage this by monitoring socioeconomic changes and undertaking prices survey/monitoring.

Community members may also experience dissatisfaction arising from the potential for the project and other developments' refusal of goods and services, for example due to inability to meet any required procurement standards. However, the procurement requirements at other third party projects may be less rigorous than Project Sunrise, because they may not have international funding stipulations, although this is not confirmed at the time of writing.

Lightsource bp will share the price monitoring data they collate with the proponents of the other third party developments to ensure visibility over the situation.

With the mitigation measures in place, from a local economy perspective, the cumulative impact is considered not significant.

Project induced in-migration

Reestablishing communities within Jabrayil and Fuzuli districts, and the Eastern Zangezur region more broadly, is a key aim of the Government of Azerbaijan's PCCP. Migration to the region is expected to be a managed process. Resettlement of Jabrayil City and the villages of Shukurbayli, Horovlu, Sarijanli, Mashanli, Boyuk Marcanli, Karkhulu, Cocuq Marcanli and Mehdili is planned before 2026, as mentioned above. However, if there is unmanaged project induced in-migration (PIIM) (e.g., from greater numbers of people seeking to benefit economically from opportunities provided by the new projects proposed in the district), then this may lead to disruptions to local community businesses with negative economic and social consequences. There is a risk that new arrivals may disrupt emerging businesses and livelihoods by engaging in unauthorised behaviour or competing for share of market. By disrupting the economic activities of local communities, individuals may face challenges in accessing and generating income, leading to a reduced standard of living.

There is a further risk that PIIM of job seekers may lead to further pressure on already strained resources and infrastructure, inflation and price increases, including cost of basic foodstuff and other household necessities.

Strategies and management control measures that should be adopted include:

- proactive early and continuous engagement to manage expectations that may lead to economic in-migration
- stakeholder engagement to discuss potential impacts from in-migration that may lead to impacts on livelihoods.

Unmanaged PIIM may exceed the limit of acceptable change, leading to significant adverse impacts on the local economy.

It is therefore recommended that Lightsource bp, the other third party projects and the Jabrayil district authorities share findings from the monitoring of socioeconomic changes in communities.

It is also recommended that Lightsource bp and other third party projects consider and share measures to reduce potential in-migration including (but not limited to) recruitment and procurement procedures and community engagement activities. The potential for in-migration should further be embedded in monitoring activities to ensure that changes to baseline conditions in communities in the AOI are identified.

Employment and skills development

Potential cumulative impacts are predicted from the construction and operation of Project Sunrise and the following third party projects (see Table 8.94):

- MV/HV substation
- gas pipeline
- operation of the Araz Valley Economic Zone Industrial Park
- reconstruction and resettlement of villages in Jabrayil district.

The baseline condition is provided in Section 5.4.

The preferred condition is for the standards of living of the impacted individuals and households of the affected communities in the AOI to be equal to, or better than, before construction.

Beneficial cumulative impacts may be encountered from Project Sunrise and the other third-party projects, including:

Generation of employment opportunities

The operation of project Sunrise and the other new developments will increase royalties, income tax and corporate tax to develop the local, regional and national economies and thus should aid social development in the area.

As outlined in Section 8.2.2, wherever possible, Project Sunrise will prioritise recruitment of workers from the local area with suitable skills and experience. These employment opportunities may offer training and skills development opportunities, strengthening the knowledge and capabilities of those employed and thereby enhancing their future job prospects on other new developments in the study area. Assuming local people are employed for all of the projects, the cumulative impact is considered beneficial.

Increased incomes of local workers may also lead to increased community spending, benefitting local enterprises. Income from employment presents opportunities for households to improve living standards within the household.

The following potential adverse cumulative impacts have been considered:

Unmet expectations of employment

- Although the repatriation of displaced communities has not yet taken place, it is expected that repatriated people will have high expectations for employment from future development projects in the area. These projects will require both skilled and unskilled labour, in particular during the construction phase. There may be a cumulative impact from unmet employment expectations across all of the projects if locals are not hired. Additionally, good hiring practices at one company, if not replicated or similar to the other companies, may lead to negative feelings/opinions and dissatisfaction of Project Sunrise and the other proposed developments.

Furthermore, in relation to employment, there is an increased risk of unfair access to employment opportunities. Vulnerable or marginalised groups may be overlooked during the recruitment process, leading to dissatisfaction, tension and conflict, and further inequalities within and among communities.

Strategies and management control measures that will be adopted by Lightsource bp include:

- Labour Management Plan – these will include measures to ensure employment opportunities prioritise local workers where appropriate and practicable
- management and recruitment of Azerbaijani Nationals shall ensure measures to promote non-discrimination and equal opportunities and ensure clear, transparent and fair recruitment procedures that prioritise local workers within the AOI
- implementation of a local supplier qualification process.

These measures will reduce Project Sunrise's contribution to the cumulative impact. Due to lack of publicly available information at the time of writing, it is unknown whether the other third party projects will have similar plans. Lightsource bp should use best efforts to encourage fair recruitment procedures across the developments with support from the Jabrayil district authorities.

Demobilisation and the termination of employment contracts

Retrenchment following construction activities from Project Sunrise may result in economic decline in the AOI as most workers will be on temporary fixed-term contracts. If other third-party project workers are also on fixed-term contracts there could be a cumulative impact on loss of employment, leading to a loss of income, economic decline and a rise in unemployment figures in the AOI.

To reduce their contribution to the cumulative impact, Lightsource bp will require contractors to develop a Local Recruitment Plan, to incorporate the management of demobilisation which shall include risk mitigation associated with end of employment and planning to facilitate re-deployment. Due to lack of publicly available information, at the time of writing it is unknown whether the other third party projects have similar plans in place. However, the incremental impact from Project Sunrise and the third party projects means that this is a potentially significant cumulative impact.

It is therefore recommended that:

- Lightsource bp and third-party project proponents collaborate and share information regarding worker skill sets which could see a transfer of workers between projects once temporary fixed-term contracts end.
- Lightsource bp and third party projects should encourage the Jabrayil district authorities, where possible, to be transparent about the temporary nature of workers' employment during construction and to regularly remind workers of this fact.

Labour and working conditions

Potential cumulative impacts are predicted from the construction and operation of Project Sunrise and the following third party projects (see Table 8.94):

- MV/HV substation
- gas pipeline
- operation of the Araz Valley Economic Zone Industrial Park
- reconstruction and resettlement of villages in Jabrayil district.

The baseline condition is provided in Section 5.4.

The preferred condition is for working conditions to be equal to, or better than, before construction. The limit of acceptable change is no violation of human rights.

The following potential cumulative impacts have been considered:

Violation of labour rights by contractors and subcontractors

There is potential for the violation of both national labour legislation and international labour standards, with particular risk associated with sub-contractors used by the third party project developers and contractor(s) who may implement different standards to those of Lightsource bp. This includes aspects such as working hours, pay and conditions, freedom from forced labour, freedom of association, child labour, equal treatment in the workplace and health and safety. Workplace injuries occur, especially amongst labourers.

Local and/or smaller enterprises are more likely to have limited international experience and human resource management capacity which may heighten the risk of such violations. Unskilled workers are the most at risk, given the historic conditions for unskilled workers and because they have less ability to advocate for improved conditions. This may impact workers' human right to just and favourable conditions at work and is therefore considered to be significant.

Lightsource bp will therefore encourage the proponents of the third party projects and the Jabrayil district authorities to develop and implement workers' codes of conduct and training for security personnel which includes rules of engagement and human rights (e.g., the Voluntary Principles of Security and Human Rights).

Infrastructure and services

Potential cumulative impacts are predicted from the construction and operation of Project Sunrise and the following third party projects (see Table 8.94):

- MV/HV substation
- gas pipeline
- operation of the Araz Valley Economic Zone Industrial Park
- reconstruction and resettlement of villages in Jabrayil district.

The baseline condition is provided in Section 5.4.

The preferred condition is defined as return to, or near the original condition of, infrastructure and services before construction

The infrastructure-related projects will help to fulfil the Government of Azerbaijan's plans to transform the region into a SMART zone and ultimately contribute to the economic development in the AOI.

Beneficial cumulative impacts from Project Sunrise and the other third-party projects may include:

Improved access to energy

In addition to Project Sunrise, which will generate and transmit additional clean energy to the national grid system, the gas pipeline will further improve access to power, which will benefit households and may have indirect beneficial effects on public services (e.g., schools and healthcare facilities).

Road improvements

Other developments including the near completed highway and railway projects will have a beneficial impact on local communities. Improved connectivity will enable greater exchange of goods and services. Improvements in road conditions for road users (e.g., business owners, public transport providers) may lead to reduced journey times and travel costs.

The following potential adverse cumulative impact is considered:

Waste management

Construction activities in particular from Project Sunrise and other projects may lead to increased pressure on regional waste management facilities and the resulting need to dispose of increased quantities of waste. Rapid population growth and increasing urbanisation as part of the PCCP may result in increased waste generation and further increase the pressure. Inadequate waste management practices may lead to adverse health and environmental impacts within new communities; this could also impact the right to health and the right to a clean environment, and is potentially significant.

Lightsource bp should liaise with the Jabrayil district authorities to encourage the development and implementation of a district-wide waste management strategy to ensure all projects appropriately manage and dispose of construction and operational waste.

This is beyond Lightsource bp's control and remit and should be driven and implemented by local authorities. However, the potential for this could be explored with the relevant stakeholders as part of ongoing stakeholder engagement.

Safety and security

Potential cumulative impacts are predicted from the construction and operation of Project Sunrise and the following third party projects (see Table 8.94):

- MV/HV substation
- gas pipeline
- operation of the Araz Valley Economic Zone Industrial Park
- reconstruction and resettlement of villages in Jabrayil district.

The baseline condition is provided in Section 5.4.

The preferred condition is no increase in social ills and traffic accidents caused from the combined effects of the project and other developments.

Security risks

During the construction period of Project Sunrise and the other projects, new community members may approach work sites in search of employment or for other reasons. This may lead to negative interactions with security personnel responsible for protecting work sites and implementing safety measures. The use of inexperienced or inadequately trained security personnel may lead to conflict and potentially the inappropriate use of force. This may lead to the violation of the right to personal security and safety.

Unmanaged and cumulatively increased levels of PIIM associated with the projects pose a range of impacts, including the following.

- An influx of male workers and other migrants may “compete” over local women and girls, with negative implications for local and community dynamics and an increased risk of gender based violence (GBV) towards women and girls.
- An increase in crime and theft as prospective job-seekers who are unsuccessful at gaining employment with third party projects may turn to crime to make ends meet. This is also a risk when workers’ contracts end.

Project Sunrise will restrict access to construction camps to reduce interaction between workers and the environment, consider PIIM prevention and management, undertake ongoing stakeholder engagement and implement a Grievance Management Procedure. At the time of writing, it is not known what management measures the other developments will implement.

It is difficult to assess the significance of this impact at this stage, but Lightsource bp should monitor the situation in the district.

Road traffic accidents and other incidents

An increase in the volume of traffic on the local road network during the construction of Project Sunrise and the other projects listed above may lead to an increase in the risk of road traffic accidents (RTAs). Though the precise location of new settlements and communities is not yet known, it is expected that towns will be established along the road and rail network. RTAs are relatively common in Azerbaijan; poor road conditions in some areas and lack of adherence to traffic speed restrictions and other rules are cited as contributing factors.

There is also an increased risk of accidents involving community members at work sites leading to injury and potential mortality. Inadequate control of access to work sites may result in the community gaining entry and sustaining injuries from interactions with construction equipment and materials or by slips, trips and falls.

Strategies and management control measures that will be adopted by Lightsource bp include:

- development and implementation of traffic management plans
- access to construction camps will be restricted

The potential increase in the number of RTAs and accidents at work sites may lead to impacts on the right to security and the right to life. The risk of RTAs may be reduced by good road conditions on new highway development projects and the impact is therefore considered to be significant.

Lightsource bp should engage with Jabrayil district authorities to encourage the development of a district wide Traffic Management Plan. This could identify sensitive receptors along key transportation routes and outline mitigation measures (e.g., speed limit restrictions, vehicle maintenance activities, awareness campaigns, recruitment of traffic wardens) to reduce the risk of road traffic accidents occurring. This is outside of Lightsource bp’s direct control and need to be exercised by the government authorities. However, the potential to progress these measures could be further explored with the relevant stakeholders.

Tangible and intangible cultural heritage

Potential cumulative impacts are predicted between the construction of Project Sunrise and the following projects (see Table 8.94):

- MV/HV substation.

The baseline condition is provided in Section 5.4.4.

Tangible cultural heritage

The preferred condition is the TCH is preserved in situ. The limit of acceptable change, if the site or structure is to be impacted, is for it to be preserved for research purposes by appropriate professional excavation.

There is the potential for cumulative impacts of damage, disturbance or disruption of access of known and unknown TCH.

Project Sunrise have committed to a watching brief on all groundworks construction activities with analysis and appropriate reporting of the results.

Based on the limit of acceptable change and assuming similar mitigation is imposed on substation as an associated facility, the cumulative impact should not be significant.

Intangible cultural heritage

The preferred condition for ICH is for the use and appreciation of the ICH to be maintained. The limit of acceptable change in the event that the ICH is altered, with the agreement of stakeholders, is that an alternative will be developed.

It is difficult to judge the value of the ICH as the local population have been dispersed from the area for many years and are mostly still to be relocated to the area. The visible features of the landscape have also been altered in the intervening period, so will be difficult for the returned population to pick up past practices.

The project will use its influence over the design of substation as an associated facility to ensure that any intangible cultural heritage is identified and mitigated in line with international standards.

8.5.3 Cumulative Impact Assessment Summary

The cumulative impacts identified in this assessment are summarised in Table 9.4 which also lists actions for Lightsource bp to mitigate cumulative impacts either by management and/or monitoring, and collaborative mitigations where Lightsource bp will engage and liaise with other proponents (or the Azerbaijani authorities) to further understand, assess or manage potential cumulative impacts or improve overall management of cumulative impacts to the general benefit of both or all parties.

In some cases the proposed measures are beyond Lightsource bp's control and remit and should be driven and implemented by local authorities. However, the potential for this could be explored with the relevant stakeholders as part of ongoing stakeholder engagement.

Lightsource bp will use commercially practicable efforts to engage relevant government authorities, other developers and other relevant stakeholders, in the implementation of coordinated mitigation measures to manage the potential cumulative impacts. This will be undertaken in accordance with Lightsource bp's Stakeholder Engagement Plan.

Table 8.95: Summary of CIA findings and management/mitigation measures

VEC	Cumulative impact	Management / mitigation measures
Soil	During construction, compaction of soil and removal of vegetation, topsoil stripping and benching may affect soil structure and stability.	Liaison between Lightsource bp and AzerEnerji to ensure good international industry practices are implemented to prevent impacts on soil.
Economy	Increase in procurement from the combined projects leading to local inflation	Lightsource bp will share the price monitoring data they collate with the proponents of the other third party developments to ensure visibility over the situation.
	Unmanaged PIIM may lead to disruptions to local community businesses with negative economic and social consequences	Lightsource bp, the other third party projects and the Jabrayil district authorities will share findings from the monitoring of socioeconomic changes in communities. Lightsource bp and other third party projects will consider and share measures to reduce potential in-migration including (but not limited to) recruitment and procurement procedures and community engagement activities. The potential for in-migration should further be embedded in monitoring activities to ensure that changes to baseline conditions in communities in the AOI are identified.
	Unmet expectations of employment	Lightsource bp should use best efforts to encourage fair recruitment procedures (transparent, public and open) across the developments with support from the Jabrayil district authorities.

VEC	Cumulative impact	Management / mitigation measures
	Retrenchment following construction activities from the projects may result in economic decline in the AOI	Lightsource bp and third-party project proponents will collaborate and share information regarding worker skill sets which could see a transfer of workers between projects once temporary fixed-term contracts end. Lightsource bp and third party projects should encourage the Jabrayil district authorities, where possible, to be transparent about the temporary nature of workers' employment during construction and to regularly remind workers of this fact.
Labour and working conditions	Violation of labour standards, with particular risk associated with sub-contractors used by the third party project developers and contractor(s) who may implement different standards to those of Lightsource bp.	Lightsource bp will encourage the proponents of the third party projects and the Jabrayil district authorities to develop and implement workers' codes of conduct and training for security personnel which includes rules of engagement and human rights (e.g., the Voluntary Principles of Security and Human Rights).
Infrastructure and services	Construction activities may lead to increased pressure on regional waste management facilities	Lightsource bp should liaise with the Jabrayil district authorities to encourage the development and implementation of a district-wide waste management strategy to ensure all projects appropriately manage and dispose of construction and operational waste.
Safety and security	An increase in the volume of traffic on the local road network during the construction of Project Sunrise and the other projects may lead to an increase in the risk of road traffic accidents (RTAs).	Lightsource bp should engage with Jabrayil district authorities to encourage the development of a district wide Traffic Management Plan. This could identify sensitive receptors along key transportation routes and outline mitigation measures (e.g., speed limit restrictions, vehicle maintenance activities, awareness campaigns, recruitment of traffic wardens) to reduce the risk of road traffic accidents occurring.

9 PHYSICAL CLIMATE CHANGE RISK ASSESSMENT

As stated in the fourth iteration of the EP4, a Climate Change Risk Assessment (CCRA) is required for:

> "Category A and, as appropriate, Category B projects. For these projects, the CCRA is to include consideration of relevant climate-related 'physical risks' as defined by the Task Force on Climate-Related Financial Disclosure (TCFD)."

This section presents a high-level analysis related to the physical risks of climate change as defined by the TCFD. This includes acute (event-driven) risks, as well as chronic risks (those due to longer-term shifts in climate patterns).

9.1 CCRA Approach

In line with guidance from EP4, the CCRA considers all climate-related risks over the expected economic lifespan of the project, which is approximately 35 years. Consequently, this CCRA considers climate-related risks up to 2058.

9.1.1 Methodology

The CCRA takes a four-step approach. First, climate hazards for the present day are identified and categorised. Second, using the latest data including climate projections up to 2058, the trajectory of climate hazards is identified. Third, using climate projections, climate hazards are recategorised based on likely future change by 2058. Fourth, the potential impacts of climate change on the project are identified, along with potential risk mitigation measures. A high-level impact assessment is presented in tabular form (see Table 9.4).

The methodology is described in greater detail in the following subsections.

9.1.1.1 Stage one: Present day climate hazards

The CCRA uses the World Bank Global Facility for Disaster Reduction and Recovery (GFDRR) hazard screening tool 'ThinkHazard!' to identify and categorise current climate hazards in the project (Douglas et al, 2017). ThinkHazard! Covers a total of eight direct climate-related hazards. ThinkHazard! uses frequency and severity data to determine how frequently a project location may sustain damage from a hazard. Hazards are categorised into four levels as described in Table 9.1.

Table 9.1: ThinkHazard! hazard ratings and description

Rating	Qualitive description
High	Users should be highly aware of potentially severe damage from this hazard for the project location. Without taking measures to mitigate the hazard and risk, high levels of damage can be expected to occur within the project or human lifetime (and potentially frequently in that timeframe, for hydro-meteorological hazards, e.g., floods, extreme heat).
Medium	Users should be aware of potentially damaging effects of this hazard for the project location. Potentially damaging events can be expected to occur within the project or human lifetime and measures to mitigate the hazard and risk should be considered. For hydro-meteorological hazards, damaging effects could occur frequently in that timeframe.
Low	Potentially damaging events are less likely to occur within the project or human lifetime but are still possible. Measures to mitigate the hazard and risk would be prudent at critical locations. Hazard has been classified based on long-term averages, and there is still potential that damaging events could occur in this timeframe.
Very low	Available data suggest that potentially damaging effects are unlikely to occur, on average, in the project or human lifetime. Hazard has been classified based on long-term averages, and there is still potential that damaging events could occur in this timeframe.

Source: Douglas et al (2017)

9.1.1.2 Stage two: Climate projections

The Intergovernmental Panel on Climate Change Sixth Assessment Report (IPCC, AR6) on the physical science basis of climate change uses Representative Concentration Pathways coupled with Shared Socioeconomic Pathways (SSP-RCPs) to develop robust storylines for future emissions.

Pathways qualitatively describe alternative socioeconomic developments that will affect mitigation goals by considering factors such as policy, technological developments, population growth, land use and GDP. The SSPs are coupled with RCPs, which provide time-dependent projections of atmospheric GHG concentration. In total, five SSP-RCPs are available for use in climate risk assessments, as shown in Table 9.2. Using the SSP-RCPs, the IPCC presents climate projections for the near term (2021–2040), mid-term (2041–2060) and long term (2081–2100) relative to 1850–1900.

Where possible, the CCRA presents scientific evidence of climate projections in line with a low (SSP1-2.6) and high emissions (SSP5-8.5) scenario. The nominal life of the PV power facility is at least 35 years (i.e., until 2058). Consequently, where possible this report presents scenarios for the medium-term only (2041-2060).

Table 9.2: IPCC's SSP-RCP Scenarios

Scenario	Description
SSP1-1.9	Most optimistic: 1.4˚C by 2100 – In this scenario, global CO_2 emissions reach net zero by 2050. There is a social shift from economic growth to human well-being with investment in education and health. This first scenario is the only one that meets the United Nations Framework Convention on Climate Change's (UNFCCC's) Paris Agreement's (2015) higher ambition to limit global average temperature to 1.5˚C[30]. The best estimate for global temperature rise in the mid-term (2021-2040) is 1.6˚C.
SSP1-2.6	Next best/low emissions: 1.8˚C by 2100 – this scenario follows a similar pathway as SSSP1-1.9, but emissions reach net-zero after 2050. There is an emphasis on sustainable development. Temperatures will rise by 1.8˚C by the end of the century. The best estimate for temperature rise in the mid-term (2021-2040) is 1.7˚C.
SSP2-4.5	Middle of the road: 2.7˚C by 2100 – global emissions only reach net-zero by 2100. There is slow progress toward increasing human wellbeing and decreasing inequality. Temperatures rise by 2.7˚C by 2100. The best estimate for temperature rise in the mid-term (2021-2040) is 2˚C.
SSP3-7.0:	Medium/High emissions: 3.6˚C by 2100 - CO_2 emissions roughly double from current levels by 2100. Economic development is slowed down by regional conflicts and nationalism. Average temperatures will increase by 3.6˚C. The best estimate for temperature rise in the mid-term (2021-2040) is 2.1˚C.
SSP5-8.5:	High emissions: 4.4˚C by 2100: Current CO_2 emissions levels roughly double by 2050. There is rapid economic growth, but this is achieved through the unabated use of fossil fuels. By 2100, the average global temperature is 4.4˚C higher than today. The best estimate for temperature rise in mid-term (2021-2040) is 2.4˚C.

Source: IPCC (2021)

9.1.1.3 Stage three: Climate hazard levels at the end of the project

Using the climate projections detailed in stage two, hazards ratings are revisited and revised based on how they are expected to manifest in 2058. Each climate hazard is given a new qualitative rating based on the potential for the frequency and severity of a hazard to cause damage to project components by 2058.

9.1.1.4 Stage four: Impact assessment and mitigation measures

Key impacts to the project that result from future climate hazards are identified. Impacts across all project components are considered and potential risk mitigation measures (or adaptations) suggested. The CCRA uses the following definitions that are consistent with IPCC terminology[31]:

[30] Note that Article 2 of the Paris Agreement recognises the principle of "common but differentiated responsibilities". The reference to 1.5˚C is thus included within the Agreement, not as a legal requirement, but rather as a mechanism for enhancing global ambition where respective capabilities allow.

[31] https://apps.ipcc.ch/glossary/

- **Impacts** generally refer to effects on lives; livelihoods; health and well-being; ecosystems and species; economic, social and cultural assets; services (including ecosystem services); and infrastructure. Impacts may be referred to as consequences or outcomes and can be adverse or beneficial.
- **Risk** is the potential for adverse consequences for human or ecological systems. In the context of climate change, risks can arise from potential impacts of climate change as well as human responses to climate change. Relevant adverse consequences include those on lives, livelihoods, health and wellbeing, economic, social and cultural assets and investments, infrastructure, services (including ecosystem services), ecosystems and species.
- **Risk mitigation (adaptation),** in human systems, is the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities.

9.1.2 Limitations and Uncertainty

There are inherent limitations and uncertainty within the CCRA process.

- Major limitations on the availability of data on the physical parameters of climate-related hazards in Azerbaijan. Data availability is poor for the region. Knowledge of past rainfall and temperature in Azerbaijan is constrained by sparse weather stations and data gaps.
- There are substantial uncertainties about future climate change in Azerbaijan. The main uncertainties come from the fact that previous studies are based on GCMs climate simulations which have coarse spatial resolutions to reproduce regional or local climate patterns.
- The SSP-RCPs were developed for IPCC AR6, which was released in 2021. Consequently, climate research is yet to incorporate this new approach into research design. Where projections that are in line with the SSP-RCPs are not available, projections in line with the RCPs are used.
- As with all CCRAs, there is a degree of professional judgement involved in the assessment process.

9.2 Present Day Climate Hazard Analysis

Using the ThinkHazard! tool, a preliminary hazard screening exercise identified three climate hazards to be included in the CCRA (Table 9.3). Hazards were included if they were deemed to be ‘medium’ or ‘high’ risk. Hazards in this CCRA include extreme heat events, river flooding, and wildfire. Water scarcity is excluded from the CCRA as this hazard is categorised as low risk. Urban flood is excluded as the project is not near an urban location. Coastal floods and cyclones are excluded as the project is not located near a coastline or in an area where cyclones occur.

Table 9.3: Current hazards in Jabrayil

Extreme heat events	Water scarcity	River flooding	Urban flood	Wildfire	Landslide	Coastal flood	Cyclone
Medium	Low	High	High	High	Medium	N/A	N/A

Source: GFDRR (2023)

Additionally, a change in solar irradiance (the power received from the sun) is identified as a potential hazard. Although a change to solar irradiance will not have a physical impact on project infrastructure, it is possible that it will have a material impact on the project if energy output is affected.

9.3 Climate Projections and Future Climate Hazard Analysis

The following sections use the latest scientific data on climate change in Azerbaijan from the World Bank Climate Change Knowledge Portal (2022) and the IPCC AR6 (2022) to provide a high-level summary of the potential trajectory of hazards over the project lifetime.

9.3.1 Temperature and Extreme Heat Events

Mean average temperatures across Azerbaijan have risen by 1.3˚C (in 2010) relative to average annual temperatures observed in the period 1961–1990 (Fourth National Communication, 2021). Data from the 6^{th} generation of the Coupled Model Intercomparison Project (CMIP6) shows that under all future emissions scenarios yearly maximum temperatures will continue to rise (Figure 9.1). Projected temperature increases are above global average increases, especially for the higher emissions scenarios. Temperatures for Garabagh are projected to rise by approximately 1.74˚C in the medium term under the SSP2-4.5 emissions pathway, and by 2.51˚C in the medium term under the SSP5-8.5 emissions pathway, from the 1995-2014 reference period.

Alongside a rise in temperature, an increase in the frequency of extreme temperature events (days where temperatures are over 35˚C) is also expected (Figure 9.2). By 2058, under the SSP2-4.5 number of hot days (over 35˚C) will rise to 28.23 days per year (at the 50^{th} percentile; 10-90 percentile range: 17.27 to 39.88 days). Under SSP5-8.5 this could be as high as 35.39 days per year (at the 50^{th} percentile; 10-90 percentile range: 21.79 days to 46.22 days).

As outlined in Table 9.3, the current hazard rating for extreme heat in the region is **medium**. Using the ThinkHazard! methodology, the potential for heat hazards in the project area is likely to remain **medium.**

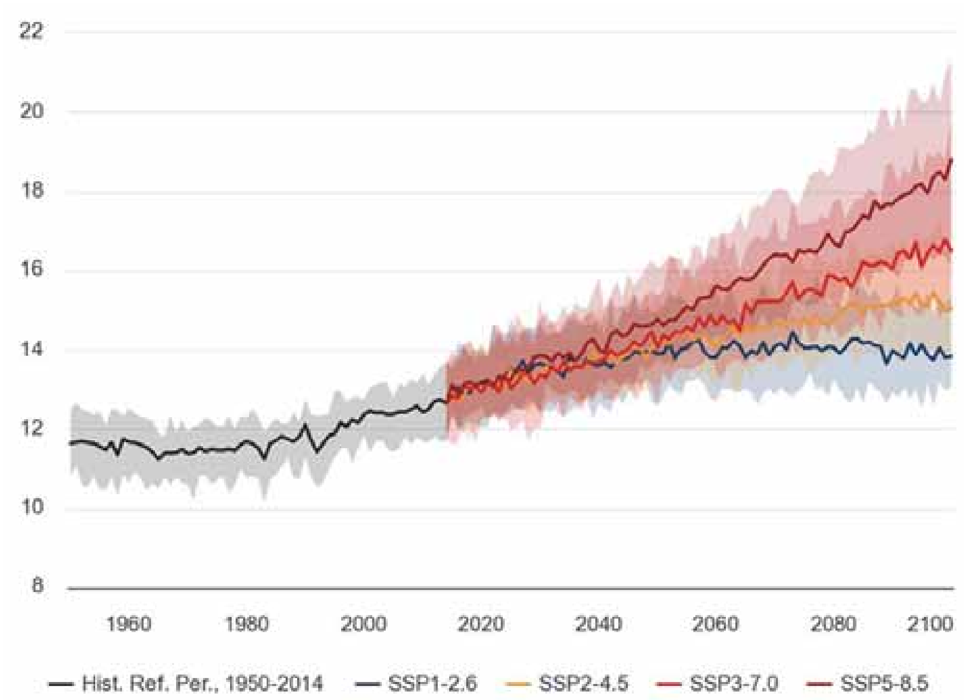


Figure 9.1: Projected average mean surface air temperature, Azerbaijan; Ref. Period: 1995-2014), Multi-Model Ensemble

Source: World Bank (2023)

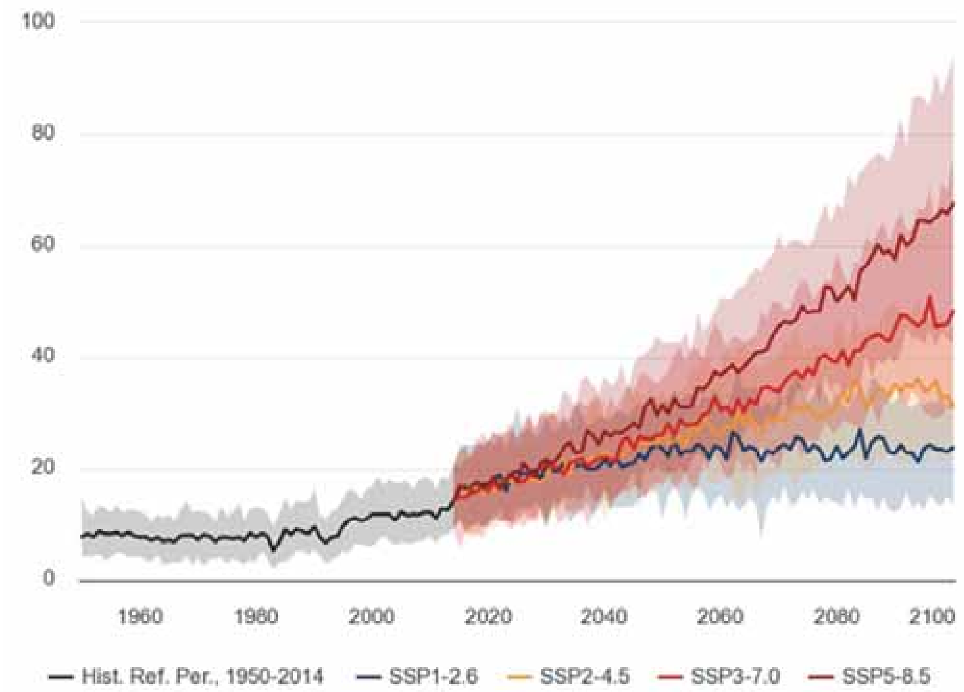


Figure 9.2: Projected number of hot days (Tmax>35°C), Azerbaijan; Ref. Period: 1995-2014), Multi-Model Ensemble

Source: World Bank (2023)

9.3.2 River Flooding

The project hydrological and hydraulic study (CE Renewables, 2023) states that the project is in an area of flood risk.

Flood risk is affected by precipitation. Garabagh has experienced a 9.62 mm decline in precipitation per decade between 1971-2020 (World Bank, 2023). However, under both a high (RCP 8.5) and medium (RCP4.5) emissions scenarios, extreme 24-hour duration precipitation events of all return periods are projected to increase across the country by the 2050s (CAREC, 2022). This may lead to an increase in river flooding. However, future river flooding is subject to substantial modelling uncertainty, largely due to the uncertainty of future projections of precipitation amounts and their spatial distribution, both of which affect flood occurrence. Additionally, a lack of station data over the region leads to large uncertainty in the estimation of observed rainfall trends and low confidence.

As outlined in Table 9.3, the current river flood hazard rating for the region is **high**. Using the ThinkHazard! methodology, the potential for river flood risk in the project area is likely to remain **high** although there is high level of uncertainty in this.

9.3.3 Landslide

Intense rainfall events, combined with faster snowmelt from warmer temperatures could increase landslide risk in more mountainous regions. Multiple non-climatic factors, including local geological conditions determine the likelihood and frequency of a landslide. Climate models do not make projections of landslides. The risk of a landslide can, to some extent, be inferred from historic and projected data on rainfall and temperature. Consequently, there may be an increased risk of landslides in the project area but there is limited data on the likelihood of increase.

As outlined in Table 9.3, the current hazard rating for landslides in the region is **medium**. Using the ThinkHazard! methodology, the potential for landslide in the project area is likely to remain **medium** although there is a high level of uncertainty in this.

9.3.4 Wildfire

Wildfire in Azerbaijan is common. However, future trends are difficult to predict because anthropogenic factors are a key driver of fire risk. In Azerbaijan, anthropogenic causes of wildfire include burning grass after the grain harvest and accidental causes (ThinkHazard!, 2023). It is generally accepted that climate change is likely to play a greater role in determining wildfire regimes alongside human activity (medium confidence) (IPCC, AR6, 2022). It is likely that the frequency of fire weather (i.e., high temperature and greater variance in rainfall) will increase. Where there are a greater number of days with weather that could support fire spread it is likely the fire season will increase in duration and severity (Son, 2021). No clear projections of wildfire frequency or intensity exist for Azerbaijan.

As outlined in Table 9.3, the current wildfire hazard rating for the region is **high**. Using the ThinkHazard! methodology, the potential for wildfire hazards in the project area is likely to remain **high**.

9.3.5 Changes to Solar Irradiance

Changes to solar irradiance affect the efficiency of solar PV. A reduction in solar irradiation and an increase in cloudiness poses a potential threat. Conversely, an increase in solar irradiation may lead to higher output. Under the RPC8.5 scenario, energy yields of PV systems show statistically significant increases for Europe, the southeast of North America and the southeast of China (Wild et al, 2015). Calculations by Crook et al (2011) show that PV output may increase by 2% for Azerbaijan.

There is no data available to give a hazard rating for changes to solar irradiance in the present day. Using available studies (e.g., Wild et al, 2015, Crook et al, 2011) the potential for loss of solar irradiance in the project area is **very low.**

9.4 Impacts, Risks and Mitigation Measures

This section presents the key impacts to the project that result from the climate hazards identified in Section 9.2. Impacts across all project components are considered in Table 9.4.

The CCRA impacts, risks and mitigation measures includes the following components:

- project site
- logistics, supply chain and product transport
- workforce and staff accommodation
- local community.

Table 9.4: Potential impacts and risk mitigation measures

Climate hazard	Potential impact on Project	Material risk to Project	Risk mitigation (adaptation) measures
Temperature increase and increase in days over 35˚C	Reduced efficiency/damage to the local electricity grid leading to temporary disruption of the exchange of electricity with the national grid. Reduced output efficiency of solar panels and power output due to hot temperatures (over 35˚C). Efficiency drops by approx. 0.8% for every 10 °C increase in temperature above 25˚C[32]. Increased ground temperatures lower capacity of underground conductors. Reduction in work force efficiency on very hot days. Increase in heat related illness (e.g., cramps, heat syncope, heat exhaustion, heat injury and heat stroke) and associated time off. Increased need for potable water on extremely hot days for workforce during construction and operations.	Reduction in maximum possible power output with associated cost implication. Changes to depreciation rates and premature asset write-off. More frequent/intense asset maintenance programmes that may lead to greater operating costs. Additional unplanned capital investment. Increased expenditure to replace damaged assets.	**Site infrastructure** Use insurance mechanisms to cover risk from delays to production(e.g., delay in start up (DSU) insurance). Review of maintenance regimes to include extreme temperatures. Technical modification to facilities to allow operation during warmer average temperatures. Update relevant policies, procedure, guideline, critical risk control standard. **Workforce** Reassess plans to manage workforce on extremely hot days. Consider additional potable water supply.
River flooding	Halt in construction and operations during extreme events.	Costs associated with delay to construction.	**Project site** Use insurance mechanisms to cover risk from delays.

[32] https://www.sciencedirect.com/science/article/pii/S0927024812000931

Climate hazard	Potential impact on Project	Material risk to Project	Risk mitigation (adaptation) measures
Landslides Wildfire	Physical damage to project infrastructure. Restricted access to site during events. Disruption to supply chain and access of goods and labour to site.	Increase in transportation costs. Delays in receiving essential supplies. Reduction in maximum possible power output with associated cost implication. Changes to depreciation rates and premature asset write-off. More frequent/intense asset maintenance programmes that may lead to greater operating costs. Additional unplanned capital investment. Increased expenditure to replace damaged assets. Increased insurance premiums and potential for reduced availability of insurance on assets in “high-risk” locations. Increased capital costs for remedial work following damage to asset.	Review of emergency management plans to cover extreme events. Climate proofing of existing assets through technical upgrades and remedial works. **Logistics and supply chain** Maintain strong relationships with multiple suppliers to secure priority services at pre-determined prices. Provide additional storage capacity for products and raw materials in case of disruption to supply. Identify multiple transport routes. Repair, maintain and upgrade company transport infrastructure. Engage with government and transport providers to ensure infrastructure is resilient under a changing climate. Consider investment in private transport links for vulnerable routes or locations. **Workforce** Consider measures to ensure key personnel are onsite before potential travel disruptions due to extreme events.

9.5 Summary

It is important to recognise that solar technology already operates in extreme conditions and at the boundaries of engineering capability. Many of the future risks identified in this report may already have been accounted for in the project design.

By the end of the life of the PV power facility, climate hazards are unlikely to have manifested in a way that presents a high-risk to Project Sunrise. Nevertheless, special attention should be paid to the evolving science especially on projections of river floods and wildfire. It will be important to continue to assess climate risk throughout the lifetime of the project.

As with all companies operating in extreme environments, the physical impacts of climate change should be included on the corporate risk register. Additionally, the implications of climate change could be assessed across the business model. Companies should disclose the assessment results to existing and potential investors and to wider stakeholder groups.

10 ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK

10.1 Introduction

This section describes how the mitigation measures and associated management plans identified in this ESIA will be implemented and monitored through the development of an ESMS that includes a suite of management plans, the ESMP.

The project has made every effort, informed by technical experience and industry knowledge, to evaluate all potential impacts and identify appropriate mitigation measures which will be incorporated into relevant management plans. Should unforeseen impacts arise during the implementation of the project, the project will undertake the necessary assessments, develop adequate mitigation measures and inform MENR as required.

10.2 Management and Monitoring Approach

In accordance with the Law of the Republic of Azerbaijan on Environmental Impact Assessment, June 12, 2018, and IFC PS 1, an environmental and social management framework has been developed. Lightsource bp's approach to environmental and social management applies the 'plan, do, check, act' continuous improvement principles of ISO 14001: Environmental Management Systems (2015), an international environmental management system standard (see Figure 10.1). How these principles are applied to the project is further described in Section 10.4. The project will also comply with ISO 45001: Health and Safety Management Systems.

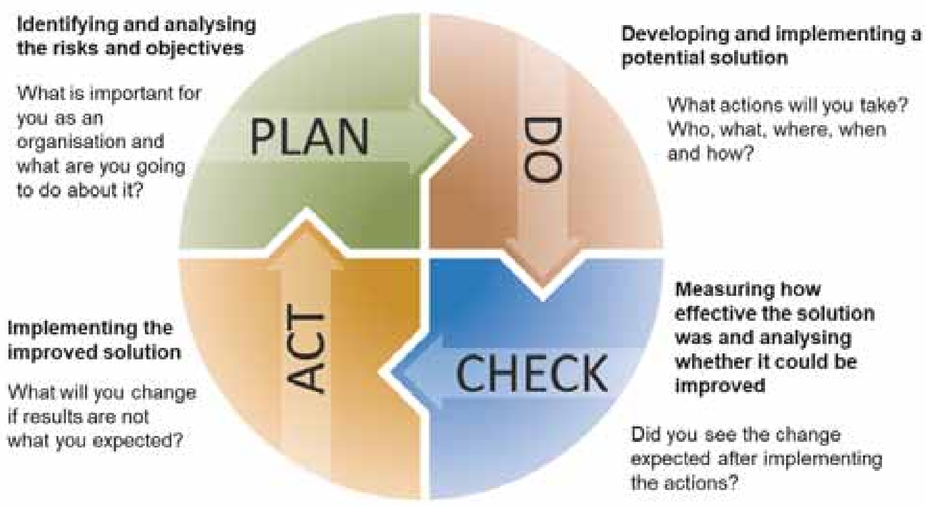


Figure 10.1: Plan-do-check-act continuous improvement principles

Source: IFC (2014)

Environmental and social impacts are managed throughout the full project life cycle through to decommissioning and closure and the entire value chain through the implementation of an ESMS, which includes the project ESMP documents and other supporting documents.

A suite of ESMP documents will be prepared prior to construction and will include management and monitoring requirements for both the construction and operational phases of the Project.

Minimum requirements for ESMP documents are included in Section 10.6 and comprise a set of topic-specific plan frameworks (e.g., waste management, pollution prevention, social management) that address the environmental and social commitments made in the ESIA as detailed in the project environmental and social commitments register (‘commitments register’) (included as Appendix 5). The final ESMP documents will be the definitive compilation of all commitments made in this ESIA and will be used to coordinate and review the environmental and social performance of the project. For each commitment made within this ESIA, the commitments register lists the responsible parties for implementation and verification, performance indicators and monitoring requirements.

Commitments detailed in the ESMP are provisional. They will be finalised following approval of the ESIA by MENR, taking into account any issues raised during the ESIA disclosure process and during contractual arrangements between Lightsource bp and the EPC contractor and O&M contractor.

10.2.1 Contractor Management

Lightsource bp manage the compliance of the EPC and O&M contractors with the ESMP through contractual clauses (within the EPC and O&M contractors’ contracts). These clauses ensure that the contractors develop and comply with the environmental and social commitments specified in the ESMP, and stipulate that the Contractor(s) allocate qualified staff and equipment to carry out the Project.

10.3 Roles and Responsibilities

Table 10.1 outlines the key roles and responsibilities of parties implementing the ESMS.

Table 10.1: Key roles and responsibilities

Role	Responsibilities
Project Owner: bp	• Maintaining permit conditions.
Project Developer: Lightsource bp	• Approval and implementation of the project environmental and social (E&S) policies, principles, and objectives. • Ensuring that an ESMS is established and maintained and providing overall direction, support, and resources for the implementation during construction and commissioning. • Ensuring the suitability of contractors (EPC/O&M and specialist contractors) work according to the E&S requirements of the project and informing them of their related duties. • Ensuring that employees are aware of and understand their E&S responsibilities and encourage proactive involvement in implementing the ESMS.

Role	Responsibilities
EPC Contractor O&M Contractor	• Comply with the relevant E&S requirements detailed in the project ESMS including the submission of plans and procedures under EPC/O&M responsibility that meet, as a minimum, project E&S standards. • Provide site personnel induction training, including communication of project E&S requirements prior to commencing on-site activities, and specific E&S training to personnel who have jobs with significant E&S risks. • Communicate relevant E&S requirements to subcontractors and specialist contractors and oversee their scope of work. • Implement self-verification processes and cooperate with and participate in project E&S site audits and inspections led by the Project Management Team. All non-conformities, non-compliances and hazards identified during these audits and inspections must be addressed with appropriate preventive/corrective actions and reported as required. • Report all project E&S issues, including incidents, and performance data to the Lightsource bp project management team E&S Manager.
Project workforce	• Be aware of and demonstrate E&S commitment through their actions by knowing and respecting the E&S rules and practices in their work areas and actively participating in E&S meetings, safety talks, toolbox talks, training sessions and drills. • Perform their job and behave in a manner which prevents accidents, eliminates harm to people and does not damage the environment; this includes stopping work that is unsafe. • Use personal protective equipment (PPE), tools, equipment, and their safeguards correctly. • Report any hazards, near misses or incidents to their supervisor.

10.4 Environmental and Social Management

The EPC contractor's ESMS, bridged with the Lightsource bp ESMS, will form the framework for managing environmental and social issues throughout construction. The EPC contractor's management system will provide details of how the commitments for which the contractor has responsibility will be implemented. A comparative arrangement will be made during the operation phase between Lightsource bp and the O&M contractor.

The management system(s) will be consistent with, but not necessarily certified to, ISO 14001 or other similar standards.

The management system(s) will focus on the main mechanisms by which commitments are translated into practice, giving special consideration to:

- practical training and raising the environmental and social awareness of personnel
- supervision and monitoring of environmental and social issues in the field and tracking the implementation of corrective actions
- continuous improvement of environmental and social performance throughout the project.

Lightsource bp's ESMS and the EPC/O&M contractor's management system(s) will each be commensurate with the scale of the project and focus on the issues that are most important for managing environmental and social performance, without burdening the project with excessively complex systems.

Table 10.2 below describes the four main stages of the plan-do-check-act process for environmental and social management.

Table 10.2: Plan-do-check-act description

Stage	Description
Plan	• Identify hazards and risks to the project, for example, through the ESIA process. 'Plan' also involves identifying legal and other requirements and setting goals and targets. • The ESMP documents list the commitments that have been generated in the ESIA process and assigns the responsibility for each commitment that will be implemented in the 'do' stage of the cycle. The ESMP documents are 'live' documents and will be updated during the course of the project, as required.
Do	• The ESMS will include the ESMP documents containing several management plans to be developed by Lightsource bp and/or the EPC and O&M contractors. • Training and skills development plans will be implemented either directly by Lightsource bp or via its contractors to ensure that required competencies are available and appropriate to the defined risks. The training programme (including daily toolbox meetings) will be updated in accordance with changes to the scope of work, incident statistics and/or regulatory requirements. • Priorities for capacity development of the project workforce in relation to E&S will be identified. Capacity development activities will be tailored to the needs of the workforce and be accessible in the appropriate language. • Lightsource bp will proactively identify vulnerable groups and develop specific engagement activities/methods where necessary to ensure vulnerable groups are aware of employment and training opportunities. Targets and hiring criteria will be included where possible and appropriate to ensure the active inclusion of women and for the training of women.
Check	• Lightsource bp and the EPC/O&M contractors will implement E&S audit and assurance processes aimed to confirm that the commitments made during the ESIA are fulfilled. • The ESMP documents will specify key indicators for environmental and social performance. • The EPC/O&M contractor will develop an environmental and social monitoring and reporting plan that reflects the specific monitoring requirements contained within the ESMP documents and will produce a combined environmental and social monitoring report monthly for Lightsource bp review. It will be the responsibility of Lightsource bp to report any material release to the MENR. Other external reporting requirements and responsibilities will be set out within the management plans.
Act	• Where performance monitoring identifies non-conformance (i.e., deviations from Lightsource bp requirements) or non-compliance (i.e., failure to comply with a legal requirement), these will be investigated to identify likely causes and appropriate corrective/preventive actions. • All non-conformances/non-compliances will be assigned a corrective action, and preventative action where appropriate. • A procedure will be developed for non-conformance/non-compliance management and action tracking.

10.5 Management of Change

Changes to the project may occur after the preparation and submission of this ESIA. Lightsource bp will develop and implement a management of change procedure so that any changes occurring during the final design stages, construction, operation or decommissioning are subject to scrutiny and any implications for environmental and social issues are identified, approved and addressed.

The management of change procedure will include:

- guidelines for the environmental and social appraisal of the change including the identification of new or revised mitigation measures
- a health and safety evaluation
- consultation with engineering and HSE disciplines
- consultation with MENR (or other authority) on the need for amendments to the ESIA permit if required
- management of change approval process.

Following management of change approval, changes to the ESMS and supporting management plans will be implemented.

10.6 ESMP Documents

This section describes the ESMP documents that will be drafted to support the implementation of the ESMS. Table 10.3 summarises the documents relevant to the project. The list is preliminary and only contains key ESMP documents, which may be subject to change as the project progresses to reflect management and contracting strategy decisions.

Table 10.3: Preliminary key ESMP documents and minimum content

Document	Minimum content
Pollution Prevention Plan	Outlines pollution prevention control measures for noise and vibration, air quality and hazardous materials in line with regulatory and good international industry practice.
Emergency Response Plan	Defines the approach to emergency risk analysis, emergency preparedness, response planning and incident management, and will include a Spill Response Plan.
Erosion, Sediment Control and Reinstatement Plan	Defines the approach to soil management and temporary erosion control reinstatement, including requirements relating to construction planning surveys and assessments, erosion and sedimentation control techniques, contaminated land and reinstatement.
Groundwater and Surface Water Management Plan	Details groundwater and surface water impacts identification and sustainable management activities including the development, implementation and maintenance of a water balance model and water management plan/strategy.
Traffic Management	Guides project logistics and supports community and driver

Document	Minimum content
Plan	road safety during transportation activities. The plan includes requirements relating to pre-construction surveys, defined transport routes, vehicles and drivers, journey management planning and culturally appropriate information, signage and safety awareness education for communities.
Waste Management Plan	Defines the approach to reduce potential waste related impacts which includes the development of a waste management hierarchy, and the waste management processes from identification of waste to final disposal and documentation.
Cultural Heritage Management Plan	Defines the approach to the identification, assessment and mitigation of potential impacts on tangible and intangible cultural heritage. Includes a Chance Finds Procedure.
Biodiversity Management Plan (BMP)	Defines the approach to reduce impacts on biodiversity prior to, during and post construction. This will include footprint management, pre-construction surveys (PCS), restrictions on the timings of works and plans for habitat management and reinstatement.
Health, Safety and Security and Environment (HSSE) Management Plan	Defines the approach to manage health, safety and security matters of the public, workers and the environment. The plan will cover community health, safety and security, including risk identification and management of community notification, worker-community interaction, sexual and communicable disease and community awareness programmes.
Workforce Accommodation Management Plan	Contains minimum requirements for any project worker accommodation with specific reference to IFC and the European Bank for Reconstruction and Development (EBRD) Workers' accommodation: process and standards. A guidance note by IFC and the EBRD (2009).
Labour Management Plan	Outlines requirements for the recruitment, employment, training and demobilisation of local project workers. Includes requirements for recruitment plans; inclusion, training and additional assistance for women; culturally appropriate training programmes and the communication of these programmes. Includes activities aimed at identifying opportunities for enhancing local content (both workforce and businesses); demobilisation support and end of contract documentation.
Social Management Plan	Brings together commitments to manage and monitor the project's impact on broader socioeconomic issues that don't fall within the areas dealt with by other plans and procedures. This includes but is not limited to issues such as inflation/price monitoring, in-migration mitigation and monitoring and mitigation and monitoring of the impact of the project's use of public infrastructure (e.g., waste facilities). Includes the Grievance Management Procedures (workforce and community).
Stakeholder Engagement Plan	Provides an overview of the planned stakeholder engagement process including stakeholder identification and analysis, the

Document	Minimum content
	stakeholder engagement programme, grievance management and data management. It is a 'live' document which is reviewed and updated throughout the ESIA phases to reflect insights and additional information gained during stakeholder engagement activities.
Decommissioning Plan	Details the measures required to effectively and safely decommission and close the project site.
Environmental and Social Monitoring and Reporting Plan	Defines the approach for E&S monitoring and reporting; including E&S monitoring and inspections programmes, management and investigation of non-compliance/non-conformance, corrective and preventative action management and tracking, and internal and external reporting.

10.7 Management and Monitoring of Cumulative Impacts

The effective management of cumulative impacts requires collaboration of all parties that contribute to these cumulative impacts. Ideally, cumulative impact management should be led by government entities that have direct influence on proponents, in order to identify the contributions of each actor and establish the mechanism to handle the cumulative effects. International best practice establishes that individual proponents should mitigate the effects generated by their project and, at a minimum, support and influence cumulative effects management strategies (IFC, 2013).

Lightsource bp will comply with IFC Guidance Note 42, which specifies that commercially reasonable attempts should be made to engage relevant stakeholders (e.g., government authorities, affected communities, other developers) in the assessment, design and implementation of coordinated mitigation measures to manage the potential cumulative impacts resulting from multiple developments in the project's area of influence.

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APPENDIX 1: REGULATORY REVIEW

CONTENTS

1 INTRODUCTION

A cooperation agreement has been signed between the Government of Azerbaijan and bp Exploration Caspian Sea Limited (bp) providing exclusivity to bp to develop 240 MWAC (~288MWp) in Jabrayil, Azerbaijan within government owned land. Lightsource Holdings 2 Limited (LSbp) are acting as developer on behalf of bp on an exclusive basis to install solar panels and associated infrastructure.

This document provides a summary of all applicable legislation, permits and approvals that are relevant to Project Sunrise.

2 RENEWABLE ENERGY POLICY AND LEGISLATION

2.1 Renewable Energy in Azerbaijan

In the Republic of Azerbaijan, the proportion of energy for electricity generation that is from renewable sources is growing rapidly. The President of the Republic of Azerbaijan set a goal to increase the share of renewable energy sources to 30 percent by 2030. By 2030, the amount of greenhouse gases emitted into the atmosphere is planned to be reduced by 35 percent. After signing the Paris Agreement in April 2016, Azerbaijan has committed to support limiting the rise in global temperature to 2.0 degrees Celsius.

2.2 State Agency for Renewable Energy

By Decree of the President of the Republic of Azerbaijan dated September 22, 2020, No. 1159, the State Agency for Renewable Energy Sources under the Ministry of Energy of the Republic of Azerbaijan (MERA) was established, and the Charter of the Agency was approved.

The Agency ensures the organization and regulation of activities in the field of renewable energy sources and their efficient use in the Republic of Azerbaijan, participates in the implementation of state policy and is part of the structure of the Ministry of Energy.

The main tasks of the State Agency are to increase the share of renewable energy sources in the installed power generation capacity up to 30% by 2030, transform the liberated territories into the Green Energy Zone, and ensure the participation of the private sector in this district.

In connection with these tasks, the President signed several regulatory documents listed below:

Decree of the President of the Republic of Azerbaijan on certain measures to accelerate economic development in the territories liberated from occupation, dated 10 December 2021

The order provides for the efficient use of the rich resources and infrastructure potential of these territories, the revival of economic activity based on partnerships between the public and private sectors and the most favourable business environment. To this end, it is planned to create favourable conditions for accelerating economic recovery in the territories liberated from occupation and increase attractiveness of the investment, application of innovative technologies, preparation of optimal benefits and incentive mechanisms to improve the business environment.

Decree of the President of the Republic of Azerbaijan No. 1209 dated 29 May 2019

According to this Decree, the Ministry of Energy was instructed to take measures to encourage the use of renewable energy sources, create a favourable investment climate and support the activities of private entrepreneurship, as well as the development of the project "Long-term development strategy for the energy sector of the Republic of Azerbaijan", for the period up to 2050. The draft strategy has already been developed by the Ministry of Energy and is based on a development model focused specifically on private investment.

Decree of the President of Azerbaijan "On measures to implement pilot projects in the field of renewable energy sources" dated 5 December 2019

In order to encourage the use of renewable energy sources and attract private investment in this sector, the Decree of the President of Azerbaijan No. 1673 "On measures to implement pilot projects in the field of renewable energy sources" was adopted. Within the framework of this Decree, a commission was established for the implementation and coordination of pilot projects for the construction of power plants of renewable energy sources (wind and solar).

State Program for the Socio-economic Development of the Regions of the Republic of Azerbaijan

The Republic adopted this state program for the period 2019-2023. The program is aimed at taking additional measures for the socio-economic development of the regions and the development of the non-oil sector in the country, improving the quality of public services and providing social infrastructure in the regions, further improving the business environment, increasing investment, opening new enterprises, jobs and reducing poverty.

A program of strategic importance was adopted - "National Priorities for Socio-Economic Development: Azerbaijan 2030"

On February 2, 2021, a program of strategic importance was adopted on "National Priorities for Socio-Economic Development: Azerbaijan 2030". According to the document, five National Priorities should be implemented in the coming decade:

- sustainable competitive economy
- dynamic, inclusive and social justice-based society
- competitive human capital and the space of modern innovations
- full return to the territories liberated from occupation
- clean environment and green growth in the country.

Decree No. 462 "On Approval of the State Program for the Use of Alternative and Renewable Energy Sources in the Republic of Azerbaijan" dated 21 October 2004

The limited hydrocarbon reserves of traditional energy sources and the prevention of environmental pollution create a need in the world to increase the amount of energy produced from alternative and renewable energy sources. Azerbaijan will consider the positive experience of other countries in using the energy of the sun, wind and other clean and renewable sources to create its own renewable energy sources.

Azerbaijan, due to its favourable natural conditions, has sufficient potential for alternative and renewable energy. However, this potential has not yet been exploited. Further, the Program provides specific measures to create energy capacities based on alternative and renewable energy sources.

Decree of the Cabinet of Ministers of the Republic of Azerbaijan No. 482, 2016 "On determining the production of electricity and power limits for the commissioning of electrical installations"

This document states that special permits for power plants of alternative and renewable energy sources are required only for power plants with a capacity of more than 150 kW, and for hydroelectric power plants and biogas power plants with a capacity of more than 500 kW.

Decree of the President of the Republic of Azerbaijan "On measures in connection with the creation of a "Green Energy" zone in the liberated territories of the Republic of Azerbaijan" Decree No. 2620 dated 3 May 2021

An Action Plan has been developed for the application of efficient environmentally friendly technologies and energy in the territories of the Republic of Azerbaijan liberated from occupation in 2022-2026. In terms of the amount of solar radiation falling on the earth's surface, the southern flat part of Karabakh (Fuzuli, Jabrayil, Zangilan regions) rank second after the territory of the Nakhchivan Autonomous Republic. Here, one square meter of solar radiation on a horizontal surface can provide 1600-1700 kilowatts / hour per year.

These activities include the construction of transport and distribution networks to provide electricity and gas, as well as the construction of a solar station in the Jabrayil region, a wind power plant in the Lachin-Kalbajar regions, the construction of rooftop solar power systems, etc.

The Decree of the President of Azerbaijan "On Accelerating Reforms in the Energy Sector of the Republic of Azerbaijan" dated 29 May 2019

This decree was initiated to take the necessary measures to attract private investment in the electric energy sector. The long-term strategy for the development of the energy sector for the period up to 2050, the initial draft of which was developed by the Ministry of Energy, is based precisely on a development model focused on private investment.

3 ENERGY AND PLANNING LEGISLATION

3.1 Introduction

This section provides an overview of the energy and planning legislation and documentation relevant to Project Sunrise.

3.2 Constitution of the Republic of Azerbaijan

The constitution is the foundation of the legislative system in the Republic.

Article 14 states that the natural resources belong to the Republic of Azerbaijan without prejudice to the rights and interests of any individuals and legal entities.

Article 39 and Article 78 state that:

- Everyone has the right to live in a healthy environment.
- Everyone has the right to collect information about the true state of the environment and to be compensated for the damage caused to his health and property by an environmental offense.
- No one can pose a threat or cause damage to the environment, natural resources beyond the limits established by law.
- The state guarantees the preservation of the ecological balance, the protection of species of wild plants and wild animals defined by law.
- Protecting the environment is everyone's responsibility.

3.3 Energy Sector Legislation

The main legislative acts in force in the energy sector related to this project include the following:

Law of the Republic of Azerbaijan on Electric Power Industry, N 541-İQ, 1998; Law of the Republic of Azerbaijan N 546-VİQD dated 17.06.2022 "On Amendments to the Law on Energy"

This law defines the legal basis for the generation, transportation, distribution, sale, and consumption of electrical and thermal energy. The main purpose of this law is to ensure the rational use of energy resources and the socio-economic feasibility of generating energy and delivering it to the energy market, considering the interests of consumers, subject to the fulfilment of all requirements relating to the preservation of the environment.

Law of the Republic of Azerbaijan "On the use of renewable energy sources in the production of electricity" dated May 31, 2021, N339-VİQ

This law defines the legal, economic, and organizational framework for the use of renewable energy sources in the overall production of electricity, as well as mechanisms for promoting the production of electricity from renewable energy sources, regulates relations arising in this area. It provides:

- rules for choosing a producer of electricity from renewable energy sources for a specific territory, a limit on the power of generated electricity, conditions for connecting to the Unified Energy Grid or determines a guaranteed buyer of energy
- tariffs for the purchase and wholesale of electricity
- rules for the application of the active consumer support mechanism
- rules for issuing a certificate for electricity produced from renewable energy sources
- mechanisms aimed at attracting private, including foreign investment in the development of the industry, one of which is the organization of auctions in the field of renewable energy.

Law of the Republic of Azerbaijan on the efficient use of energy resources and energy efficiency, July 9, 2021 (replaces the Law "On the use of energy resources" May 30, 1996, No. 94-IG)

This law regulates relations arising in the field of production, storage, transmission, distribution, sale and consumption of energy, and applies to state bodies (institutions), individuals and legal entities operating in this area, including end users.

It provides:

- rules for the formation and use of the energy efficiency fund
- rules of state control over the efficient use of energy resources and in the field of energy efficiency
- establishes administrative liability for violation of this law
- rules for conducting an audit, submitting a report on the results of an energy audit
- requirements for the energy management system
- minimum energy efficiency standards for buildings
- regulations for labelling products related to energy consumption
- eco-design requirements for products that consume or affect energy consumption.

Power and Thermal Plants Law, No. 784-IQ, 28 December 1999 (last amended 2019)

This law establishes the legal basis for the design, construction, operation, and use of permanent installations (power plants) that produce electrical and thermal energy. The law considers power production installations located in a single (indivisible) space and in technological connection as a single power plant. Independent power plants are economically and organizationally completely independent legal entities that are not subordinate to the unified state electric power system.

This law determines the grounds for the construction, operation and reconstruction of power plants, methods of transportation and distribution of electricity, establishes the executive authorities that issue permits for activities, technical requirements for construction and operation, as well as compliance with sanitary and environmental requirements in force in the territory of the Republic of Azerbaijan.

3.4 Urban Planning and Building Regulations

The following are extracts from the relevant regulations.

3.4.1 Urban Planning and Building Code (Chapter 3)

Urban planning and building code of the Republic of Azerbaijan, approved by the Law of the Republic of Azerbaijan dated June 29, 2012, No. 392-IVQ, with amendments and additions as of May 13, 2022

3.4.1.1 Article 7.0

In the Republic of Azerbaijan, urban planning and construction activities are carried out based on the following principles:

- 7.0.1. ensuring social minima associated with conditions for healthy and safe living, work and recreation
- 7.0.2. security
- 7.0.3. ensuring ecological safety and environmental protection
- 7.0.4. ensuring compliance with urban planning documentation
- 7.0.5. protection of objects of historical landscape and cultural heritage
- 7.0.6. public information.

3.4.1.2 Article 8

- At urban planning and construction sites, in particular at construction sites intended for human habitation and use, social minimums related to the conditions for healthy and safe living, work, and recreation, defined by this Code and other regulatory legal acts, must be provided.

3.4.1.3 Article 9

- 9.1. The safety of the building area and the construction site must be ensured in terms of compliance with the requirements related to fire protection, protection from hazardous natural or man-made impacts.
- 9.2. Based on the requirements established in this Code and other regulatory legal acts, other regulatory documents related to urban planning and construction must provide for security measures related to the protection of the development area and the construction site from fire, hazardous natural or man-made impacts.

3.4.1.4 Article 10

- 10.1. As part of urban planning and construction activities, environmental safety and environmental protection should be ensured.
- 10.2. The evaluation of construction activities in terms of their impact on the environment is carried out in accordance with the law. The results of the assessment should be considered when determining measures to ensure environmental safety and environmental protection.

3.4.1.5 Article 11

- 11.1. Construction projects must comply with the requirements of urban planning documentation, including certain detailed plans. In the absence of such a plan or the expiration of its term, construction projects are allowed if the documentation for the planning of the territory where these projects will be implemented (general plan and (or) general plans), as well as the requirements provided for in the development of a detailed plan, and at the same time the following conditions:
    - 11.1.1. The construction of the projected facility is envisaged within the zones in which there are buildings.
    - 11.1.2. The object, the construction of which is envisaged by the type and scale of use, corresponds to the existing buildings.
- 11.2. The erection of a construction object outside the scope of the detailed plan and outside the zone in which there are buildings in the meaning provided for in Article 11.1 of this Code is allowed only if it has infrastructure and facilities for engineering and communication support in the relevant territory (sufficient justification opportunities) and construction objects are intended for the following purposes:
    - 11.2.1. To carry out activities related to agriculture and forestry.
    - 11.2.2. For use by employees of an agricultural enterprise.
    - 11.2.3. For the implementation of entrepreneurial activities related to the supply of communications, electricity, gas, water, heating, sewerage, or the relevant territory.
    - 11.2.4. For research, development, or use of wind, solar or hydropower.

- 11.3. Except as provided for in Articles 11.1 and 11.2 of this Code, the implementation of other construction intentions is unacceptable in the following cases:
    - 11.3.1. The object, the construction of which is envisaged, is contrary to the master plan.
    - 11.3.2. There is a threat that the object, the construction of which is envisaged, will have a harmful impact on the environment or will itself be subject to such an impact.
    - 11.3.3. The object, the construction of which is envisaged, requires the irrational use of state or municipal funds in connection with the creation of infrastructure, security, or health.
    - 11.3.4. The object, the construction of which is envisaged, violates the interests related to the protection of the environment, land, cultural heritage sites or natural features of the landscape.
    - 11.3.5. The facility, the construction of which is envisaged, poses a threat to the water management, or jeopardizes protection from natural phenomena (floods).
- 11.4. It is necessary to study the position of municipalities regarding construction projects and intentions provided for in Articles 11.2 and 11.3 of this Code.
- 11.5. For checking the compliance of construction projects with urban planning documents, as well as for other services provided by the relevant structures in the field of construction activities and the list, the amount, and cases of which are established by the relevant executive authority, a fee is charged.

3.4.1.6 Article 12

- As part of urban planning and construction activities, the protection of areas where the historical landscape and cultural heritage sites, specially protected natural areas or objects are located should be ensured.

3.4.1.7 Article 13

- The relevant executive authority or the structure created by the relevant executive authority, or the relevant municipality are obliged to inform the public about all the stages and content of the planning area, about significant construction intentions.

3.4.2 Urban Planning and Building Code (Chapter 4)

3.4.2.1 Article 15

- 15.1. The system of normative documentation in the field of urban planning and construction includes:
    - 15.1.1. Technical regulatory legal acts, related to documents, norms and rules of territorial planning, as well as justification for urban planning.
    - 15.1.2. Technical regulatory legal acts on maintenance of the state cadastre of urban planning.
    - 15.1.3. Technical regulatory legal acts of organizational and methodological nature, related to standardization and certification of construction materials and products, geodesy, engineering surveys and construction works, permits for operation of the construction object.
    - 15.1.4. Technical regulatory legal acts, determining the provisions of the reliability of objects construction, fire and explosion safety, protection

against dangerous (harmful) impacts of natural and man-made nature, quality and compatibility of building materials, products and structures.
    - 15.1.5. Technical regulatory legal acts on design and construction of construction projects, including main pipelines (water, sewerage, gas, oil pipelines, etc.) and communications (lines power transmission, communications, etc.).
    - 15.1.6. Technical regulatory legal acts on engineering and communication support for the population points or their parts, separate construction objects.
    - 15.1.7. Technical regulatory legal acts on ensuring safety during construction.
    - 15.1.8. Technical regulatory legal acts on pricing and estimates for construction projects, funded by public funds.
    - 15.1.9. Technical regulatory legal acts on ensuring requirements related to civil defence, in the design and construction of facilities construction.
    - 15.1.10. Normative legal acts on supervision in the field of urban planning, architecture and construction activities.
- 15.2. The legal basis of normative documents in the field urban planning and construction of this Code and other normative legal acts.
- 15.3. In cases provided for in international treaties, to which the Republic of Azerbaijan is a party, norms and standards of foreign countries or international organizations related to urban planning and construction, can be used in the territory Azerbaijan Republic.

4 ENVIRONMENTAL AND LAND LEGISLATION

4.1 Introduction

This section presents the environmental and land legislation relevant to Project Sunrise.

4.2 Law of the Republic of Azerbaijan on Environmental Impact Assessment, June 12, 2018

This law provides the Environmental Impact Assessment (EIA) procedures for projects of economic importance, projects of strategic importance, planning for the development of regions and individual economic areas in accordance with Article 39 of the Constitution of the Republic of Azerbaijan and paragraph 20, Article 94.

The law states that the main purpose of the EIA procedure is to identify the possible harmful effects of the planned activity on the environment and humans. The law comprises a list of the mandatory contents of the EIA document, an assessment of the scale and intensity of the impact in spatio-temporal terms, as well as the implementation of measures to eliminate them, or maximum mitigation, and a list of activities requiring mandatory environmental assessment. The law requires the participation of state and municipal authorities, individuals, and legal entities, including non-governmental organizations, in the conduct of EIA and Strategic Environmental Assessment (SEA). The law establishes the need for public hearings organized by the owner of the proposed activity. State programs, draft legislative acts, schemes for the development of individual regions and economic sectors require a SEA.

EIA is carried out by the company during the design stage of the intended activity.

The impact assessment should include: air quality; surface water and groundwater; sediment in water bodies; landscapes; soil; flora and fauna; ecological systems and biodiversity; ecologically sensitive areas; health of the population; socioeconomics (employment, education, health care, road transport and engineering infrastructure); cultural heritage; climate change.

The EIA is carried out after preliminary consultations with the Ministry of Ecology and Natural Resources (MENR). Preliminary consultations are conducted with the aim of determining the content, scope and methods of the assessment in advance, and ensuring the completeness and accuracy of the information to be reflected in the EIA document. While conducting the EIA, the customer must hold public hearings with individuals living in the area where the intended activity is carried out and legal entities operating in that area, as well as with landowners in accordance with the Law of the Republic of Azerbaijan "On Public Participation".

The MENR is responsible for the review and approval of the EIA report.

4.3 Law of the Republic of Azerbaijan on Environmental Protection, June 8, 1999

The law defines the legal, economic, and social foundations of environmental protection. The purpose of the law is to ensure environmental safety in the field of protecting the ecological balance of the environment, eliminating the harmful effects of economic and other activities on natural ecological systems, preserving biological diversity and rational organization of nature management. This law regulates the relationship of society and nature to strengthen the rule of law and legal rules in the field of improving the quality of the environment, rational use and restoration of natural resources, and environmental protection.

4.4 Law of the Republic of Azerbaijan "On Obtaining Information About the Environment" March 12, 2002

This law governs relations arising in connection with the timely receipt of complete, reliable information on the state of the environment and the use of natural resources by public authorities and local self-government bodies, as well as by responsible persons.

4.5 Law of the Republic of Azerbaijan on Atmospheric Air Protection, March 27, 2001

Atmospheric air is an integral part of the environment, affecting the health, working capacity of people, flora and fauna. This law, establishing the legal basis for the protection of atmospheric air, is aimed at exercising the rights of the population to live in a favourable environment and obtaining accurate information on the state of environment.

4.6 Law of Azerbaijan Republic on Radiation Safety, 30.12.1997

The law determines the state policy, the powers of state bodies, control over the development and observance of legislative acts in the field of radiation safety.

Establishes the rules for measures in case of a threat of a radiation accident, the procedure for compensation for damage to health and property of the population as a result of a radiation accident.

4.7 Law of the Republic of Azerbaijan on Fauna, 04.06.1999

The law establishes the rules for exercising state control over the protection and use of wildlife, guided by humane principles. The law determines the methods for protecting habitats of wild animals, migration routes, wintering areas, conditions for breeding and reproduction; separation of the functions of control over the protection and use of fauna and the functions of economic activity; regulation of the number of animals to timely prevent damage to public health, nature and economy.

4.8 Law of the Republic of Azerbaijan on Specially Protected Natural Areas, 24.03.2000

Specially protected natural territories and objects are the national treasure of the Republic of Azerbaijan and have a special ecological, scientific, cultural, and aesthetic value.

This law determines the legal basis for the organization and protection of specially protected natural areas and the protection of specially protected natural objects in the territory of the Republic of Azerbaijan.

4.9 Law of the Republic of Azerbaijan on Environmental Safety, 1999

This law regulates relations in the field of environmental safety in the course of activities by legal entities and individuals, state bodies and local governments and their officials. The purpose of this law is to establish the legal framework for the protection of human life and health, society, its material and moral values, the environment, including atmospheric air, outer space, water bodies, subsurface mineral resources, earth, natural landscape, flora, and fauna from the danger arising from the impact of natural and anthropogenic factors.

4.10 Land Code of the Republic of Azerbaijan, 1999, No. 695-IQ

The subject of the Land Code of the Republic of Azerbaijan is the regulation of land relations arising from the use of various types of ownership of land, the implementation of land-related obligations of owners, users and tenants of land and the protection of their rights to land, the creation of conditions for the rational use of land and its protection, restoration and improvement of soil fertility, reclamation of lands that have become unusable as a result of pollution and destruction, preservation and improvement of the natural environment.

The law establishes the powers of the state in the field of regulation of land relations, and also determines the ownership of land, and also determines liability for damage to land or other violations in the field of land ownership.

4.11 Law on the Protection of Historical and Cultural Monuments, No. 470-IQ, 1998

This law regulates relations related to the protection, study, and use of historical and cultural monuments. The state guarantees the protection of historical and cultural monuments, and legislative bodies, executive and judicial authorities, local governments and other organizations, legal entities and individuals are obliged to protect historical and cultural monuments, to provide assistance to the organization designated for their protection. The entities specified in the Law, when conducting excavation or construction work on the territory of location of historical and cultural monuments, must first obtain permission from the body (organization) established by the relevant executive authority, taking into account the opinion of the organization established by the relevant executive authority, and after receiving this permission to follow the instructions of the body (organization) established by the relevant executive authority, and specialists in the protection of monuments when carrying out excavation or construction work.

The protection of immovable monuments of history and culture in the border zone and on the border strips of the state border of the Republic of Azerbaijan, in the zone of military operations during armed conflicts, located on land plots in use and on the territories of military structures, is carried out by the relevant executive authorities.

4.12 Law of the Republic of Azerbaijan on Sanitary and Epidemiological Welfare, 1992

The law reveals the meaning of the concept of sanitary and epidemiological well-being, which is ensured by:

- The implementation of state, regional and local programs to promote health, prevent diseases of the population, improve the environment and living conditions of people.
- The observance by state bodies and public associations, enterprises, organizations, and institutions, regardless of their subordination and form of ownership, by officials and citizens as an integral part of their activities of sanitary rules and norms, hygienic standards.
- Carrying out work on hygienic education and upbringing of the population, aimed at the formation of a healthy lifestyle, a high sanitary culture.
- Widely informing the population about the state of health, hygienic and epidemiological conditions, about preventive, sanitary and hygienic and anti-epidemic measures.
- A system of state and departmental sanitary supervision, production, and public control.

4.13 Civil Code of the Republic of Azerbaijan, 1999

4.13.1 Article 246. Acquisition of land for state needs

- 246.1. The decision on the purchase of land for state needs in accordance with Article 157.9 of this Code is taken by the relevant executive authority in the manner prescribed by the Law of the Republic of Azerbaijan "On the purchase of land for state needs".
- 246.2. The decision of the relevant executive authority on the acquisition of a land plot for state needs is registered in the state register of real estate.

4.14 Law of the Republic of Azerbaijan "On Non-Governmental Organizations) (public associations and foundations) June 13, 2000, No. 894-IQ

Any individual and legal entity (with the exception of state authorities and local self-government bodies) can become a member of a public association in the Republic of Azerbaijan.

A non-governmental organization has the right to carry out in the country and abroad any type of activity that is not prohibited by the legislation of the Republic of Azerbaijan and does not contradict the goals provided for by the charter of the non-governmental organization.

5 INTERNATIONAL CONVENTIONS AND AGREEMENTS

In accordance with Article 10 of the Constitution, the Republic of Azerbaijan maintains international relations with other states on the basis of the principles provided for in the universally recognized norms of international law.

Azerbaijan has been a member of the European Energy Charter since 1998. In May 2015, the European Energy Charter received international status, which unites 55 countries. In 2018, Azerbaijan acceded to the II Hague Document of the Energy Charter, and in 2019, the International Energy Charter Forum was held in Baku on the theme "Ensuring energy transition through technological and political innovation".

In 1996, Azerbaijan was acceded to the Council of Europe, with the acceptance of the conditions and requirements of the community. In particular, Azerbaijan has joined most of the international agreements on various topics. In the field of environmental law, there are several international Conventions and Protocols. In addition to the above, there are the requirements of international financial organizations on environmental and energy issues. In particular, loans from the International Finance Corporation (IFC), the European Bank of Reconstruction and Development (EBRD) and the Asian Development Bank (ADB) are issued subject to compliance with the relevant environmental and other norms and rules developed by these organisations, as well as the so-called Equator Principles (EP).

The Equator Principles (EP) are intended to serve as a common framework and risk management system for financial institutions to identify, assess and manage environmental and social risks in project financing. EP 4 is the latest version of the document, which, due to the coronavirus pandemic, entered into force on October 1, 2020, and not on the previously set dates.

The table below presents the conventions and agreements that have been ratified by Azerbaijan.

Table 1 International Conventions and Agreements

International Convention or Agreement	Date of Ratification
Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, February 25, 1991)	01.02.1999
European Convention on the Conservation of European Wildlife and Natural Habitats (Bern, September 19, 1979)	28.10.1999
UN Convention "on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters" (Aarhus, June 25, 1998)	09.11.19
Montreal Protocol on Substances that Deplete the Ozone Layer (15-17 September 1997)	18.07.2000
Convention on Biological Diversity (June 5, 1992), Cartagena Protocol on Biosafety to the Convention on Biological Diversity	23.03.2005
International Plant Protection Convention (Rome, 1951)	14.03.2000
UN Framework Convention on Climate Change (Kyoto Protocol, 1992)	18.07.2000
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Washington, March 3, 1973)	23.07.1998
UN Convention "On the Protection and Use of Transboundary Watercourses and International Lakes" (Helsinki, March 17, 1992)	22.10.2002
UNESCO Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar, February 2, 1971)	18.07.2000
UN Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel, March 22, 1989)	06.02.2001
Convention on "Long-Range Transboundary Air Pollution" (Geneva, November 13, 1979)	04.09.2002
Stockholm Convention "On Persistent Organic Pollutants" (May 22, 2001)	09.12.2003
Convention on "Transboundary Effects of Industrial Accidents" (Helsinki, March 17, 1992)	04.05.2004
Framework Convention for the Protection of the Marine Environment of The Caspian Sea (Tehran, November 4, 2003)	04.04.2006
"European Landscape Convention" (Florence, October 2000)	06.04.2011
Convention on the Legal Status of the Caspian Sea (August 12, 2018, Aktau, Kazakhstan)	12.02.2019
Convention Concerning the Protection of the World Cultural and Natural Heritage (November 16, 1972)	06.12.1993
Convention of the World Meteorological Organization (Washington, 11 October 1947	03.10.1993
Annex No. 3 Meteorological Service for International Air Navigation to the Convention on International Civil Aviation	14.07.1992

6 PERMITS AND LICENSES REQUIRED

In accordance with Azerbaijani regulations the following permits and licenses are necessary for construction and commissioning of Project Sunrise.

Table 2 Legislation and Permits for the Project

<table>
<tr><th>S/N</th><th>Permit, licence, or approval</th><th>Authority</th><th>Legislation</th><th>Period for Obtaining Permit/Approval</th></tr>
<tr><td>1</td><td>Land use permit (already granted to Azerenergy)*</td><td>Local authority</td><td>Law of the Republic of Azerbaijan on Licenses and Permits
Civil Code of The Republic of Azerbaijan</td><td rowspan="5">These permits are issued within maximum period of three months from the application. Exact duration was only confirmed for the EIA (EIA Law), but a general rule for document review process by the authorities is that is not longer than 3 months. If submitted documents are found unacceptable, this period begins after the amended documents are submitted.</td></tr>
<tr><td>2</td><td>Construction permission</td><td>Ministry of Ecology and Natural Resources
Ministry of Health
Ministry of Emergency Situations</td><td>Law of the Republic of Azerbaijan on Licenses and Permits
Law on Environmental Impact Assessment</td></tr>
<tr><td>3</td><td>License for energy production</td><td>Ministry of Energy</td><td>Specific legislation not identified</td></tr>
<tr><td>4</td><td>License for connecting to the grid</td><td>Azerishig/Azerenergy OJSC</td><td>Specific legislation not identified</td></tr>
<tr><td>5</td><td>Commissioning act for power generation</td><td>Issued by Azerbaijan Energy Regulatory Agency</td><td>Specific legislation not identified</td></tr>
</table>

**The land acquisition letter provided states a clear description of what is required from the Ministry of Energy in the second paragraph. This is translated below:*

1. *A total of 940 hectares of land should be given to the Ministry of Energy of the Republic of Azerbaijan for the construction of a 240 MW solar power plant in the administrative territory of Jabrayil region.*
2. *It should be established that the Ministry of Energy will:*

   2.1 upon receiving the site, control its sanitary condition;

   2.2 ensure registration of the land use right in the State Service for Real Estate Affairs (Ministry of Economy);

   2.3 in accordance with the requirements of the legislation, ensure that a construction permit is obtained as well as all other necessary paperwork resulting from this Order;

   2.4 prevent the occupation of the field and the illegal destruction of greenery;

   2.5 taken appropriate measures to protect the monuments that may be found in the area during the works being carried out.

APPENDIX 2
SPECIALIST STUDIES

2a	Geomorphology baseline	Kangarli, Talyat	Head of the department - Doctor of Geological and Mineralogical Sciences Corresponding Member of ANAS
2b	Soils	Baghirova, Bahruyya	Doctor of Philosophy in Agricultural Sciences, Associate Professor, ANAS
2c	Geology	Kangarli, Talyat	See above
2d	Hydrogeology	Kangarli, Talyat	See above
2e	Botany	Guliyev, Tofig	Expert on geobotany
2f	Zoology	Ibrahimov, Shaig	DSc of Biological Sciences Professor
		Mustafayev, Namig	Doctor of Biological Sciences Associate Professor
2g	Tanglible cultural heritage	Najafov, Shamil	Archaeologist PhD in History Associate Professor ANAS
2h	Hydrometeorological data	National Hydrometeorological Service under the Ministry of Ecology and Natural Resources (MENR) of Azerbaijan Republic	
2i	Landscape photos		

APPENDIX 2A: GEOMORPHOLOGY BASELINE REPORT (KANGARLI, T., 2023A)

1.1 Geomorphological demarcation

The territory of the Republic of Azerbaijan has a very complex geomorphological structure. Denudation-structure and structure-denudation mountains, depressions and valleys were formed here according to the weak and strong influence of tectonic movements on the terrain. Volcanic mountains and plateaus, accumulative-denudation plateaus and plains, accumulative plains, etc. have developed over time. The origin, age, morphological characteristics, geological structure and manifestation of the relationship with tectonic movements of the terrain in the territory of the Republic of Azerbaijan have led to the emergence of a number of geomorphological sub-provinces in four regions (Front Caucasus, Greater Caucasus, South Caucasus depression, Lesser Caucasus), six provinces (Samur-Davachi, Eastern Greater Caucasus, Kura depression, Outer Lesser Caucasus, Inner Lesser Caucasus and Talish), and within the provinces.

The territory of the Karabakh region, which is represented by mountainous and plains, is divided into sub-provinces and regions, being a part of the Outer and Inner Lesser Caucasus, as well as the provinces of the Kura depression.

The Outer Lesser Caucasus geomorphological region includes the north-eastern outer orographic units of the Lesser Caucasus mountain system. Here, the ridges are separated from each other by tectonic depressions. Erosion processes play an important part in geomorphological features. In the territory of the Republic of Azerbaijan, this province is represented by the North-Eastern slope, Eastern slope and South-Western slope geomorphological sub-provinces, of which the first sub-province has only its eastern part within the borders of Karabakh.

The geomorphological region of the Inner Lesser Caucasus includes areas of increased volcanic activity in the Pliocene and Anthropocene, as well as mountains and intra-mountain depressions that develop in an arid climate. Volcanic and glacial landforms (kars, single valleys, moraine hills, etc.) are widespread here. Along with fluvial processes, arid-denudation processes occupy the main place in the development of the modern terrain. In the Karabakh region, this province is divided into the geomorphological sub-provinces of the Karabakh Volcanic Plateau and Araz Ranges.

The complexity of new tectonic movements and exogenous relief-forming processes in the geomorphological region of the Kura depression has led to the diversity of the terrain structure. In the described region, the province acts as a sub-province of the foothill plains of the Lesser Caucasus.

Of these, the project area and surrounding areas geomorphologically correspond to the South-Western slope sub-province of the Outer Lesser Caucasus province, the Araz range sub-province of the Inner Lesser Caucasus province, and the South-West Araz plain sub-province of the Lesser Caucasus sub-province.

Below is a description of the mentioned sub-provinces:

The Eastern slope sub-province is represented by the Karabakh range. In the watershed part of the ridge, above 1,800-2,000 m, the slopes are bare and intensely fragmented. Gravitational landforms have evolved. Flat surfaces are common in the middle and low mountains. Ridges of structural and structural-denudation origin, valley depressions surrounded by them (Khachinchay, Dovshanli, Hasanabad, etc.) have developed. At the junction of the Khojaly (Khankendi) depression and the Baghirkhan (Bagrigan) range, large avalanche plumes were formed as a result of seismo-tectonic processes along the active tectonic fault. Mountain massifs and elevations of intrusive origin (Galaychi, Bozdag, Gazanchi, etc.) are widespread in the lowlands. The ridge descends in the southeast and passes into a sloping plain in the Lower Araz depression (geomorphological region).

The South-Western slope sub-province covers the Hakari river basin. The terrain has been subjected to deep erosion and is buried under volcanic sediments in some places. Ridges of tectonic-denudasion and lithostructural origin, intrusive massifs (Dalidag, etc.), inter-algae depressions (Pirjan, Lachin, etc.) are typical for the peninsula. There are remains of levelling surfaces are observed in watersheds and slopes, sprinkles on the slopes of Mikhtokan and Chalbayir ridges, and terraces in river valleys. Karst has developed. The slopes of river valleys are relatively sloping and their watercourses are smooth. The river valleys are relatively wide, their slopes are often subjected to landslides.

The south-eastern branches of the Zangezur range are represented in the sub-province of Araz ranges in the territory of the Republic of Azerbaijan. The sharply divided terrain forms resulting from ancient magmatism take an important place here. Surrounded by a monoclinal ridge from the west and east, the Okchuchay gorge contains a deep depression. The valleys of other rivers are characterized by steep slopes and great inclination of their bed. The depth of erosion is more than 1,200 m. Badland and pseudokarst forms have developed on some slopes.

The geomorphological region of Araz plain belongs to the sub-province of the foothills of the Lesser Caucasus. Its surface is composed of continental sediments of the Eopleistocene-Holocene age. The area extends to the ancient cone of the Hakari River in the west, and connects with the upper level of the Mil plain in the east. The border between the Araz and Mil plains is determined by the Kondalanchay valley. From the morphostructural point of view, the plain belongs to the group of Kura folded-block, graben-synclinal, steep differentiated troughs where the latest subsidence and relative uplifts are manifested.

The transition to the mountainous zone is gradual. Its surface is cut by the valleys of the rivers that originate from the Lesser Caucasus Mountains and form the left tributaries of the Araz. The depth ranges from 10-15 to 100-220 m. The most characteristic landforms are the subduction cones and intercone depressions, as well as bendland manifestations along the Hakari River.

Low-slope plains of the region are located between the south-eastern part of the Lesser Caucasus and the lower reaches of the Araz River. This region covers a large area between Basitchay and Kondalanchay and is represented by Inji, Gayan, Jabrayil and Harami plains. In the terrain, the Araz region corresponds to a deep-cut sloping plain with beds of mountain rivers and a network of ravines.

A network of streams and rivers has developed extensively in the region. In the west, the surface of the plain rises to a height of 400 m. The valleys stretch in the south-eastern direction towards the Araz river, which is the base of their erosion. The north-western part of the plain is covered with proluvial-deluvial sediments formed as a result of the erosion of the rocks that formed the branches separated from the Karabakh range. In the south-eastern part, the surface of the plain reaches the 80-100 m terrace of the Araz river and descends 60 m into the valley of the Araz river.

This flexural zone was subjected to subsidence during the Paleocene-Miocene, as a result of which 1,200-1,500 m thick bottom molasse sediments were accumulated. At the end of the

Miocene, the entire area is subjected to a general uplift with the Lesser Caucasus. At the same time, a sharp lowering of the erosional base occurs. In such conditions, the territory is extensively fragmented, and a low mountainous terrain with hills and dashes is formed. In the Upper Pliocene, a relative subsidence occurs in the surrounding areas of the Lesser Caucasus. This is accompanied by the Akchagil transgression, which causes a sharp rise of the general erosion base. As a result, the depression is filled with coarse-grained upper molasse deposits up to 500 m thick. At the end of the Late Pliocene, the denudation-accumulation surface of the Araz plain is formed. In late Absheron, the plain joins the general uplift of the Lesser Caucasus. The Araz river changes its location in the south-eastern direction and creates its own modern bed, which reaches a depth of 80-100 m, starting from the Gurgan period.

The surface of the plain is covered with clayey rocks with a thickness of 20 m and more. Near the river valleys, they pass to alluvial-proluvial pebbles. These pebbles are smooth. Upper Pliocene freshwater molluscs are found in lenticular rocks. Upper Pliocene fisheries have been found in the sediments of the ancient cone of the Hakari river.

1.2 Morphosculpture

The terrain forms that make up the morphosculpture of the project area and surrounding areas are formed only by the influence of exogenous (denudasion and accumulative) processes and are represented by river valleys, flat surfaces, interalgae depressions, volcanic terrain forms, ancient glacial forms and badlands.

Regardless of the absolute height, all mountainous areas are places where denudation processes prevail. Accumulation processes play a key role in terrain development in flat areas. Accumulation processes are also observed in local mountainous areas where denudation processes prevail. In the tectonic, erosion-tectonic depressions of this belt, especially in the middle and lowlands, the accumulation process overtakes erosion.

1.2.1 River valleys, terraces and cones

River valleys are a widespread major form of erosion in the area. The general direction of the hydrographic network and the cutting depth of the river valleys depend on the orographic features and direction of ridge watersheds.

Usually, the river valleys of the mountainous region can be canyon according to their morphological characteristics, V-shaped, and box-terrace in foothill plains. The river valley morphology has a great influence on the flow of rivers. As a rule, when rivers with a very large flow volume leave the mountainous area, rock particles of different sizes are accumulated and depth erosion does not occur. If the sloping plain meeting the foothills is more or less tectonically stable, positive forms of accumulative terrain (cones) are formed there, which is clearly visible in surrounding areas.

River terraces are one of the most important elements of the morphological structure of river valleys located in mountainous regions and foothill plains. 10-11 terraces have been identified in the river valleys of the Lesser Caucasus. As a rule, low terraces are accumulative, middle terraces are erosion-accumulative, and high terraces are erosion terraces. According to their age, river terraces belong to the Upper (terraces with a height of 40-45 m, in some places up to 55 m), Middle (up to 130-150 m) and Lower (up to 250-300 m) Pleistocene. In other words, low terraces up to 5-7 m high are New Caspian (Holocene), terraces between 10-55 m high are Khvalin (Upper Pleistocene), terraces between 50-60 and 180 m high are Caspian (Middle Pleistocene), and terraces located above 200 m belong to Baku (Lower Pleistocene) ages. Bed terraces are the best preserved terraces. In many river valleys, Khvalin, even terraces dating back to the Khazarian centuries, have been preserved quite well. Ancient terraces located higher up are quite poorly preserved. It is possible to find only small fragments of them in most river valleys.

In the strip where mountains and plains meet, the main terrain formed by rivers and even large ravines and gorges is the accumulation cones. Cones differ in size, morphology (appearance on the terrain) and a number of other characteristics depending on the water content of the rivers, volume of the flood, tectonic regime of the contact zone of the mountains and plains, and finally the characteristics of terrain development. Flattening cones are widespread in the Araz plain. The largest flattened cone on the territory of Azerbaijan is the ancient cone of the Araz river.

The river network is very dense, but most of the rivers are small mountain ones. River waters flowing through the rocks of different denudation characteristics form river valleys that differ from each other in terms of depth and morphology. Most of the valleys have a mixed nature, mainly consisting of several old and young areas. Young areas are usually characterized by deep cuts of river valleys and steep slopes, while old valleys are wide and terraced. River valleys are very similar to each other in terms of the number, height and location of terraces on the slopes.

All river valleys are characterized by a general expansion in the direction of the flow and subsidence of flooded terraces. However, the parts of the river valleys that cut troughs and depressions are an exception. Here, the valleys widen a bit, their cutting depth decreases.

River valleys can be divided into several parts according to their morphological characteristics. The top is usually V-shaped, with steep slopes and a longitudinal bottom section. The bed of the river is full of huge gambars and crevices of rooted rocks. There are no accumulative terraces, there are slightly noticeable erosional outcrops on the slopes. The sources of some rivers are located in the development zone of ancient glaciation, as a result of which their valleys have the most sharply divided slopes.

In the lower reaches of most of the rivers, the widening of valleys with a hollow structure is noted, and accumulative and erosion-accumulative terraces (one or several) of different ages and heights are found.

In the transition from mountains to plains, river valleys often assume a V shape and terraces are not developed. However, there is an alternation of narrow and wide areas. The transverse profile of the river valleys is characterized by the presence of steep walls in the lower part of the younger sections, in contrast to the older areas in the upper part of the slopes. Erosion ridges of small width are clearly visible on the slopes.

The lower part of river valleys is located in the zone of sloping plains. The depth of the valleys sharply decreases in the areas where the rivers come out of the mountains (often up to 1 m), then the valley widens with the increase of depth in the direction of the Araz river valley (the depth of the valley is 10-55 m).

1.2.2 Ravines

Ravines, usually in the arid-denudation lowlands, sometimes form a dense network in the sloping plains and break up the surface. These are the typical erosion forms of the Araz plain. In some areas, the density of the ravine network reaches 2-3 km/km2 or even 4-6 km/km2.

The depth of the vast majority of ravines in the plains is 3-5 m. In the foothills, this figure reaches 10-20 m and even 30-50 m.

Most of the ravines are primary ones, developing in the deluvial-proluvial, alluvial-proluvial sloping plains, on the slopes of monoclinal and anticlinal ridges. In many cases, “bottom ravines” are developed. Most of them have a stepped longitudinal profile.

In addition to ravines, gobos are also widespread in the above areas. However, the area where gobos of different sizes are typically distributed is Harami and partially Arazb plains. Here, gobos are the most widespread form of erosional terrain, forming a typical “gobo terrain” that stands out from the rest of the areas due to its morphology.

1.2.3 Badland

As the name suggests, badland areas are slopes that are fragmented to the maximum possible extent by erosion furrows, ravines, and clay karst forms, devoid of soil and vegetation cover. Such slopes are typical of the lower reaches of the Hakari river at the south-western edge of the Araz plain. The areas where Badland is developed consist of sediments of Pliocene and Lower Pleistocene age – oil clays, sandstones, cherts and conglomerates. As a rule, the main development zones of badland belong to the hard slopes where these rocks are located. The oiliness of the clays and the hardness of the slopes are favourable for the formation of surface flows during the rainy season. Due to the development of pseudokarst in some places, the atmospheric water infiltrates to small depths, destroys the slopes composed of clay layers and increases the degree of fragmentation of the slopes.

1.2.4 Karst

Although the karst process is more or less developed in the mountainous zone of the region, the typical karst landscape is spread over very small areas (only in areas where carbonate rocks are distributed). The karst process occurs mainly in the watershed of the Karabakh range, in the north-eastern slope (Aghdara, Aghdam, Khojavand, Hadrut districts), in the south-eastern slope (Fuzuli, Hadrut, Jabrayil districts), in Susuzlug and Hochaz ridges where thick carbonate rocks come to the surface or lie at a shallow depth. Many small caves, shafts, wells and other forms are spread in areas where karst rocks are spread. Among them, Azykh, Taghlar and other caves and groups of caves are located in Khojavand, Lachin, Kalbajar and other districts. In these areas, the typical surface (terrestrial) forms of karst (steppes, gyps, etc.) are also observed but are poorly developed. Although individual karst areas are not very large, they have their own hydrological and hydrographic characteristics. In massifs and plateaus consisting of karst rocks, rain and snow water mainly seeps underground. Usually, karst massifs are characterized by abundant underground water and springs.

1.2.5 Gravitational landforms

Landslides, avalanches, avalanche cones and plumes have developed under favorable geological and geomorphological conditions under the influence of gravity in the mountainous zone of Karabakh.

Landslides are relatively rare in the area. The reason is the wide spread of volcanic rocks. Most of the observed landslides involve deluvial and deluvial-proluvial sediments. Therefore, rock masses subjected to landslides are not thick. Such landslides are mostly found on the banks of rivers, partially at the foot of slopes, in areas where the thickness of the deluvial sediment cover has increased. In addition, landslides covering thick layers of volcanogenic-sedimentary rocks were also recorded in some areas. They are particularly common in the zone where ophiolite rocks come to the surface. Widespread landslides are observed in the Hakari river basin.

Avalanches are observed in all river basins, being more frequent on steep slopes in the mountainous zone. In the foothills and plains, avalanches occur on the steep slopes of river valleys and ravines. Avalanches occur mainly under the influence of slope collapse and seismic events. In the plain zone of the region, avalanches develop along the banks of loose rocks of some rivers and on the slopes of large ravines.

Avalanche cones and plumes do not differ significantly from avalanches in terms of their formation mechanism. Avalanche cones have developed mainly in high and medium mountain zones. They are also common in the lowlands and foothill plains and belong to the ridges, hills and slopes of river valleys. Clay debris is mainly observed in high mountains, and gravel debris is mostly observed in medium and low mountainous areas. Avalanche cone products are collected at the foot of steep slopes and create special terrain forms. Among these forms, the cones, developed at the foot of the steep slopes, occupy a special place. At the foot of steep slopes with developed vegetation, cones are not found. The Murovdagg range is the typical distribution area of Avalanche cones and plumes. Avalanche cones are divided into two groups, old and new, according to their age. While the surface of old cones is usually covered to varying degrees with herbaceous plants, the surface of new cones is bare. In the basins of flooded rivers, the abundance of cones increases the probability of flooding.

1.2.6 Accumulative-denudation landforms

The wide terrace plains created by the great rivers of the region in the depressions are of accumulative-denudation origin. The Gorus Plateau developed over a large area in the Hakari river basin and its southeastern continuation, the Gubadli plateau, are the largest accumulative-denudational plateau plains of the region. These are the accumulations that took place in Paleohakari and its tributaries (these rivers created a network of valleys reaching a depth of 300-400 m in the Middle Pliocene) as a result of a considerable rise of the local and regional erosion base in the Akchagyl age of the Upper Pliocene, and probably due to the weak burial of the Lesser Caucasus Mountains. These plains are composed of large fragmented pebbles and products of volcanic eruptions, especially their wash debris, and partly of travertine. The accumulation surface is generally undulating and inclined to the south. In the central and southern parts of the basin, those young volcanogenic and continental sedimentary layers are thicker in the river valleys formed before the Upper Pliocene and become much thinner in watersheds.

At the end of the Pliocene and the Quaternary period, the increase in the general uplift tendency in the area increases the deepening erosion activity of the Hakari and Bazarchay (Bargushad river), as well as their tributaries. Also, the formation of smaller valleys by regressive erosion from the slopes of the deepening river valleys has led to a gradual fragmentation of the ancient accumulative surface. Currently, these ancient accumulative plains are a sloping plateau cut by valleys with a depth of 50-100 to 300-400 m and a height of 400-1,200 m.

APPENDIX 2B: SOILS BASELINE REPORT (BAGHIROVA, B., 2023)

1.1 Territories liberated from occupation

A total of 207,000 hectares (30.4%) of the previously occupied lands can be used for cultivation, 54,700 hectares (8.0%) for perennial crops, and more than 380,000 hectares (55.9%) as pastures that may be of special importance in the development of animal husbandry. Most of the pastures are made up of summer pastures. 37,800 hectares of the land under perennial crops are vineyards, one of the most profitable areas of agriculture, more than 2,000 hectares are orchards, and the rest are mulberry plantations, which are of exceptional importance for the development of cocooning, and other perennial crops. 128,200 hectares of agricultural land, 80,500 hectares of arable land, and 38,200 hectares of the area for perennial crops are irrigated.

The influence of soil-cultivating factors, the diversity of natural conditions and the development of ancient farming culture have led to the formation of a complex soil cover in the previously occupied territories. Areas higher than 3,500 meters above sea level have almost no soil cover here. In these areas, there are faint traces of the initial soiling process on the sunny parts of the steep cliffs and stony-gravel steep slopes. Since the soiling process is only at an initial stage, they are not so different from rocks, with only mosses found in favorable places.

The mountain-meadow soil type was formed under the alpine and subalpine meadows at the altitudes of 2,000-3,200 meters above sea level of the Lesser Caucasus Mountains. The influence of the soiling process, the physical and chemical characteristics of soil composition, and other factors have caused the formation of the following soils in the area: primitive mountain-meadow, grass-peat mountain-meadow, grass mountain-meadow. Mountain-meadow soils are very rich in organic matter, its amount in the upper A layer is 10-15%, sometimes even more, and it decreases sharply with depth, nitrogen content is 0.50-1.16%, pH = 4.7-6.1. The total of active temperatures is lower than 800o C, the average annual temperature is – 12o C, the absolute minimum temperature is - 24-30o C, the absolute maximum temperature is 17-19o C, the annual amount of precipitation is 1,000-1,300 mm. These lands are characterized by high productivity, they can be used mainly as summer pastures, partly as mowing land, planting (plowing) is strictly prohibited. Care must be taken even in using them as pastures. Otherwise they may be subject to the erosion process.

From 700 to 2,000 meters below the alpine and subalpine zone, a mountain-forest zone is located in large areas on the northern and northeastern slopes of the Lesser Caucasus in medium and low mountainous areas. According to its geo-botanical composition and moisture conditions, the zone is divided into two subzones: mesophilic and xerophilic forests. The mesophilic forest subzone covers the upper part of the forest belt and is characterized by a mild warm and humid climate. This diversity has led to the formation of the main brown mountain-forest soil type, which is relatively widespread in the forest belt, and brown mountain-forest soils under the xerophilic oak-beech forests, which have dry and moderately warm climate characteristics.

Although these lands have high fertility, they cannot be widely used in agriculture because they are mostly covered by forests. Only the relatively flat areas freed from the forest (clearings) can be used mainly for the cultivation of grain and fodder crops.

The lands being studied as part of our research are located in Jabrayil district, which is part of the Zangezur economic district. The region belongs to the zone of xerophilic forests and dry subtropical steppes. The landscape of the zone is characterized by xerophilic forests, shrubs, and grass-steppe plants. Since vegetation mainly consists of drought-loving sparse forests and bushes, it has sufficient illumination of the area with sunlight. Of forest trees, the oak-beech association is dominated by partly pistachio-juniper forests and sybrek-type bushes. The climate here is characterized by dry, very hot summers and mild winters.

The following soil types are mainly distributed in the zone: mountain gray-brown (chestnut), grass-brown, mountain-black soils. The soil types in the study area are: undeveloped mountain gray-brown (chestnut), consolidated mountain gray-brown (chestnut), mountain gray-brown (chestnut) and colluvial sand sediments of the slopes and riverbed sediments.

Mountain gray-brown (chestnut) soils are spread over large areas (200-400 m) in the dry steppe foothills and low mountain areas of the Lesser Caucasus and Karabakh. Mountain gray-brown (chestnut) soils are formed on hard limestones, limestone conglomerates, marls or deluvium of pebbly-clay carbonates in mid-mountain zones.

Vegetation consists of oak forests and forest thickets. The forests have been cut down, well-developed understory plants (hawthorn, cranberry and alder) and grass have developed.

The following sequence of genetic layers is characteristic for these soils: AO-AUzv-Ayvz (p)-Bmca (pve)- Btca (vep)- CcaL. The AO layer with a thickness of 1-2 cm is slightly deformed, the structure is soft. In non-forested and dry areas, the AO layer is absent.

The humus layer has a thickness of 15-28 cm, is alkaline or brownish-brown in colour, has a nut-ball or granular-ball structure. As depth increases, it becomes larger or acquires a cloddy structure. This layer contains many woody and herbaceous roots and rhizomes, caprolites and worm tracks. The mechanical composition is clayey and heavy loamy, gravel is found in the lower part. It does not boil under the influence of HCl.

Mountain gray-brown (chestnut) soils are rich in absorbed bases and its total Ca is 85-90%. These soils are carbonated along the entire profile, and the soil (pH=7.2-8.3) has a moderately alkaline environment. Mountain gray-brown (chestnut) soils are rich in compounds (nutrients) for the normal development of agricultural plants, so they are suitable for viticulture, grain growing, fodder growing, fruit growing, tobacco growing, potato growing, vegetable growing, melon growing, cocoon growing, etc. Although it is not considered very suitable for cotton, it can even be used in cotton cultivation.

Mountain gray-brown (chestnut) soils are common in only a few areas. Coarse-grained effusive weathering products of Jurassic and Cretaceous rocks and bouldery chert-garnet deposits containing large amounts of arite and erosite minerals dominate as soil-forming rocks.

Mountain gray-brown (chestnut) soils differ in some morphological structural features. These are a relatively high humus layer (AU-10-15 cm) that transitions sharply to a lacy flour-like layer (Bdc) consisting entirely of fine gypsum crystals with a slightly sedimentary admixture. Usually, cones from the late strata are replaced by large tuffaceous sediments. The distribution of $CaCO_3$ along the profile in the described soils is different from other mountain gray-brown soils.

Carbonates are less noticeable in the upper (AU) layer of late mountain gray-brown (chestnut) soils. A high amount of $CaCO_3$ is noted in the upper part A/B of the layer (8.2–10.5%). The granulometric composition of these soils is characterized by a sharp variegation, which depends on the distribution of late soils in different forms of terrain and depth of the late layer. These soils are not saline.

In some cases, B-BC layers consist entirely of late derivatives.

These lands are used very little in agriculture. Most of these lands include raw and long-term fallow areas. The soils we have described have been widely used under grape plantations in recent years, as they are very demanding on gypsum and carbonates in the soil.

1.2 Quality characteristics of soils

The lands that were occupied by the Armenian armed forces for a long time were widely used in agriculture and are different from the lands of other territories of the Republic in terms of their quality. It has been determined that most (up to 17%) of the lands included in quality group I (high quality lands) and more than 24% of lands included in quality group II (good quality lands) are located in the previously occupied territory of the Upper Karabakh economic region.

71.8% (489,000 hectares) of occupied agricultural lands are high and good quality lands belonging to I and II quality groups, 24.0% of lands belong to III group of average quality, 4.0% of lands belong to IV group of low quality lands, and 0.2% of lands belong to V group of unusable. Most of the medium and low-quality soils, 16.0%, consist of pasture lands. Quality indicators of these lands are very high compared to other economic regions of the republic.

Of course, the high quality of occupied agricultural lands also had an impact on productivity. Studies show that up until 1990s, compared to other regions, the yield per hectare for grain was 11-18 quintals, for potatoes 22-35 quintals, for vegetables 40-55 quintals, for melons 35-60 quintals, for fruits 40-52 quintals, for grapes 45-50 quintals.

1.3 Climate characteristics

Along with land resources, one of the natural factors that have the strongest influence on agricultural production is agro-climatic characteristics. It is no secret that the productivity of agricultural crops is highly dependent on weather conditions. Planting and cultivation of plants, vegetation period, harvesting and transportation, implementation of important agro-technical and land reclamation measures, etc. all depend on climate features.

The role of the Lesser Caucasus mountain systems in the formation of the climate of the territories freed from occupation is very important. The Lesser Caucasus mountain system is distinguished by the diversity of its climate and, in turn, has a great influence on the climate of the plain areas of the republic. Areas of the Lesser Caucasus Mountains up to 300-400 meters in height have hot summers and mild winters. The average temperature of the hot months (July, August) fluctuates between 24°-26°C, the maximum temperature is 35-37°C. The average temperature of the coldest month (January) is 1.0-3.9oC, the absolute minimum temperature is -15-25oC. In the foothills of the Lesser Caucasus, the first frosts occur in late November and last frosts occur in the middle of March.

The low and mid-mountain areas of the Lesser Caucasus Mountains in the territory of Azerbaijan are characterized by a mild climate. Here, the total of active temperatures are equal to 3,000-3,500°C. The average temperature of the warm months varies between 12-10o0, the maximum temperature between 35-38°C. The average temperature of the coldest month is 1-2oC, and the absolute minimum temperature is -27-28oC. Frost-free days last 200-230 days, frosty days are from mid-November to the latter half of April. The amount of annual precipitation varies between 300-800 mm. During the warm months, intense rainfall occurs, which are sometimes replaced by hail. Permanent snow cover does not exist, the snow that falls melts almost immediately. When the winter is harsh, the snow cover remains on the ground for 30-40 days. There are not many winds here, mostly weak and moderate winds, and their average annual speed reaches 1.5-3.0 m/s. Various agricultural sectors in the area, mainly grain growing, grape growing, potato growing, tobacco growing, fruit growing, partially sericulture and animal husbandry, can be developed. Climate features are conducive to the development of agricultural plants.

The middle and some high areas of the Lesser Caucasus are characterized by a relatively mild hot summer. The sum of active temperatures is equal to 2,500-3,000°C. Depending on the altitude and the steepness of the slopes, the average temperature of the warm months fluctuates with a large amplitude and is equal to 16-20°C. The maximum temperature reaches 30°C, and the absolute minimum temperature reaches -22-25°C, in some places even -27°C. The average temperature of the coldest months is -2-4°C. The first frosts usually start from the end of October and last until the end of April. The number of frost-free days is equal to 150-200 days. The amount of annual precipitation varies from 300 to 1000 mm and is often observed with hail, 4-6 days of hail during the year. The territory can be widely used in cereal cultivation, potato cultivation and animal husbandry. It is also possible to develop fruit growing in relatively warm areas.

We believe that it is important for the population to pay attention to some of the following issues in order to know the impact of climate conditions on agricultural production during the use of the lands. Even in ancient times, our farmers believed that the land was suitable for cultivation, namely its exposure to the sun, and planted the most important crops. Later, the development of science proved these ideas accurate. In recent times, special attention has been paid to the issue of the influence of climate conditions on many areas, especially agricultural production. From this point of view, every household (entrepreneur) should be able to assess the impact of weather conditions on production. In other words, along with other factors, weather conditions should be taken into account in the organization of the farm and efficiency of its operation. For this, first of all, farmers should know what weather factors to consider and how to obtain them.

Climate conditions also affect the specialization of production. After collecting and summarizing climate data, it is easy to determine their impact on the performance of each farm. Information about what plants should be given preference should also be taken into account. According to the studies, recent climate changes have caused considerable damage to agriculture. Excessive rainfall, hail, unexpected frosts, high-speed winds and other unpredictable climate changes have had a negative impact on the development of agricultural crops, as well as their productivity and production. However, in modern times, it is possible to fight against the negative effects of climate factors by carrying out work on agricultural fields correctly and in accordance with the relevant rules.

1.4 Literature

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APPENDIX 2C: GEOLOGY BASELINE REPORT (KANGARLI, T., 2023B)

1.1 General information

The project area is attributed to the southeastern part of the Atrvin-Karabakh megazone (Lower Araz structural zone), which covers the centre of the Lesser Caucasus mountain range and the northeastern and southeastern slopes in Azerbaijan (Figure 2.2). In the geological structure of the region, the megazone is represented by a complex of sedimentary, metamorphic and magmatic formations with a wide stratigraphic range, from rocks of Middle Jurassic age to modern sediments, and is divided into smaller (secondary) structural zones that differ from each other in lithological and structural characteristics (from northeast to southwest):

The Lok-Karabakh zone is a complex system consisting of a combination of anticlinal and synclinal structures. Volcanogenic, volcanogenic-sedimentary and sedimentary material complexes of the Mesozoic, and partially Paleogene, as well as intrusive formations, are represented in its structure. The northeastern edge of the zone is covered by the Pliocene-Holocene molasses of the Middle Kura depression, while the southwestern wing is separated from the neighbouring Goycha-Hakari zone by large counter-faults and uplifts.

The Goycha-Hakari zone is composed of Middle-Upper Jurassic, Cretaceous and Paleocene-Eocene sedimentary and volcanogenic-sedimentary rocks collected in compressed folds. In its geological structure, the Toraghaychay and Saribaba bends, which have been brought into tectonic contact and are located in a backstage manner, are distinguished, while the southwestern border is defined by the Lachin-Bashlibel fault. The southeastern part of the Amasia-Goycha-Hakari allochthonous ophiolite belt, represented by a package of tectonic covers and olistostromes, is located within the boundaries of the zone. The formation period of the covers corresponds to the Late Cenomanian to Early Santonian time interval. The sedimentary-volcanogenic derivatives of the Upper Santonian-Eocene smooth the surface of the autochthonous and allochthonous complexes together and form the neoautochthonous layer.

The Gafan zone is composed of Middle-Upper Jurassic, Cretaceous and Paleogene volcanogenic, sedimentary-volcanogenic and sedimentary complexes covered by Neogene-Anthropogenic terrestrial-volcanogenic and continental-subaerial formations. Its northeastern edge is complicated by the Lachin and Kohnataglar anticlinal uplifts and the narrow Khuzabirt syncline that separates them. The Khochaz depression occupies a central position in the zone, which is buried under the sloping Eocene-Holocene complex of the Kalbajar zone in the northwest, and its southeastern end is covered by the Lower Araz Pleistocene continental molasses. The southwestern flank of the zone is formed by the Gafan-Besitchay dome-like rise.

The Kalbajar zone covers the beginning of the Hakari and Tartar basins and, responding to the sloping eastern part of the Goycha-Ordubad graben of rift origin, is composed of Paleocene-Holocene volcanogenic-sedimentary and volcanogenic complexes, partially flattening the structural plan of the western continuation of the Goycha-Hakari zones.

The structural-material complexes of Lok-Karabakh, Goycha-Hakari and Gafan zones extend in the southeast and are buried under the continental molasses of the Lower Araz zone. The project area is located on the northwest edge of the central part of this zone and corresponds to the cover strip of the Upper Cretaceous rocks of the central Khochaz bend of the Gafan zone with Upper Pleistocene deluvial-proluvial formations.

1.2 Tectonics

The Ashagi-Araz structural zone represents a transversal emplacement depression, starting from the Migri valley and extending along the lower reaches of the Araz river in the northeast direction to the Lesser Caucasus bend. The sedimentary layer is represented by the Oligocene-Holocene molasses lying obliquely, and these rocks transversely cover the Jurassic, Cretaceous and Eocene complexes of the first three structural zones mentioned above, which dip in the southeast direction with an azimuthal unconformity. At the base of the molasses, it is assumed that there is a large fault of left displacement, which corresponds to the Palmyra-Absheron lineament zone and extends in the northeast direction.

The direction of the Lesser Caucasus structures changes from southeast to east-southeast as they approach the left bank of the Araz River, and the tendency of periclinal closure is noticeable in them. The outcrops of Paleogene-Neogene rocks, which are traced along both banks of the Araz River, are evidence of that. A complete periclinal closure of the Mesozoic structures with the Paleogene complex probably occurs on the right bank of the river, while the modern configuration of the river is related to the Eopleistocene-Holocene rocks overlying the older rocks. The Paleogene rocks involved in the geological section of the depression intrude into the lower reaches of the Hakari and Barghusad rivers in a gulf-like manner. The Oligocene formations opened on the left bank of the river extend in the northeast direction with steep angles, and further (in the territory of Iran) in the east direction. The Miocene rocks on the left bank of the river (around the village of Mashanli) lie obliquely, repeating the Oligocene stretch, and on the right bank they are cut into a transverse file.

According to the results of seismic exploration, the sub-horizontal undulating surface of the Mesozoic is located at a depth of 500-700 m and is characterized by a boundary velocity of 3 km/h. The ancient base from the Jurassic (Vs = 6.0-6.7 km/s) is exposed to a step uplift in the southwest. It rises from 6.5-7.0 km to 3.0-4.0 km around the city of Jabrayil and northeast of it.

1.3 Stratigraphy

The formations of the Jurassic, Cretaceous, Paleogene, Neogene and Quaternary periods are involved in the geological structure of the project area and adjacent mountainous areas.

1.3.1 Jura

The middle and upper branches of the Jurassic system appear around the west and northeast of the project area.

1.3.2 Middle Jurassic

The Middle Jurassic complex consists of Bayos, Bat and Kelloway floors and is composed of volcanic and volcanogenic-sedimentary rocks with a total thickness of 2,000 m.

The formations of the Bayos floor level are exposed mainly in the Lok-Karabakh zone, as well as the Okchuchay gorge (on the border with Armenia) in the south-west of the Gafan zone, in the boundaries of the Gafan-Basitchay uplift. Upper Bayos sediments (Kizilja formation) are composed of liparite-dacite porphyries and pyroclastic formations (about 360 m).

The sediments of the Bat floor are more widespread and known in the southeastern parts of the Lok-Karabakh, Goycha-Hekari and Gafan zones. The lower boundary of the floor passes along the ceiling of liparite-dacite tuffs. In some places, a basal conglomerate layer formed from fragments of liparite-dacite tuffs lies at the base of the Bat complex. The upper boundary of the Bat floor is determined by the formation of the Kelloway floor in the section. According to the characteristic features of the cross-section and fauna findings, the Bat floor is divided into Lower-Middle Bat (Dashkasan Formation) and Upper Bat (Kurekchay Formation) sub-floors.

Volcanogenic material prevails in the Bat section: Lower-Middle Bat sediments are composed of andesite and andesibasalt flows alternating with tuff conglomerate, tuff breccia, tuff and tuffites, sandstone, siltstone and argillites are present in the Upper Bat section along with these rocks. The total thickness of the Bat complex varies from 400 to 1500 m in different areas. *Oecotraustes splendens, O. ziegleri, Choffatia sp. indet., Perisphinctes cf. evolutoides, Partshiceras cf. subobtusum, Holcophylloceras zignodianum, Caliphylloceras cf. disputabile, Lissoceras ex gr. psilodiscus, Hibolites ex gr. rusiformis* and others were found in upper Bat argillites, and *Holcophylloceras zignodianum, Partschiceras subobtusum, Nannolytoceras sp. indet., Oxycerites cf. aspidoides, Syncyclonema demissum, Plagiostoma cf. harpax, Mytilus asper* were found in different sections.

The Kelloway floor is represented by a volcanogenic-sedimentary facies (Lower Kapaz sub-layer) and almost in all areas where the Bat sediments are spread, its geological section continues conformably and in some places non-conformably. It is divided into three sub-floors. *Macrocephalites macrocephalus, Pleurocephalites subtimidus* etc. in the lower sub-floor, *Reineckeia anceps, Erymnoceras coronatum* etc. in the middle sub-floor, *Peltoceras athleta, Oecoptychius refractu,* etc. in the upper sub-floor. Lower Kelloway consists of alternation of argillite, tuffstone, siltstone, shale, pebbly conglomerate and tuff, Middle Kelloway is represented by calcareous tuffite, tuffaleurolite, tuffstone, argillite, gravelite and pebbly conglomerate, and finally, Upper Kelloway is composed of tuff and calcareous tuffites. The total thickness of floor sediments varies from 65 to 325 m in different sections.

1.3.3 Upper Jurassic

In the region, the Upper Jurassic occurs with all three floors and is represented by volcanogenic, volcanogenic-sedimentary and sedimentary facies.

The Oxford sediments lie conformably on the Upper Kelloway Formations and are divided into the Lower Oxford (Upper Kapaz Formation) and Middle-Upper Oxford (Lower Galakand Formation) sub-facies, which are mainly sedimentary rocks. The Lower Oxford mainly occurs in sedimentary facies, marl, sandstone, sandy limestone, clayey tuff, argillite, occasional tuffite, tuffaleurolite, etc. and is represented by rocks (50-80 m). *Perisphinctes biplex, Calliphylloceras manfredi, Sowerbyceras protortisulcatum,* and other fauna of of Lower Oxford was found here. The Middle-Upper Oxford sediments lie conformably on the Lower Oxford Formations and consist of alternations of tuff, tuff breccia, tuff conglomerate, tuff and tuffites (300 m). In the southeastern direction, the volcanic facies are replaced by sedimentary rocks and are represented by sandy, marbled, siliceous, pelitomorphic and organogenic limestones in the Kondalanchay basin (100-130 m). These include Middle-Upper Oxford *Ptygmatis pseudobruntrutana, Pseudonerinea yailensis, P. pupoidea,* and other fauna remains.

Derivatives of the Chimeric floor are less common and are mainly observed in the Khojavand and Hadrut bends, as well as in the southwest Gafan-Basitchay uplift, and are represented by the Lower Kimerij (Upper Galakand sub-layer) and Upper Chimeric (Gonaggormez layer) sub-layers. In the north and northeast of the region, Chimeric formations usually conformably overlie the Oxford sediments, and in the southwest, in the Okhchuchay valley, they transgressively overlie the Upper Bayos volcanics. Lower Chimeric is composed of alternation of organogenic-clastic, pelitomorphic and sandy limestone, tuffite, siltstone, tuff gravelite, gravelite and conglomerates (700-820 m). Their age is characterized by faunal remains of *Taramelliceras externnodosus, Ataxioceras pseudohomalinum, Phaneroptyxis pupoides, Ptygmatis pseudobruntrutana,* *Helicokoenia variabilis etc.* The upper Chimeric complex consists of variegated tuff conglomerate, tuff breccia, tuff, tuff gravel, andesite porphyrite and sandy limestone (25-160 m). Fossils of *Trochocyathus laminus, Pygope jznitor and Terebratula angusta* of Upper Chimeric age were found in the limestones.

Sediments of the Tithonian floor are is not common in the region and mainly participate in the Gafan-Basitchay uplift in the south-west in the Khojavand bend of the Lok-Karabakh zone. These sediments are represented by the Lower Tithonian (Lower Gushchular sub-layer) and Middle-Upper Tithonian (Upper Gushchular sub-layer) strata unconformably overlying the Kimeric and Oxford complexes. The Lower Tithon consists mainly of organogenic-clastic sandy limestones (200-270 m), and the Middle-Upper Tithon consists of organogenic, gravelly and sandy limestones (60-170 m) containing fine-grained conglomerate layers. A rich Tithonian gastropod and coral fauna remains are observed in the section of the floor.

1.3.4 Cretaceous

Cretaceous sedimentary and volcanogenic-sedimentary material complexes cover a significant part of the region and are represented by derivatives of both. The Lower Cretaceous sediments are mostly observed in the northern, northwestern and southwestern parts of the region, and the Upper Cretaceous deposits are observed in the northeastern, northern and western flanks. The division is based on the typical lithological and paleontological characteristics of the section.

1.3.5 Lower Cretaceous

In the general geological section of the region, the Lower Cretaceous occurs with all levels from the Berrias to the Albian and is represented by volcanic, pyroclastic, terrigenous and carbonate facies.

Derivatives of the Berrias and Valangin floors include the lower and middle parts of the volcanogenic-sedimentary layer opened on the southwestern flank of the Gafan-Basitchay uplift, consisting mainly of volcanites (Alt Bartaz sub-layer). The geological cross-section consists of stratification of diabase and andesite porphyrites and their tuffs, tuffite, tuff conglomerate, tuff breccia, tuff gravel, tuffstone, occasionally limestone (600-800 m).

The Hoteriv floor covers the upper part of the thick Lower Cretaceous volcanogenic-sedimentary layer (Upper Bartaz sub-layer) exposed in the Gafan-Basitchay uplift of the Gafan zone and is represented by andesite porphyrites, tuff conglomerate, tuff breccia, tuffstone and limestone (200-350 m). *Terebratula acuta, Zeillerta cf. tamarindus*, *Exogyra sp*. and other fauna remains of Valanginian-Hoteriv age are found in calcareous mudstones and sandy limestones, which prevail in the upper part of the section.

The sediments of the Barrem floor (Okhchuchay formation) are exposed in the Bargushad (Bazarchay) and Okchuchay basins in the Gafan zone, as well as on the left bank of Araz, and consist of an alternation of calcareous sandstone, tuffstone, and sandy and organic limestone (340-530 m). These rocks unconformably overlie Hoteriv and even Valangin sediments and contain *Neithea dagestanica, N. atava, Terebratula praelonga, T. sella, T. acuta, Harpogodes pelagi, Lima royeriana, L. cf. undata, Belbekella multiformis, Lelleria cf. tamarindus, Waldhem aff. morrisi, Weithea dagestanica, Requenia ammonia, Monopleura urgonensis,* and other fauna remains.

Derivatives of the Aptian floor have a great thickness (up to 500 m) around the village of Dolanar in the boundaries of the Gafan-Basitchay uplift and are represented by sandy limestone, calcareous tuff-sandstone and conglomerates (Dolanar formation). Faunal remains characterizing the Aptian rocks are *Deshayesites weissi, Costidiscus pausinovosum, Duvalia* *gressiana, Pseudohaploceras matherani, Mesohibolites uhligi, Neohibolites ewaldi, etc., Acanthoplites aschiltensis subangula, Aucellina caucasica, A. aptiensis, A. nassibianri,* etc.

The Albian floor is represented in the region only by its middle and upper sub-floors and is observed in the geological section of Khuzabirt bends north of the project area (Garov formation). There was a regional hiatus in sedimentation in the Lower Albian, and because of this, the Aptian derivatives were subjected to deep washing. As a result, Middle and even Upper Albian rocks in various areas unconformably overlie Aptian, or even Barremian and Hoterive surfaces. In the geological structure, the Middle Albian is composed of tuff, sandstone, argillite, marl and crystalline limestone (25-200 m), while the section of the Upper Albian mainly consists of tuff, marl, sandstone and argillite (55-205 m). The following characteristic fauna remains were found in the Albian sediments: *Neohibolites stylioides, Inoceramus concentricus, Plicatula inflata etc., Mariella bergeri, Puzosia cf. mayoriana, P. quenstedti, Actinoceranus sulcatus, Kossmatella agassiziana, Aucellina aptiensis, Barbatia narzanensis etc., Scaphites hugardianus etc., Haustator vibrayeanus etc., Turrilites hugardi, Mortoniceras inflata, Variamussium ninae etc., Anisoceras armatum, Hysterogeras orbignyi,* etc.

1.3.6 Upper Cretaceous

Derivatives of the Upper Cretaceous are represented by their upper layers in the geological cross-section and appear in sedimentary, volcanogenic-sedimentary and volcanogenic facies.

Argillites, siltstones, sandy, clayey, gravelly, pelitomorphic, crystalline limestones, calcareous sandstones, gravelites, tuff-sandstones, tuff-conglomerates, tuff-gravelites, tuffites and andesite flows are involved in the section of the Konyak floor (Dolanar Formation) (40-100 m). Typical fauna remains of *Inoceramus inconstans, In. crassus, Globotruncana subbotinae, Striatella striata etc., Actaeonella gracilis, Trochactaeon angustatus, Protocardia cf. Hillana,* etc. are represented.

The Santon floor is present in all sections with its lower and upper sub-layers of volcanogenic-sedimentary facies (700-800 m). The lower sub-layer (Lachin Formation) is represented by tuff-conglomerate, tuff-breccia, lava-breccia, tuff-gravelite, tuffite, tuff-sandstone, tuff, silt-tuffite, andesite and andesibasalt coatings, siltstone, argillite, sandy limestones, calcareous sandstones and gravelites. The section of the upper sub-layer (Tulusdag Formation) includes clayey, sandy, clastic and gravelly limestones, sandstones, conglomerates, gravelites, occasional tuffites, tuff-conglomerates and tuff-breccias. Lower Santonian is characterized by *Globotruncana subbotinae, Globotruncanella chalilovi, and Upper Santonian Globotruncana arca, G. subarca,* etc.

The sediments of the Campanian floor (Gubadli formation) are mainly represented by carbonate facies (60-70 m). Limestone and marls (Micraster cf. schroederi, Echinocorys marginatus, inoserams are found in the lower part of the section), and sandy and pelitomorphic limestones lie in the upper part. Globotruncana arca, Heterohelix globulosa, sea urchins are found in the latter. In some areas, the section includes sandy, clayey, marly, gravelly, breccia-like and crystalline limestones that contain layers of tuff, tuffite and gravelite.

Formations of the Maastrichtian floor (Gardibaba Formation) are represented by organogenic-clastic limestones with *Orbitella apiculata* (30 m). In some sections (Dağtumas, etc.), the upper part of the carbonate layer of the Upper Cretaceous is conditionally attributed to the Maastrichtian.

1.3.7 Paleogene

Separate incomplete cuts and outcrops of Paleogene (Eocene and Oligocene) sediments of sedimentary and volcanogenic-sedimentary facies are exposed to the surface in the lower reaches of the Hakari River in the Khochaz bend southwest of the project area, and it is considered possible that they are buried under modern sediments and directed towards the northeast.

1.3.8 Eocene

Eocene sediments are limited in the area and are represented by the Lutetian, Barton and Priabonian strata.

The Lutet and Barton floors are exposed in the Hakari and Bargushad (Bazarchay) river basins and are represented by an irregular alternation of argillite, siltstone, sandstone, limestone, tuff-breccia, tuff-conglomerate and tuffites, which appear in the form of the Iskanderbayli formation of volcanogenic-sedimentary facies (200 -260 m). *Acarinina bullbrooki, A. rotundimarginata, A. triplex, Globigerinatheka subconglobata, Globigerina frontasa, G. subtriloculinoides, G. pseudoeocaena, G. inaequispira,* etc. found in the section are confirmed by faunal samples.

Clay, argillite, sandstone, gravelite and sandy limestones of Barton age discovered at depths of more than 150 m as a result of drilling in the southeast dipping part of the Khojavand bend northeast of the project area were exposed under the Quaternary or Oligocene sediments. The age of the rocks was determined by finding Globigerina azerbaidjanica, Caucasina eocoenika, C. aziderensis faunal remains.

Formations of the Priabon floor are represented by sedimentary rocks of the Dagtumas formation, which transgressively covers the roof of the Iskanderbayli formation in the Hakari river basin. Basal conglomerates lie at the bottom of the section, and the next section consists of an alternation of gravelite, siltstone, sandstone, argillite and clayey limestone (50-160 m). The age of the rocks is confirmed by typical foraminiferal complex: *Globigerina inflatiformis, G. eocaenica, G. inflata, G. pseudoeocaena, G. corpulenta,* etc.

1.3.9 Oligocene

In the geological structure of Karabakh, the rocks of the Oligocene come to the surface in the Hakari and Bargushad (Bazarchay) river basins, as well as on the left bank of the Araz around Khudafarin bridge.

The Lower Oligocene (Muganli Formation) appears on the left bank of the Hakari River to the east of the villages of Ishigli and Muradkhanli, and in the Bargushad river basin starting from the vicinity of the city of Gubadli, it extends for 20-25 km in the southeast direction along the left and then the right bank of the river, as well as the right tributary of the Hakari River is in the gorge of Gilyatagchay. Around the villages of Khojakhan, Mughanli, and Vanedli, it is found near the Araz river and covered with alluvial-proluvial rocks of the Lower Pleistocene. Creamy conglomerate-breccias (80-120 m) layered with argillite and sandstones, which make up the lower part of the cross-section of the Gilyatagchay River, lie unconformably on the Middle Eocene formations, and the upper part consists of sandstone, tuffstone, tuff, fine-grained conglomerate, conglomerate-breccias, gravelites, sandstones, tuff-sandstones, tuffites and clays (600-800 m).

In the northern direction, the basal conglomerate layer is lost from the section, and around Gubadli the section is composed of tuffstone, sandstone, siltstone, clay, gravelite, conglomerate, and sometimes different limestones, which contain lignite and gypsum layers (230-340 m). The typical mollusc fauna found here (*Lentidium donaciforme, Corbula (Lenticorbula) sokolovi* *slussarevi, Astarte trigonelloides, Cardium cingulatum, Area sandbergeri, Loxoconcha tunicata, Cutherura planchida, Trachyleberis nativa, Nonionella azerbaidjanica plana, Rotalia bessariformis,* etc.) confirm the age of the rocks.

The Upper Oligocene (Khudaferin Formation) is represented by clays, argillites, clayey limestones, sandstones, calcareous sandstones, siltstones, tuff-sandstones, tuffs, gravelites, conglomerates with occasional layers of gypsum and lignite in the Diridag field on the left bank of the Araz River (~650 m). *Glycymeris obovatus, Cordiposis incrassata, Panope heberti, Lentidium lamberti, Babylonia caronis, Cassidaria buchi, Natica hantoniensis, Globigerina bulloides, Pseudohastigerina micra, Bulimina pupoides* and others fauna indicate that the section is Upper Oligocene. Numerous boreholes drilled between Jabrayil, Fuzuli and Horadiz locations surfaced Upper Maykop sediments with similar lithology and age confirmed by characteristic microfauna at depths of 550-1,075 m and a thickness of about 500 m.

1.3.10 Neogene

The rocks of the Neogene period are represented by the formations of the Miocene and Pliocene periods, coming to the surface in the south-eastern part of the Lesser Caucasus.

1.3.11 Miocene

The Miocene complex with sedimentary facies opens in the Diridag area on the left bank of the Araz River (around Hasanli and Mashanli villages of Jabrayil district) and continues the section of the Upper Oligocene.

The Lower Miocene sediments are represented by the Diridag Formation forming a gradual transition to the Upper Oligocene in the Diridag area. The cross-section consists of clays containing marl, sandstone, siderite concretions, with layers of sandstone and marl (145 m). Neobulimina elongata foraminifera typical of the Lower Miocene were identified in the rocks.

The Middle Miocene is involved in the geological section of the Diridag area with all its regional levels.

The Tarkhan regiofloor (Khalafli Formation) is covered by a layer of sandy clays (80-90 m) containing rare layers of sand and sandstone. On the rocks, Ostrea lamellosa, Crassostrea gryphoides, Turritella aff. Turris, etc. are encountered.

Chokrak regiofloor (Hasanli Formation) is represented by alternation of very sandy calcareous and non-carbonate clays and calcareous medium-grained sandstones and less conglomerates (140 m). In sandstones and clays: *Congeria sandbergeri, Loripes dujardini, Parvicardium hispidiforme, Donax natjurus, Turritella gradate,* etc. were found.

The sediments of the Karagan regiofloor (Mashanli Formation) consists of clays supporting pebbly sandstone layers (130 m). *Spaniodontella, Otolithus corius, Discorbis arculus* are registered here.

The Konka regiofloor (Alikeykhali formation) is represented by the freshwater-continental facies and is expressed by sands and sandstones (40 m) retaining clay layers. *Mytilaster incrassatus, Dorsanium duplicatum, Hydrobia kubanica,* etc. is encountered.

The total thickness of the Lower-Middle Miocene complex opened in the Diridag area is about 400 m.

The Upper Miocene is represented by the Sarmatian stratum (Caylagchakmag formation) occurring in the freshwater-continental facies in the Diridag area and consists of clays supporting sandstone layers (115 m). Rocks of the same age and similar composition are involved in the section of numerous bore wells dug in the Arazyan and Karabakh plains.

1.3.12 Pliocene

Within the region, the Pliocene formations are represented by the upper Akchagil regiofloor and are in the sedimentary facies. According to the results of borehole excavations, Akchagil rocks of marine origin in the Araz plain are located under continental molasses of the Quaternary period and are composed of alternating layers of clay, sand, sandstone, sometimes gravel and conglomerate (230-480 m).

1.3.13 Quaternary period

Sediments of the Quaternary (or Anthropogenic) system represented by all divisions (Eopleistocene, Pleistocene and Holocene) are distributed in the continental molasses facies mainly in the lowlands, foothills and plains of the region.

1.3.13.1 Eopleistocene

Derivatives of the Eopleistocene branch represented by the Absheron regiofloor extend in the form of a narrow strip along the left bank of Araz, and are also distributed in the Bargushad and Hakari basins. The composition of the regiofloor undergoes lateral facies changes from northwest to southeast.

In the Hakari valley (downstream), the Hakari formation consists of mixed alluvial, deluvial, proluvial, fluvioglacial, lacustrine and pyroclastic formations. As you move away from here, the role of pyroclastic rocks gradually decreases. In other areas where the stratum is spread, its composition consists of clay, sand and gravel layers, layers and sediments (30-200 m) that contain volcanic ash, as well as diatomite. In some places, they are in complex interaction with each other. The upper layers of the formation are believed to belong to the lower part of the Lower Pleistocene.

The Eopleistocene thick volcanic ash and ash tuff, stretching from southwest to northeast along the coast of the Araz River and represented by the Araz Formation, is composed of conglomerate, gravel, sand, silt, and clay (200-250 m). The lateral transition zone between the Hakari and Araz formations is buried under the Pleistocene sediments. Typical gastropods in clay and silts – Buthinia aff. tentaculata, Melania ex gr. rhodensis, Pisidium cf. amnicum, valvata sp. were found. According to the data of geological planning and borehole drilling, pyroclastic rocks in the northeastern part of the Araz and Karabakh plains are missing from the section, and the stratum consists mainly of sand, loose sandstone, gravel, clay, sometimes limestone and marls (160-260 m). Helox (Helicella) aff. in limestones. criceturum and Planorbis margaritatus faunal remains are found.

1.3.13.2 Pleistocene

The Pleistocene floor is represented by continental molasses (alluvial-proluvial, deluvial, deluvial-proluvial, fluvioglacial formations) in the Araz plain and is divided into Lower, Middle and Upper Pleistocene sub-floors.

The Lower Pleistocene covers large foothill areas and is also spread in the Hakari (middle and lower reaches), Bargushad, Okhchuchay, Basitchay basins, and consists of alluvial-proluvial formations (containing sand and clay layers) unconformably lying on top of the Araz and Hakari formations and older complexes. (25-30 m). Volcanic ash and pumice layers are observed in the lower part of the section in the southwest of the lowland plain.

The Middle Pleistocene is represented by the Khojakhan formation with volcanic-sedimentary facies in the form of outcrops protected from erosion in isolated places in the Bargushad-Hakari river valley. On the right bank of the Hakari river, around the village of Khojakhan, they are composed of tuff breccia and tuff conglomerates, andesite and andesibasalt lava flows layered with sandstone and clay layers located on the Hakari formation (170-210 m).

The Upper Pleistocene is represented by deluvial-proluvial clay, sand and clay in the Araz plain (5-30 m).

1.3.13.3 Holocene

Holocene sediments in the area include alluvial and alluvial-proluvial formations of river beds (pebbles, gravel-pebbles, boulder-pebbles filled with sand, sands, sands, clays), deluvial-proluvial, eluvial-deluvial sediments accumulated in the valleys and mountain slopes of some low mountainous areas. Their thickness varies from 1-2 m to 20-30 m in different areas.

1.4 Magmatism

Magmatism, which is the most important form of manifestation of the Earth's internal activity as a result of deep heat-mass transport, occurred many times in the Kimmerian stage, which differs in the geodynamic conditions of the history of the geological development of the Caucasus and is represented by continental, transcontinental and oceanic magmatism, as well as their types. The territory of the region belongs to the Central volcanic-plutonic belt of the Lesser Caucasus. Magmatic derivatives of different age and composition of this belt occupy an important place in the geological structure of Lok-Karabakh, Goycha-Hakari and Gafan zones. Derivatives of these zones open around the northwest of the project area and are buried under Pleistocene continental molasses of the Araz plain in the southeast direction. Taking this into account, the involvement of magmatic derivatives of different ages and shapes in the deep geological structure of the project area is possible.

1.4.1 Mesozoic magmatic formations

The Mesozoic magmatic formations in the region were formed in the Middle Jurassic, Late Jurassic-Early Cretaceous and Late Cretaceous periods and were mostly composed of basic and medium magmatic complexes.

1.4.1.1 Middle Jurassic formations

The magmatism of this period was represented by Bayos basalt-rhyolite and Bat basalt-andesite-dacite-rhyolite and gabbro-plagiogranite formations in the boundaries of the Lok-Karabahh and Gafan zones in the west and east of the project area.

The basalt-rhyolite formation comes to the surface of the earth in the limits of the Karabakh uplift, and the contrast is composed of the Lower Bayos basalt and Upper Bayos rhyolite complexes. A small outcrop of the formation is also located in the south-west of the region in the Okhchuchay valley on the border with Armenia. In the facies composition of the formation, volcanogenic-clastic rocks have a dominant role (60-65%), lavas (25-35%) and volcanogenic-sedimentary rocks (5-10%) have a subordinate role. The composition of the lava facies ranges from basalts to rhyolites, with the presence of andesibasalts and small amounts of dacites. According to petrogeochemical parameters, the rocks of the basalt sub-formation show the tholeitic trend of high differentiation of Cu, Co, Mo, Pb, Au and Ag, and the rocks of the rhyolite sub-formation show the calcium-alkaline trend of high concentration of Cu, Mo, Zn, Sn; high positive correlations of the latter can be a criterion of potential mineralization of rhyolite sub-formation metasomatites.

Basalt-andesite-dacite-rhyolite formation developed in Lachin and Karabakh structures in volcanic and volcanogenic-sedimentary facies. Lava breccia is due to the continuous differentiation composed of lava, volcanic breccias, agglomerate tuffs and tuff breccias, extrusive and subvolcanic. Lava and lava breccia flows of basalts (thickness from 2-5 to 60-80 m) make up 70% of the thickness of the section and are characterized by considerable stability and continuity, and acid vulcanites are quickly weathered. Extrusives are present in all structures and correspond to andesibasalt, andesite and rhyolite. Sub-volcanoes consist of stocks, dykes and ridges composed of dacites and rhyolites, sometimes basalts. According to their petrochemical characteristics, the basalts of the formation correspond to tholeite, and other differentials correspond to calcium-alkaline series. Vulcanites of the formation belong to sodium and potassium-sodium series. According to geochemical parameters, significant positive correlations between Ni, Cr, Mn, Co and Cu were determined for the base and middle rocks of Karabakh and Lachin uplifts. The maximum concentration of cobalt was found in the base and middle of the zone, and the minimum concentration was found in acid rocks. According to the petrochemical data, the volcanics of the formation are similar to those of the island arcs, the evolution of the primary alloy was first tholeitic, and later calcium-alkaline.

The gabbro-plagiogranite formation occurs with the Bululduz massif and its apophyses, which occupies a central position in the Shalva-Lachin intrusive group, within the boundaries of the Lachin anticlinal uplift (156 ± 1.5 million years). It is intrusive and formed in two phases: the first phase (up to 2%) – gabbro (gabbro, gabbro-diorites, sometimes quartz diorites), and the second phase (up to 98%) plagiogranites (plagiogranites, quartz diorites, granodiorites, granites). The variations of the chemical composition of the rocks correspond to the trend of the calcium-alkaline series with increasing silica and alkalinity and decreasing iron content. Most of the ore elements, Cu, Pb, Zn, are close to clark, while Cr, Ni, W, Mo are below clark.

1.4.1.2 Late Jurassic-Early Cretaceous formations

The basalt-andesite-dacite and gabbro-tonalite formations correspond to the magmatism of this period within the borders of Lok-Karabakh and Gafan zones.

Volcanogenic derivatives of the basalt-andesite-dacite formation are widespread and represented by lower basalt-andesibasalt and upper andesite-dacite complexes. The composition of the formation includes the rocks of the Middle Jurassic Kelloway floor, which forms a unit with Oxfordian volcanic derivatives. The Early Cretaceous volcanics of the formation are almost indistinguishable from their Late Jurassic equivalents and form a single Kelloway-Early Cretaceous complex composed of andesite, andesibasalt-rich lava and volcanic-clastic cover with alternating sets of rifogenic limestones. Among the rocks of the formation, the most widespread medium types are andesibasalts, andesites, slightly less basalts, and the least common are sour types of dacites, rhyodacites, rhyolites). According to geochemical characteristics, Ni, Y, Yb, Cs, Cr, Zn, Pb, Mo in the rocks are below clark, and Co is twice as much as clark; the distribution of the latter conforms to the normal model. Cu is high in pyroclastic facies, low in lava and subvolcanics. Its higher amounts are found in rooted facies and rocks enriched with sulphide ore minerals. The rocks of the formation also contain high amounts of Sc. The sub-volcanic facies is represented by small extrusive domes, sills and dykes of andesite and andesibasalt composition. The hypabyssal intrusives located in the Gafan-Basitchay uplift are composed of granodiorite, gabbro, diorite, quartz diorite and their various types, together with effusives form a volcanic-plutonic association.

1.4.1.3 Late Cretaceous formations

Trachybasalt-trachyandesite formation and subalkaline gabbroid complex were formed in the Late Cretaceous period in the Karabakh region.

Derivatives of trachybasalt-trachyandesite formation cover large areas in Khojavand, Hadrut and Khochaz bends. Volcanites composed of different types of basalts in the Khojavand depression have a regional distribution and their thickness varies from 4 m on the edges to 600 m in the area of the volcanic centers. At the limits of the Hadrut bend, the volcanogenic formation consists of lava and lava breccias of basalts, as well as tuff breccia, agglomerate and crystalloclastic tuff, with a thickness of 235 m. Subalkaline rocks are widely developed in Khochaz depression, andesites are also found. In the petrofund of the formation, the presence of sub-alkaline picrobasalts, as well as potassium-alkaline basalts - olivine tuffites, leucite tephrites, andesites and dacites in the Hadrut depression, and andesites in the Khochaz bend were determined. In general, typomorphs for such structures are picrobasalts, basalts and andesibasalts with different alkalinity, sour rocks and andesites are occasionally found. Petrochemical characteristics of the rocks are: predominance of subalkaline and alkaline series, the high content of K2O and Na2O, as well as TiO2 and P2O5 has enabled us to determine the indicator types of rocks and similarity of their parameters to those of mature island arcs and continental collision zones.

In the volcanites of the Khochaz depression, consisting of trachybasalt and andesite complexes, despite all their differences, the inheritance of a number of chemical and petrochemical parameters allows them to be considered as derivatives of a single magma. According to the complex of geological and petrogeochemical parameters, the main mass of effusives consists of the alkaline olivine-basalt series, which determined the formation nature of the Late Cretaceous sediments of the depression. In general, these volcanites can be compared to the subalkaline series of riftogenic structures.

The complex of subalkaline gabbroides developed in the form of small intrusives that are the cumulative remnants of the initial magmatic melt in the Khojavand depression, where trachybasalts are widely represented. Also, the Shalva intrusive (78±2.5 million years) belonging to the Shalva-Lachin intrusive group occurs within the boundaries of the Lachin anticlinal uplift. Petrochemically, subalkaline gabbros can be regarded as the beginning of the tephrite-trachybasalt-trachyandesite series and belong to ultramafic rocks with increased alkalinity. But in the case of a clear predominance of the main plagioclase, they belong to gabbroids due to their modal mineralogical composition. It is assumed that they correspond to the ultrabasic cumulates of the bottom parts of the intrusive masses.

1.4.2 Ophiolite association of Goycha-Hakari zone

The ophiolite association is a joint, classically expressed belt of hyperbasite, gabbroide and effusive-radiolarite complexes in the space-time framework. It consists of a narrow trough and is fully and widely developed in the Goycha-Hakari zone controlled by the Lachin-Bashlibel fault. The complexes that make up the association belong to the oceanic crust and have allochthonous deposition. Two tectonic plates are separated in its structure:

– the gabbro-serpentinitic sub-Silk cover is composed of serpentinized dunite, harsburgite, lherzolite, troctolite and gabbro (~1000 m); The absolute age of gabbroids determined by the Sm/Nd method is Late Triassic (Karni, Nori);

– the volcanic-sedimentary upper Nagdali cover consists of tholeiitic, diabase and aphyric basalts and carbonate-siliceous and siliceous rocks alternating with them, radiolarites, jasper and Late Jurassic-Early Cretaceous micritic limestones (1500-2000 m).

At the base of the Silk cover, it forms a gradual transition with the autochthonous Albian-Cenomanian complex and consists of a chaotic assemblage of hyperbazilts, gabbroids, effusive-radiolarite series, emplacement rocks and metamorphic rocks of the Pre-Jurassic basement.

Hyperbasite outcrops in the Goycha-Hakari zone have been subjected to various degrees of metamorphism and tectonic changes. Metamorphism is expressed by primary anhydrous iron-magnesium silicates, hydrous magnesium silicates, and the serpentinite group of lizardite, chrysotile, antigorite minerals. Due to the presence of regenerative gases (H2, CH4, CO2) brought by fluids – due to the impact of primary and endogenous processes, as well as stress deformations, derivative, hydrothermal-metasomatic – there is late serpentinitization of different depths.

The gabbro complex consisting of gabbro, gabbro-norite and norite forms a “transition zone” – feldspar peridotites, olivine gabbro and troctolites in the contact zone with hyperbasite. Such derivatives are related to the complex multistage metasomatic processing of ultrabasite under the influence of gabbro intrusives.

The effusive-radiolarite complex covers different horizons of the hyperbasite-basite cover and rarely lies directly on the olistostrome layer. According to the structural features and paleontological data, two unconformable layers are distinguished in its composition:

– alternation of lava flows with Upper Jurassic corals and sometimes sandstones (Late Jurassic-Early Cretaceous) siliceous rocks;

– siliceous rocks with horizons and beds and gravelite, sandstone and ultramafic rocks, various effusives, as well as small clastic breccias consisting of plagiogranite and gabbro (Late Cretaceous, Early Senonian).

The presence of different age and different effusive-radiolarite types in the uplift and their density in the cross-sections do not allow us to follow the sequence of their manifestation.

1.4.3 Cenozoic magmatic formations

Manifestations of Cenozoic magmatism in the Karabakh region are represented by Paleogene, Neogene and Late Pliocene-Holocene age formations developed in the Goycha-Hakari, Gafan and Kalbajar zones within the Central volcanic-plutonic belt of the Lesser Caucasus.

1.4.3.1 Paleogene formations

The magmatism of this period was represented by the basalt-andesite-dacite-rhyolary and gabbro-diorite-granodiorite formations of the Middle-Late Eocene and granosyenite-granite formations of the Oligocene-Early Miocene.

Basalt-andesite-dacite-rhyolite formation derivatives are located in Kalbajar, Galaboynu and partially Mikhtokan bends in the northwest of the project area. In these depressions, volcanism occurred mainly in the Middle Eocene, and in the Late Eocene, it was weakly manifested and expressed by volcanogenic and volcanogenic-sedimentary layers. The lower volcanogenic layer (Middle Eocene) consists of agglomerate lavas and lava breccias of basalt, andesite and dacite with volcaniclasticites, and the upper layer (Upper Eocene) is represented by tuffogenic-sedimentary derivatives that contain andesite lava flows. According to their petrochemical properties, the rocks of the formation belong to calcium-alkaline (less tholeiitic) and subalkaline (relatively alkaline) series. The base and middle members of the normal and subalkaline series are geochemically characterized by fairly wide values of non-coherent elements such as K, Na, Li, Rb, Sr, U, Th, and values of Cr, Co, Ni, Ti below Clark. The low value of Ni/Co ratio (<15) shows that they correspond to island arc derivatives. Small values of K/Rb and Ba/Sr ratios indicate the active participation of the earth's crust in the process of magma formation.

The gabbro-diorite-granodiorite formation is observed in the form of Middle and Late Eocene intrusives in the areas where the Upper Cretaceous and Eocene complexes are spread within the borders of the Goycha-Hakari zone. Also, the Keshishtepe intrusive (45±1.5 million years) belonging to the Shalva-Lachin group occurs within the boundaries of the Lachin anticlinal uplift. The Middle Eocene intrusives developed in the form of slag-like elongated igneous masses. They were formed in one phase of magmatism and consist of gabbro-diorite and diorite in the central parts, and porphyry varieties on the edges. Late Eocene intrusives form massifs of stock, discordant bodies and laccolith-like formations. They were formed in three phases and are represented by appropriate facies sequences: 1) gabbroid phase - gabbro-diorite-monsodiorite-syenite-diorite-diorites; 2) granitoid, phase – quartz diorite-granodiorite-adamellite-granites; 3) phase of porphyry-like granites - diorite porphyry-granodiorite porphyry-granite porphyries. Dykes are arranged in diabase, diorite-porphyry and aplite. The rocks of the first intrusive phase have undergone contamination processes and correspond to hybrid derivatives. The calculation of the petrochemical parameters of the Middle Eocene-age intrusive rocks allowed us to determine their correspondence to the high aluminum, potassium and potassium-sodium calcium-alkaline series. Late Eocene intrusives of Asia correspond to Middle Eocene rocks only with a relatively high degree of oxidation of the crystallization environment. According to their geochemical parameters, the Middle Eocene intrusive rocks have low values of Be and Ba, as well as Co, Ni, V, Mn and NTE, the Late Eocene gabbroides of the intrusive complex are high for Be, low for Ba, and low for Cr, Co, Ni, and V. The complex as a whole has weak radioactivity.

The granosyenite-granite formation emerged with its plutonic phase from the two-phase Delidag granitoid batholith (30-35 million years, Oligocene-Lower Miocene) which is 4-6 km wide and extends 20 km to the southeast at the source of the Tartar river in the northwest of the project area. The rocks of the first syenite-diorite phase are spread in a small amount, cover the hypabyssal part of the intrusion and have a hybrid character. They consist of syenite, granosyenite, quartz syenite, quartz syenite-diorite and their biotite and amphibole types. Derivatives of the second granite-granodiorite phase make up the main part of the massif and are composed of biotite granite, granodiorite, granite-aplite and quartz syenite. According to its petrochemical properties, it belongs to the normal and sub-alkaline series of calcium-alkaline rocks. The presence of petrographic parameters in the facies sequence of the differentials reflects their compatibility and proximity to the primary uniform acidic magma that underwent differentiation. According to geochemical studies in the rocks of the Delidag intrusive, there has been an increase in the amount of radioactive elements from the early phases of syenite-diorites to later ones – granites and granosyenites, and this is probably related to the potassic metasomatosis of the late phase of intrusive activity. The amounts of Co, Ni, and Ti are 2-3 times higher for acid rocks than for clark, and Mn and Cr are lower.

1.4.3.2 Neogene-Anthropogenic formations

The Neogene-Anthropogen volcanic formations corresponding to the collisional stage of the Alpine evolution of the Lesser Caucasus developed independently in the areas where the Paleogene volcanism spread spatially within the boundaries of the Gafan and Goycha-Hakari zones. The magmatism of this period is represented by Late Miocene andesite-dacite-rhyolite, Late Pliocene rhyolite and Late Pliocene-Holocene trachybasalt-trachyandesite formations.

The andesite-dacite-rhyolite formation occurs in the intrusive and volcanogenic-sedimentary facies located in the Kalbajar depression. Volcanogenic-sedimentary formations are represented by two layers: the lower layer is composed of medium and acidic volcanics belonging to the Late

Sarmatian – andesite, sandstone, liparite, liparite dacite flows and their tuffs and tuff breccias, and the upper layer of Meotis-Pont age is megaplagioporphyry andesite, andesidasite, dacite, consists of rhyodacite, rhyolite, quartz latites and their pyroclasts. The subvolcanic facies consists of andesidacite and rhyodacite laccolite and stucco-like masses of Nardivan, Keti, Gizilgaya areas. Hydrothermal-metasomatic processes expressed by propylitization and quartzization of acid rocks are typical for the formation. Andesites, trachyandesites and quartz latites are most common in the petrofund of the formation. The petrochemical parameters of the rocks allow us to consider them to be close to the subalkaline latite series, corresponding to the normal and subalkaline series of the calc-alkaline series. The subalkaline role in the geochemical composition of formation rocks belongs to alkaline (Rb, Li) and alkaline-earth elements (Ba, Sr). With the increase of silicon, the amount of the former increases, and the amount of the latter decreases. The amount of iron group elements in acidic and medium differentials is slightly higher than the standard values for andesite.

The rhyolite formation is represented by volcanic domes and extrusive formations in the Kalbajar depositional basin, as well as lava flows and covers and small amounts of pyroclasts. Volcanic domes (Kechaldag, Big and Small Davagozu, etc.) consist of rhyolites in the base part and obsidian, perlite and pumice, which replace them in the upward sequence. The latter are a light natural type of perlite. Rhyolite volcanic glasses are divided into potassium-sodium, sodium and potassic groups based on their genetic basis. This formation corresponds to the normal series due to FeO/MgO – calcium-alkaline type, and to the K-Na series due to Na2O/K2O. Based on the geochemical characteristics of the rocks of the formation, alkaline and radioactive elements are at the Clark level for acid rocks, while Li, Zr, Mo, Pb, Sn and copper are low for the formation, i.e. not exceeding the Clark levels of acid rocks, Cr is higher than Clark, and Ni and Mg are close to Clark levels. Y and Yb from NTE are also close to Clark.

The trachybasalt-trachyandesite formation occurs mainly in the form of lava sheets and volcanic domes in the Kalbajar emplacement basin. Volcanic entities have a height of 200-350 m with a crater size of 200-250 m. Lavas and pyroclasts are involved in their structure. Volcanites are polygenic and sometimes monogenic, practically not subjected to derivative transformations. The petrographic composition of the formation includes trachyandesite, quartz latite, trachyandezibasalt, latite, trachydolerite and subalkaline basalts. Volcanites of the formation are located on the Late Pliocene-Eopleistocene rhyolirformation and were formed as a result of the activity of the Sarmsagil, Ayi-Chingilli, Galingaya, Sarchali, Kirzimidag and Dikpillakan volcanic centers and are divided into 5 age groups – Late Pliocene, Eopleistocene-Early Pleistocene, Middle Pleistocene, Late Pleistocene and Holocene.

The rocks of the formation consist of deep formations and high-pressure clinopyroxenites, amphibolites, gabbroids and quartz-alpine rocks, as well as inclusions of megacrysts of sanidine, pyroxene, amphibole and quartz, which are crustal xenoliths and xenocrysts. In contrast to host rocks, a slightly increased amount of TiO2, FeO, MnO, MgO, CaO, expressed as f=14-36, is typical for deep formations. According to the petrochemical characteristics, the poorly differentiated K-Na sub-alkaline rocks of formacyan differ from the typical calcium-alkaline series by high alkalinity and iron content, and are distinguished from K-shoshonite-latite by a low value of the K2O/Na2O ratio. A characteristic feature of the series is the transition from the olivine-normative composition of the main types to hypersthene-normative in the middle types, as well as the increase in iron content with the increase of SiO2. Geochemically, the series is characterized by high amounts of NTE, as well as Sr, Ba, Zr, F, P and uranium. It should be noted that such specificity of subalkaline basaltoid volcanoes is typical for the entire eastern part of the Lesser Caucasus. Petrochemical study of molten contents allows to determine the formation of rocks in the process of crystallization differentiation of subalkaline olivine-basaltoid magma.

1.5 Geophysical sites

The complex geological structure of the project area and the surrounding region is reflected in the distribution of local anomalies of gravity and geomagnetic field, and compared to other regions of Azerbaijan, they are distinguished by high differentiation. When looking at the distribution map of gravimagnetic anomalies, it is clear that individual local areas correspond to structures and rock complexes of the visible upper part of the geological section. Some anomalies that are inconsistent with surface geological conditions are associated with deep structural elements and igneous bodies.

1.4.1 Gravitational site

The high-precision measurement carried out in the territory of Azerbaijan made it possible to compile a generalized Bouguet anomaly map on a scale of 1:500000. On the Bouguet gravity anomaly map of the territory of Azerbaijan (picture ...) two intense negative anomaly bands are visible, which are connected with the Greater Caucasus and Lesser Caucasus ranges. These two negative bands are separated from each other by positive and non-intense negative anomalies.

In the area of the Lesser Caucasus, in the zone of intense negative anomaly, the extreme value of Bouguet anomaly reaches -160 mGal. The isolines of the Bouguet anomaly bulge to the north, generally reproducing the arcuate shape of this zone. A characteristic feature is that the minimum axis does not correspond to the highest terrain of the Lesser Caucasus mountain range and is located south of it. The central axis of this minimum, which includes the project area, extends 30 km south of Goycha Lake in the pan-Caucasian direction, and the northeastern border is bounded by the Ardabil-Lachin-Dilijan gravity step, which is the most intense in the Caucasus.

The maximum value of the Bouguet gravity field in the positive Azerbaijan anomaly, which covers the Lower Kura plain, Talish mountains and partly the foothills of the Lesser and Greater Caucasus, is 96 mGal and is located 20 km southwest of Saatli. This maximum has two overhangs as a narrower relative maximum. One of them extends to the north and then merges with the Alazan zone. The other extends to the north-west and covers Khankendi. The gravity maximum of Azerbaijan is divided into three parts of different nature, taking into account the relative maximum. The first of these is the relative maximum extending in the direction of Ganja-Tovuz-Tbilisi and is called the Khojavand-Tbilisi maximum passing through the north-eastern periphery of the project area. This relative maximum is called the Shamkir-Talysh maximum. In other words, the Shamkir-Talysh maximum covers the northwestern part of the Lesser Caucasus and its northeastern slope, including the mountainous district of Talish. The Khojavand-Tbilisi maximum covers a wide range of Jurassic and Cretaceous volcanic rocks with abundant and different ages of acidic and alkaline intrusives.

Smaller anomalies are separated inside the first-order Little Caucasus minimum. One of these anomalies is the second-order Shalva maximum located in the upper reaches of the Hakari River. This maximum also covers the eastern part of the Mikhtokan ridge.

1.5.2 Magnetic area

According to the typical anomalies (Za) and total anomalies (ΔT) of the vertical components of the geomagnetic field, the territory of Azerbaijan is divided into three parts: areas with negative values, positive values and areas with anomalies that change signs. The Karabakh region belongs to the third area, it is divided into secondary areas covering the northeastern slope and foothills of the Lesser Caucasus, which, in their own way, have separate sharp anomalies of both signs with an intensity of several hundred gammas, sometimes even 1,000 gammas.

Local negative anomalies are noted in the border highlands of Karabakh with Armenia: Big Hinaldag area (-500 gamma), Dalidag area (-400 gamma), Istisu area (-100 gamma), Tutgunchay basin (-150 gamma), Zangilan area (-300 gamma), Gubadli area (-200 gamma). In addition, there are positive value anomalies in the region

Although the areas of Kalbajar, Lachin, Shusha and Khankendi are characterized by positive anomalies (+50± +100 gamma), a negative anomaly (-300 gamma) is observed in the area between these three cities.

Despite the positive anomaly (+50 gamma) in Jabrayil district located in the southern part of the region, a high negative anomaly (-600 gamma) is noted on the border of the Islamic Republic of Iran.

1.5.3 Distribution of natural radioactivity and volume activity of radon gas

The natural radioactivity of the Karabakh territory is reflected in the integrated gamma-background created by radionuclides that have the random-possibility feature of their location in the rocks. In previous studies, we noted the lithological composition of the stratigraphic intervals of individual sedimentary rocks and the change of their radioactivity depending on their age.

The average level of radioactivity of the rocks distributed in the Lesser Caucasus is 6-8 mR/hour. Natural radioactivity indicators are based on lithology, formation, etc. of rocks and it varies depending on its properties. The rocks of the Jurassic complex are widespread in the geological structure of the project area. The lower part of the complex (Middle Jurassic) is represented by volcanogenic, volcanogenic-sedimentary, and the upper part (Upper Jurassic) by volcanogenic-sedimentary and carbonate facies. Such a wide distribution of Jurassic rocks is also reflected in the distribution of the radioactive field in the region. A strip of high radioactivity is traced along the Kalbajar-Shusha-Jabrayil line from northwest to southeast. Radioactivity here ranges from 7.5 to 10.5 μR/h.

Cretaceous rocks also cover large areas in the region. Upper Cretaceous sediments in the foothill belt, in the basin of the Tartar River, are in the terrigenous-carbonate facies, and are characterized by very low radioactivity - about 4.5-5.5 μR/h. This indicator is 4-5 mR/h in organic-crushed limestones distributed in Aghjakand and Aghdam areas. The background of radioactivity in Santon and Campanian rocks exposed along the Khojaly-Fuzuli line is slightly higher - 5.5-7.0 mR/h.

Areas of relatively high radioactivity with indicators of 6-9 mR/h are separated in places where the Paleogene (Eocene) age volcanogenic complex spreads in the Kalbajar depression.

In the project area, places where alluvial-deluvial-proluvial sediments of the Quaternary period, represented by gravel, gravel, sand, sand and clay, are spread, are characterized by very weak radioactivity - 3.5-5.0 mR/h.

All isotopes of radon, the heaviest radioactive element in the periodic system, are radioactive and decay very quickly. The half-life of the most stable radon isotope Rn222, formed during the decay of the U238 isotope, is 3.8 days, while the second long-lived isotope of radon, thoron (Rn220), which is formed during the decay of Th232, is 55.6 days.

In general, the volume of radon activity in the region is at a normal level, but its distribution on the territory is mosaic. The concentration level of radon here ranges from 30-70 Bq/m3, in some cases even 80-90 Bq/m3.

In the central part of the Karabakh zone, a band of weak radioactivity (60 Bq/m3) is traced from the north to the south, up to the latitude of the city of Khojaly. Then, along the Aghdam-Khankendi-Lachin line, the radon volume activity is relatively high in a narrow strip stretching from the northeast to the southwest and is 60-70 Bq/m3. Another strip characterized by radon volume activity of 65-70 Bq/m3 is observed between Kalbajar and Zangilan.

Another strip, characterized by the activity of radon up to 60 Bq/m3, is followed to the south, around the city of Jabrayl, where radioactivity decreases to 45-50 Bq/m3. In Fuzuli district, radioactivity drops to 30-40 Bq/m3, and in Beylagan city to 15 Bq/m3. In the northwest, around the city of Istisu, and in the south, south of Zangilan, there are small areas characterized by radon concentration of 80 Bq/m3.

1.6 Seismicity

The territory of the region is characterized by weak seismicity and belongs to the 7-point zone on the map of possible occurrence zones of strong earthquakes. Seismicity is mainly observed in the northern part of the territory. An earthquake of magnitude 7 that occurred in 1868 and was felt in the territory of Karabakh was recorded here. The last strong earthquake occurred in Zangezur in 1968 and was felt in the region with an intensity of 6 points.

In order to study the stress and deformation areas of the Earth's crust in the region, an analysis of focal mechanisms of earthquake foci was carried out. It was found that most of the studied area is prone to compression, and displacement is noted in the northwestern part of the area. Two main types of movement have been identified for the region: uplift and left-lateral horizontal displacement. The analysis of the source mechanism shows that the compression axes of stronger earthquakes are directed to the northeast, and those of weaker earthquakes are directed to the southeast.

Classification of strong (I0≥5 score) tangible earthquakes that occurred in and around the region:

<u>March 18, 1868, time of occurrence - 1830</u>

A strong earthquake was felt in the east of the South Caucasus. In Zurnabad, vertical tremors were observed with slight damage to buildings. Some houses in Shusha have large cracks. Cracks appeared in the walls from north to south due to a strong shock in Bilasuvar. In Jabrayl, cracks formed in ceilings, plaster of the walls fell off.

<u>November 10, 1916, time of occurrence – 0557</u>

A V-VI magnitude earthquake affected many locations. As a result of two vertical blows in Zurnabad, hanging lamps swayed, clinking of pots and pans was heard, the door frames trembled. In Aghdam, windows were shaking, plaster of the walls fell off. In Gindarkhan, ground shaking from north to south and it lasted 11 seconds. In Shusha, 3 shocks were felt within 3 seconds, during which the lamps were swinging, furniture was shaking, and after the earthquake, water in the wells was rising. It is possible to estimate the strength of the earthquake in the mentioned locations at V.

<u>February 19, 1924, time of occurrence - 0701</u>

A strong earthquake that occurred in the territory of South Azerbaijan was felt with great intensity (VI-VII points) in the entire Karabakh zone. 2 impulses were felt in Fuzuli. As a result, large cracks appeared in the walls of several large buildings, and houses in some villages were destroyed. The ground shaking in Hadrut and nearby areas lasted for 38 seconds. 85% of the buildings were damaged, cracks appeared in the walls, windows were broken. The earthquake was also felt in Shusha and Khankendi, where several houses were damaged.

<u>January 13, 1927, time of occurrence - 1832</u>

An earthquake of magnitude IV-VI occurred in the Karabakh zone. Strong earthquakes were felt in Shusha and Khankendi.

<u>1963, February 18, time of occurrence - 1403</u>

The earthquake occurred in the territory of Aghdam district and was felt in most parts of Karabakh with a magnitude of VI-VII. Relatively weak vibrations were observed in Khankendi, Shusha, Fuzuli, Lachin and Tartar.

<u>June 9, 1968, time of occurrence - 0056</u>

A strong earthquake was felt in all settlements of Zangezur, as well as in Gubadli-Lachin zone of Karabakh. In the epicenter, the intensity of the earthquake was I0 = VIII points, V-VI points in Lachin district, and V points in Gubadli and Jabrayil districts. The earthquake was also felt in Khankendi and Shusha.

APPENDIX 2D: HYDROGEOLOGY BASELINE REPORT (KANGARLI, T., 2023C)

The hydrogeological conditions of the region were formed under the influence of a wide range of complex and diverse natural and man-made factors. Groundwater, which is mainly distributed in mountainous areas composed of rocks of magmatic origin and continental molasses of the Kura-Araz plains, is unevenly distributed and has significant reserves. Starting from the second half of the 20th century, as a result of the anthropogenic influence, the hydrogeological conditions have fundamentally changed, the levels have dropped in areas of intensive exploitation of groundwater, the level of groundwater has risen and approached the surface due to infiltrations from reservoirs and irrigation networks, and the process of creating artificial groundwater horizons in arid areas is underway. Mineral and thermal waters are widespread in the mountainous zone. The hydrogeological conditions of the region, especially the foothill plains, have been studied and the balance of underground water and operational reserves have been determined.

1.1 Underground water bodies

Hydrogeological regions are the main taxonomic unit separated as a result of the complex analysis of hydrogeological, geological-geomorphological, lithological-facies, hydrological, climatic and anthropogenic factors in the hydrogeological characterization of territories. The following pore-crack and pore-layer hydrogeological basins are distinguished within the borders of the region based on the similarity of hydrogeological conditions, underground water resources, regularities of hydrodynamic and hydrochemical parameters: 1 – Mountainous pore-crack water basin; 2 – Karabakh plain pore water basin; 3 – Mil plain pore water basin; 4 – Araz (Jabrayil) plain pore water basin to which the project area belongs.

1.1.1 Underground water complexes

The territory of the region is characterized by the presence of a sharp division of the terrain, a thick erosion zone, rock fissures, a thin deluvial clay cover, numerous river valleys filled with alluvial and fluvioglacial sediments, and foothill plains. The distribution of groundwater in the mountainous zone, regardless of stratigraphic division, is mainly related to erosion zones and tectonic disturbances, and the water content of rocks of different ages depends on their lithological composition, fracture and drainage conditions of the area. The distribution of flow in the mountainous zones shows that underground flow is directed radially from the center of those zones to the periphery, exactly like the surface flow.

The geological-hydrogeological characteristics of these areas have created conditions for the manifestation of underground water in the form of falling and rising springs.

1.1.1.1 Groundwater of the mountainous zone

Numerous springs in the mountainous zone of the region are associated with all stratigraphic units from the Quaternary to the Middle Jurassic. Fractured, in some areas karstified limestones are more watery, volcanic rocks are less watery, and intrusive derivatives are poorly saturated with water.

The consumption of springs due to different rocks usually varies from 0.1-1.0 to 2-3 l/s, in some cases reaching 10 l/s. The thickness of bed sediments in river valleys varies from 9-14 to 60-70 m. The flow rate of wells dug into the underlying sediments is 3-12 l/sec, the filtration coefficient of water retaining rocks varies from 5-8 to 50-60 m/day. The level of mineralization of underground waters of this zone is usually 0.3-0.8 g/l, their chemical composition is calcium with hydrocarbonate and sodium with hydrocarbonate.

In volcanic-tuff rocks, there are numerous springs with a flow rate of 8-10 l/s, sometimes up to 50-70 l/s. The degree of mineralization of hydrocarbonate calcium waters of volcanic rocks usually does not exceed 0.1-0.5 g/l.

Pressurized and non-pressurized aquifers have been opened with exploration and exploitation wells of different depths dug in different areas. The static level of unpressurized water is settled from a depth of 0.1-1.0 to 60-85 m, the consumption of wells varies from 0.1-4.2 l/sec. Pressurized waters are mainly associated with tectonic fault zones. The consumption of wells dug for this type of water varies between 0.8-12 l/sec. The degree of mineralization of non-pressurized and pressurized waters of the region varies from 0.3-0.5 to 20-22 g/l. The waters have different and variable chemical composition.

1.1.1.2 Groundwater of foothill plains

The pore water basins of the foothills are areas rich in potable and low-salinity groundwater. In the foothills and interalpine plains of the rivers that take their sources in the mountainous zone, the intermingled flow cones are of Upper Pliocene-Pleistocene and Holocene age alluvial, alluvial-proluvial and alluvial-deluvial origin, which in most cases have a great thickness (300-500 m, sometimes 1,500-2,000 m). It is composed of sediments consisting of cobblestones, pebbles, sand and gravel, clay and silt. The erosional masses removed from the mountainous zone were deposited with a well-observed regularity during the formation period in the foothill plains. The lithological composition consisting of well-washed and selected debris materials – cobblestones and pebbles – is replaced by gravel, sand, silt and clay along the flow towards the plain. Fine-grained silt-clay sediments dominate the peripheries of the yield cones. The main parts of the cones of the rivers is composed of pebbly rocks by almost 90-100%, and in the peripheries it decreases to 15%, sometimes it is completely replaced by sand and gravel.

As the terrain lowers, the ancient cones are replaced by younger ones. The heads of the ancient cones are subjected to intensive denudation during the uplift of the mountainous zone and serve as a source of detrital material for the younger cones. The amount of re-deposited clastic material begins to decrease over time due to the weakening of the uplift rate of the mountainous zone and the change of physical-geographical conditions. Therefore, detrital materials are distributed over a wider area in ancient cones than in younger cones. Clay layers are located in areas with higher absolute value in the cones of young growth. For this reason, the coarse-grained clastic materials exposed in the central parts of the foothill plains are not related to pressureless water, but to pressure water horizons.

1.1.1.3 Hydrodynamic conditions of pore water basins in foothill plains

In the foothill plains, groundwater creates a single pressure-free water horizon in the upper parts of the flow cones of rivers. A single water horizon is directly divided into unpressured and several pressurized water horizons by the appearance of clay-silt layers or rocks with clay filler in the lithological section in the central and peripheral parts. In particular, in the Jabrayil plain, one non-pressure and one pressure water horizons are separated. The lithological composition of the rocks determines the variability of filtration coefficients of the collectors of non-pressure and pressurized water horizons. As a rule, an increase in the filtration coefficient is observed along the downward flow of groundwater from the contact zone of the continental molasses with host rocks of the mountainous zone. This increase has a maximum value in the central parts of the cones and then sharply decreases towards the peripheries. The sediments of older cones are characterized by weaker filtration properties. A similar regularity is observed in the change of effective thickness of underground water horizons. The effective thickness of underground water complex in the Jabrayil plain increases as it moves away from the foothill zone and is characterized by maximum values (200 m and more) in the central parts of the cones.

The non-pressurized water horizon is spread over the entire area of the foothill plain. The mirror of non-pressurized waters settles at depths of 60-80 m in the head parts of the cones and up to a few centimeters in the wedge and discharge zones. The thickness of permeable rocks is 3-4 m. Consumption of wells drilled in non-pressurized waters does not exceed 25-30 l/s, but in most cases varies from 3-5 to 15-20 l/s. Non-pressurized water is manifested by numerous springs with flow rates varying from 0.1-0.3 to 15-20 l/sec in the zones of wedging and discharge.

The filtration coefficient of permeable rocks ranges from 0.1-0.5 (peripheral parts of most of the cones) to 25-48 m/day (central and head parts of the cones).

Pressurized water horizons are formed a few kilometers below the contact zone of bedrock with the clastic material of cones and are distributed in a limited area compared to the non-pressurized water horizon. The ceiling of the pressurized water horizon was opened with wells at depths of 200-300 m in the Jabrayil plain. The piezometric level of pressurized water is settled both below the ground surface (from 0-3 to 70-80 m) and above (+1 - +3 m +20 +50 m). The consumption of wells drilled for pressurized water varies in a range of 0.2-5-6 l/sec. The maximum values of permeability of reservoir rocks (2,000-5,000 m2/day) are observed in the central parts of the flow. As with other hydrogeological parameters, permeability also decreases towards the peripheries and has minimal values.

1.1.1.4 Hydrochemical conditions of porous water basins in foothill plains

Due to the conditions of formation, the underground waters of the foothills belong to the zone of intensive water exchange and are of infiltration origin. The chemical composition of these waters is formed as a result of atmogenic, biogenic, lithogenic and evaporation processes. Biogenic and atmogenic processes determine the composition of infiltrates entering from the earth's surface. The lithogenic processes determined by the interaction of underground flow with rocks of different lithological composition and the degree of dissolution of chemical components are more important in the formation of the chemical composition of groundwater in the foothill plains. Evaporation processes are typical for areas where groundwater is shallow (peripheries of plains and most plain areas) and favors continental salinization of soil and rocks. In general, the chemical composition of groundwater of the foothill plains, depending on the direction of the underground flow, ranges from hydrocarbonate-calcium-sodium in the foothill zone (degree of mineralization of groundwater is 0.3-0.6 g/l), to hydrocarbonate-sulfate and hydrocarbonate-sulfate-chloride calcium-sodium (degree of mineralization is 0.6-1.0 g/l), in the peripheries of the cones it changes to sulfated sodium-magnesium and chloride sodium (degree of mineralization is more than 1.0 g/l) (table 2d).

Since the pore-crack and crack waters of mountainous zones are poorly studied, it is impossible to reach a definite conclusion about the role of these waters in the formation of the chemical composition of groundwater in foothill plains.

Table 2d: Characterization of the chemical composition of potable and low-saline waters in the pore-layer basins of foothill plains

Indicator	Karabakh plain	Mil plain	Araz (Jabrayil) plain
Dry residue, g/l	0.3-2.3	0.5-2.6	0.3-3.0
Total roughness, mg-eq-l	0.6-16.0	0.4-13.0	2.3-24.7
pH	7.4-8.4	7.1-8.3	7.0-8.1
Chlorides, mg/l	10-1040	46-1440	4-480
Sulfates, mg/l	9-810	4-506	10-886
Nitrates, mkg/l	Up to 10000	Up to 3000	Up to 9040
Fluorine, mkg/l	Up to 800	Up to 150	Up to 1080
Manganese, mkg/l	Up to 90	Traces	Traces
Iron, mkg/l	Up to 70	Up to 13	Up to 100
Copper, mkg/l	Up to 200	Up to 35	Up to 34
Zink, mkg/l	Up to 40	Up to 42	Up to 160
Strontium, mkg/l	Up to 1950	Up to 1800	85-2000
Lead, mkg/l	5-80	Up to 50	Up to 100

Depending on geological features, feeding and discharge conditions (presence of springs, underground flow to rivers, discharge of pressurized water into a non-pressurized water horizon as a result of upward filtration and subsequent evaporation, etc.) for potable and low-salt waters are widespread within the limits of foothill plains.

In the lower parts of the plains, mainly in the peripheral zones of cones, depending on these factors, potable and low-saline waters are quickly replaced by saline, highly saline waters and even salt solutions. In most parts of the Karabakh and Araz (Jabrayil) plains, the degree of mineralization of underground waters is up to 1 g/l, which makes them good for drinking. A high degree of mineralization (3-5 g/l) is typical for water horizons of Absheron and Akchagil age in Karabakh and Mil plains. In general, the Karabakh and Mil plains are characterized by very complex hydrochemical conditions: while the waters of the non-pressure and II-pressure horizons are salty in some areas, the degree of mineralization of the waters of I-pressure horizon, which is between them, is 1 g/l. Groundwater in some areas of the Mil plain is very salty or consists of salt solutions with a degree of mineralization up to 100-200 g/l.

One of the main quality indicators of groundwater is the concentration of micro-components in them. River waters and underground flows where elements of rocks in the mountainous areas are dissolved play a key role in the formation of the micro-component composition of groundwater spread around foothill plains.

This caused a high amount of iron, manganese, copper, zinc, lead, molybdenum and other trace elements to migrate to the groundwater of Karabakh, Mil and Araz plains. A certain amount of fluorine, iron, stable strontium, molybdenum, selenium, mercury, and in some plains beryllium and manganese are found in the groundwater of plains. The amount of these elements in groundwater suitable for drinking is below permissible limit.

1.2 Conditions of formation, transit and discharge of groundwater

The main sources of groundwater in the mountainous zone are atmospheric sediments, melt waters of small glaciers where there is snow, and in some cases river waters. Both unpressurized and pressurized groundwater in the foothill plains originate from a single and undivided unpressurized groundwater horizon at the head of the flow cones of the rivers. Intensive absorption of atmospheric sediments and surface water is taking place in this zone. According to the comb-like structure of Upper Pliocene-Pleistocene and Holocene clastic sediments, separated from each other and divided into pressurized and non-pressurized water horizons, the underground flow moves along the plain towards the regional discharge zone. The central parts of the river cones are the zone of transit of underground flow and discharge between separate horizons. The non-pressurized water horizon, which has a maximum thickness in the formation zone, rapidly loses this thickness in the transit zone and becomes wedged in the discharge zone. On the contrary, the thickness of pressurized water horizons increases in the transit zone and the thickness of pressurized water horizons decreases in the discharge zone. In the Karabakh and Mil plains, the regional groundwater discharge zone is the Kura river, and in the Araz (Jabrayil) plain it is the Araz river.

1.2.1 Feeding sources of ground water

The main sources of groundwater nutrition are atmospheric sediments, permanent snow and local glacier meltwater in the mountainous zone, as well as atmospheric sediments, river waters and underground flows from foothill plains.

The sustainability of groundwater resources in mountainous areas, primarily groundwater resources that are not related to tectonic faults and cracks, is determined by the sustainability of their feeding sources. Groundwater related to tectonic faults and cracks is less affected by external factors.

The average annual amount of atmospheric precipitation is 700-1,400 mm at 2,700 m, more than 900 mm at 1,500-2,700 m, and 500-800 mm at 1,000-2,000 m. In the Araz (Jabrayil) plain, the average annual amount of atmospheric sediments is 285-595 mm.

In mountainous and foothill zones, in the high parts of the plains, atmospheric precipitation exceeds evaporation, while moisture in the area is quite high. This creates favorable conditions for the formation of surface flow and, under appropriate conditions, underground flow.

In the lower parts of the plains, evaporation is several times higher than atmospheric precipitation, moisture is characterized by very small values, there are no conditions for the formation of flow. On the contrary, surface and underground waters are subject to intensive evaporation.

River waters play an important role in the formation of groundwater in the plains. After the second half of the last century, there have been dramatic changes in the conditions of groundwater feeding by river waters. The creation of reservoirs on the rivers, the construction of irrigation canals and the development of irrigated agriculture have dramatically increased feeding. Under natural conditions, underground water is fed by river water, mainly in the bed of rivers, while the rest of the water is removed from the area by transit flow, with the creation of irrigation systems. Most of the river water is distributed in the area, and as a result, the infiltration of river water increases significantly.

Due to the development of irrigated agriculture, serious changes have occurred in the balance of surface and underground water. On the one hand, as can be seen, the infiltration of surface water into underground water has increased sharply, but on the other, underground water extracted from pressurized horizons by drilling thousands of water-utilization wells first feeds the non-pressured water horizon lying on the surface, thus a process of redistributing the balance of underground water within the system takes place. This process continues and gets stronger.

The geological-structural and lithofacies characteristics of the foothills pore-layer underground water basins, the generality of feeding sources precondition the emergence of a tight hydraulic connection between the pressurized and non-pressurized water horizons. However, in the head and central parts of the flow cones of the rivers, mainly non-pressurized waters feed pressurized ones, while the opposite feeding occurs in the peripheries.

1.2.2 Groundwater resources

For the beginning of the 1990s, the forecast operational reserves of potable and slightly mineralized underground water in the Karabakh region were estimated at 8,253,900 m3/day, including 7,909,900 m3/day for the Karabakh-Mil pore-layer water basin, 344,000 m3/day for Araz (Jabrayil) pore water basin. Forecast reserves for mountainous areas have not been calculated. Confirmed reserves were calculated in the amount of 2,231,500 m3/day for the Karabakh-Mil pore-formation water basin and 234,600 m3/day for the Araz pore-formation water basin.

APPENDIX 2E: BOTANY BASELINE REPORT (GULIYEV, T., 2023)

1 SPRING BOTANY SURVEY (May 2023)

1.1 Flora and vegetation cover

The study area is geographically located in the southern part of Karabakh, in the Goyan steppe. The Gayan steppe, a plain in Jabrayil district of Azerbaijan, covers the territory between the Karabakh ridge and the Araz river.

The plain has a slope towards the Araz. The height of our sites ranges from 250 to 350 meters above sea level.

The landscape is composed of semi-deserts and dry steppes, in some places with mountain and xerophyte vegetation cover.

The soils are ordinary gray, brown (photos no. 0806-0808, 0845-0848, 0852, 0853, 0879-0881, 0953).

We have studied two sites allotted for the construction of a solar power plant:

The northern area is located northeast of the right bank of the Chaylag river (left tributary of the Araz River), between rural roads Minbashili and Mirak.

The southern area is located northwest of the left bank of the Chaylag river, between rural roads Minbashili and Soltan.

1.1.1 Northern area

1.1.1.1 Secondary vegetation

Most of the territory is a flat slope, with a predominance of secondary and cultivated vegetation in steppes. Before the war, this area was used for vineyards.

Overview photographs No. 0671-0674 and No. 0684-0687 were taken from the north, east, south and west. GPS coordinates: 8675392/4357531 and 8675495/4357378.

In terms of the species composition of the flora, it is made up of weed and segetal vegetation of abandoned fields. As can be seen in photographs No. 0679 - 0682, 0692, 0805, it develops between the wild bushes of the Vitis vinifera vineyard with the participation of such species as *Onopordum acanthium, Eryngium campestre, Picnomon acarna, Limonium scoparium, Centaurea solstitialis, Carthamus lanatus, Achillea micrantha, Salvia nemorosa, Cirsium vulgare, Peganum harmala, Chondrilla juncea, Scorzonera leptophylla* and others. Photo #0678.

Weeds include steppe species of flora and subshrubs such as *Bassia prostrata, Artemisia lercheana* and *Bothriochloa ischaemum.*

1.1.1.2 Steppe

In the northeastern and eastern zones of the site, on slopes and shallow depressions, there are sagebrush-bearded steppes with a dominance of *Artemisia lercheana* (Mugwort), Photos No. 0695, 0712, 0713, and *Bothriochloa ischaemum* (Yellow bluestem), Photo No. 0727. They cover small areas.

GPS coordinates: 8675969/4357157 and 8676043/4357256. Photos No. 0742, 0743 and overview photos of the area No. 0729 – 0732 were taken from the north, east, south and west.

1.1.1.3 Semi-desert

Wormwood semi-deserts

In the southern part of the plain, in the wastelands of former vineyards and along the slopes, semi-desert formations of wormwood are noted with a dominance of *Artemisia lercheana* (Mugwort) and *Poa bulbosa* (Bulbous bluegrass). There is also a diversity of ephemeral synusia with the participation of such species as *Filago pyramidata, Koeleria phleoides, Lolium rigidum, Helianthemum salicifolium, Nigella arvensis, Hordeum leporinum, Euphorbia falcata* and others.

Wild bushes of Vitis vinifera (Common grape vine) and occasional Capparis spinosa (Caper bush) were noted everywhere. Photos No. 0785-0787. GPS coordinates: 8676667/4355656, 8676617/4355707 and 8676602/4355696.

Photographs No. 0770-0772 and overall photographs of the area were taken from the north, east, south and west. No. 0782-0785.

Capparis spinosa *(Caper bush)*

1.1.1.4 Lowland meadows

In the southern and southwestern parts of the site, on slightly sloping depressions and humid places, there are biotopes of lowland meadow vegetation. The altitude here is 312 meters above sea level with a predominance of shrub formations *Lycium ruthenicum* (Russian box thorn) and

Alhagi pseudalhagi (Camelthorn-bush), with *Artemisia lercheana* sagebrush and *Lagonychium farctum* mimosa shrub.

Shrub formations are created by *Lycium ruthenicum*. GPS coordinates: 8677067/4355591. Photos No. 0755, 0758 and 0759. The topsoil is covered by the perennial *Cynodon dactylon* mixed with *Limonium scoparium, Cardaria draba, Polygonum argyrocoleon, Hordeum leporinum, Tripleurospermum parviflorum, Phleum paniculatum, Anisantha rubens, Torilis nodosa, Lagoseris sancta* and *Lagonychium farctum*.

In the wastelands of former vineyards, shrub formations are transformed into communities dominated *by Alhagi pseudalhagi* and *Lagonychium farctum*. The grass cover is also dominated by *Cynodon dactylon*. Semi-shrub *Capparis spinosa* (Photos No. 0786, 0787) and *Zygophyllum fabago* have been recorded. GPS coordinates: 8676705/4355804.

Pure formations with a predominance of *Alhagi pseudalhagi*. GPS coordinates: 8676478/4355897. Overview photos were taken from the north, east, south and west. No. 0788-0791.

1.1.1.5 Trees and shrubs

Throughout the area, xerophytic species of trees and shrubs characteristic of arid light forests have been recorded.

There are several bushes of *Celtis glabrata* (Nettle-trees). GPS coordinates: 8675469/4357274 and 8675424/4357026. Photos No. 0700, 0702, 0707. GPS coordinates: 8676602/4355696. Photos No. 0779, 0780.

A group of four trees of *Robinia pseudoacacia* (Locust Tree) species. GPS coordinates: 8675422/4356960. Photos No. 0714, 0718.

In the hollow of a moat, a large tree *Morus alba* (White Mulberry) was found. GPS coordinates: 8675934/4356816. Photos No. 0742, 0743. Also, there were several small Tuta trees. GPS coordinates: 8676617/4355707. Photos No. 0778

Pistacia mutica (Pistachio). GPS coordinates: 8675594/4357022. Photos No. 0721, 0722. GPS coordinates: 8676705/4355804. Photos No. 0765, 0766.

In the central part of the site, there are several large trees *Pistacia mutica* from 4 to 7 meters in height, and next to it a mulberry tree *Morus sp*. up to 3.5 m in height. GPS coordinates: 8676617/4355707 and 8676478/4355897. Photos No. 0775, 0776, 0792-0795 and 0797.

Closer to the rural road in a dry canal at the border of the area, a sapling of Ficus carica (Fig) was observed with some vegetation around it. GPS coordinates: 8675376/4356989. Photos No. 0733, 0735.

In the southeastern part of the site, inside abandoned vineyards, bushes of *Amygdalus nana* (Wild almond) were recorded. Photos No. 0802, 0803 (GPS coordinates: 8676729/4355557) and Rosa sp. (Rose hip). Photo No. 0801 (GPS coordinates: 8676712/4355591).

In the northeastern side, in the territory of former vineyards, cultivated specimens of garden grapes *Vitis vinifera* were found. Photos No. 0679 - 0682, 0692, 0805.

As noted above, dense shrub formations formed by *Lycium ruthenicum* are quite common. GPS coordinates: 8677067/4355591. Photos No. 0755, 0758 and 0759.

1.1.2 Southern area

It is an inclined hilly plain of the Araz zone approximately 10-12 km south of the city of Jabrayil. The riverbed, the left tributary of the Araz, runs along the center of the site, which dries up in the summer. The average height is around 320-350 meters above sea level.

The landscape on the slopes is made up of dry steppes and in depressions between the slopes by semi-deserts. In river floodplains and along the edges of the canal, there are meadow-like formations.

1.1.2.1 Steppe

Lower mountain steppe formations are typical on the tops and slopes, with a dominance of *Bothriochloa ischaemum* (Yellow bluestem) and *Stipa lessingiana* (Lessing feather grass), with the participation of herbaceous species such *as Helianthemum lasiocarpum, Koeleria cristata, Lappula squarrosa, Euphorbia orientalis, Teucrium capitatum, Trachynia distachya, Medicago caerulea, Galium verum, Linum corymbulosum, Arnebia decumbens* and *Ephedra distachya* shrub.

GPS coordinates: 8675365/4354660. Overview photographs of the area were taken from the north, east, south and west. No. 0811 - 0814.

GPS coordinates: 8675573/4354388. Overview photographs of the area No. 0832 - 0835, 0838, 0840.

GPS coordinates: 8674842/4353844. Overview photographs of the area were taken from the north, east, south and west. No. 0889 - 0892.

In some places, on the tops of the slopes, pure formations are recorded with a dominance of feather grass *Stipa lessingiana* and ephemera; the composition of the formation is characterized by *Bassia prostrata* (Photos no. 0932-0934), *Bromus anatolicus, Koeleria cristata, Teucrium capitatum, Stachys atherocalyx, Onobrychis cyri* (Photos No. 0883), *Teucrium chamaedrys*, *Achillea millefolium, Agropyron cristatum*. GPS coordinates: 8675573/4354388 and 8675225/4353502. Photos No. 0840, 0909, 0910, 0912, 0913.

The soil cover under the steppe formations is densely covered with lichen of *Parmelia sp*.

1.1.2.2 Semi-deserts

Wormwood semi-deserts

In depressions and on the plain between the slopes, semi-desert communities are developed with a dominance of *Artemisia lercheana* and ephemera, in places with saltwort. The formation is dominated by *Poa bulbo*sa and the typical semi-desert ephemera *Filago pyramidata, Lepidium perfoliatum, Tanacetum achilleifolium, Erodium ciconium, Bromus japonicus, Aegilops triuncialis, Bupleurum semicompositum, Convolvulus arvensis, Malvalthaea transcaucasica, Alyssum turkestanicum desertorum, Delphinium divari catum.*

In communities of *Artemisia lercheana*, the flowering subshrub *Capparis spinosa* is scattered throughout the study area (photo 0942).

GPS coordinates: 8675442/4354629. Overview photographs of the area No. 0820 - 0822.

GPS coordinates: 8675666/4354291. Overview photographs of the area were taken from the north, east, south and west. No. 0841, 0842, 0844, 0849 - 0851.

GPS coordinates: 8674958/4352030 and 8674352/4352359.

GPS coordinates: 8673739/4351619. Overview photographs of the area No. 0947 - 0949.

GPS coordinates: 8674143/4351769. Overview photographs of the area No. 0966 - 0968, 0970.

1.1.2.3 Saltwort small-shrub semi-deserts

There are saltwort small-shrub semi-deserts on flat plains. They are made up of pure and mixed formations of saltwort such as *Salsola dendroides* and *Salsola ericoides* with ephemera. Sometimes there are *Suaeda microphylla* in their composition.

Ephemers are dominated by *Hordeum leporinum, Aegilops cylindrica, Phalaris minor*, of herbs - *Senecio vernalis, Lagoseris sancta, Medicago denticulata, Stellaria media, Filago pyramidata, Medicago sativa, Sisymbrium loeselii, Tanacetum achilleifolium* and others. The dominant ephemeroids are *Poa bulbosa and Allium rubellum*.

Mixed associations are *Salsola dendroides* and *Salsola ericoides*.

GPS coordinates: 8675016/4353042. Overview photographs of the area No. 0921, 0922, 0925, 0926.

Pure associations - *Salsola dendroides* and ephemera.

GPS coordinates: 8674989/4352537. Overview photographs of the area were taken from the north, east, south and west. No. 0935-0938 and 0943.

GPS coordinates: 8675925/4353931. Overview photographs of the area No. 0857, 0859, 0860.

1.1.2.4 Lowland meadows

In wet depressions of the plain and along the edges of the Araz tributary, *Alhagi pseudalhagi* formations develop, in some places in combination with saltwort *Salsola dendroides*. The bed of the Araz completely dries up in the summer, as can be seen in photo No. 0864, 0865, 0868, 0871.

The phytocenosis includes the following species: *Poa bulbosa, Filago pyramidata, Lepidium perfoliatum, Bromus japonicus, Papaver arenarium, Alyssum turkestanicum, Medicago sativa, Hordeum geniculatum, Lolium rigidum, Adonis bienertii, Eryngium campestre, Atriplex lehmanniana*.

GPS coordinates: 8675884/4354001. Overview photographs of the area No. 0854 - 0856.

GPS coordinates: 8675548/4354051, 8673707/4352637, 8674741/4352006 and 8674748/4351886. Photo No. 0983 was taken near Ficus carica tree. Overview photo No. 0863 – 0867.

In depressions and riverine zone, we noted mixed or transitional *phytocenoses Alhagi pseudalhagi* and *Salsola dendroides*.

1.1.2.5 Trees and shrubs

Just as in the previous study area, xerophytic species of trees and shrubs characteristic of arid light forests are observed here. Among them are:

Tamarix ramosissima (Saltcedar) - usually found in slope depressions and inside dried canals.

GPS coordinates: 8675442/4354629. Photos No. 0823, 0824, 0827, 0829-0831.

GPS coordinates: 8675414/4352276, 8673999/4352416, 8674215/4351571. Photos No. 0944, 0945.

GPS coordinates: 8674215/4351571, in a dry canal No. 8674082/4351469. Photos No. 1001, 1003.

GPS coordinates: 8673874/4351283. Photo No. 0997.

Ficus carica - in the central part of the site, in a ravine between slopes, a group of wild *Ficus carica* trees up to 6-7 meters in height was encountered. Photos No. 0976, 0981, 0983. GPS coordinates: 8674748/4351886

Ephedra distachya. On the tops of rocky slopes, *Ephedra distachya* bushes reaching a height of 15-30 cm with a low crown were found.

Single bushes - GPS coordinates: 8675365/4354660. Photos No. 0818, 0819.

Formations of *Ephedra distachya* within sagebrush biotopes. GPS coordinates: 8675146/4353710 and 8675173/4353681. Photos No. 0900-0905.

Atraphaxis spinosa (Atraphaxis) - low-growing shrubs we observed in the dry bed of the Araz tributary, on rocky mounds. GPS coordinates: 8675442/4354099. Photos No. 0868-0870.

Elaeagnus angustifolia (Oleaster) - Inside a dried-out ditch, three Loja saplings were found in a depressed state, as seen in photo No. 0950-0952 and a few felled trees. GPS coordinates: 8673810/4351628.

Also, one bush of wild Pomegranate was found here - *Punica granatum*. It is 60-70 cm high, with a partially dried crown. GPS coordinates: 8673828/4351639. Photos No. 0956, 0958.

1.2 Rare and protected species of flora of Azerbaijan

Two rare species listed in the Red Book of Azerbaijan were found in the study areas*

Ficus carica - tree

Punica granatum - shrub

*** Red Book of the Republic of Azerbaijan, 2013.**

https://eco.gov.az/index.php?ln=az&pg=319

Photo - *Ficus carica*

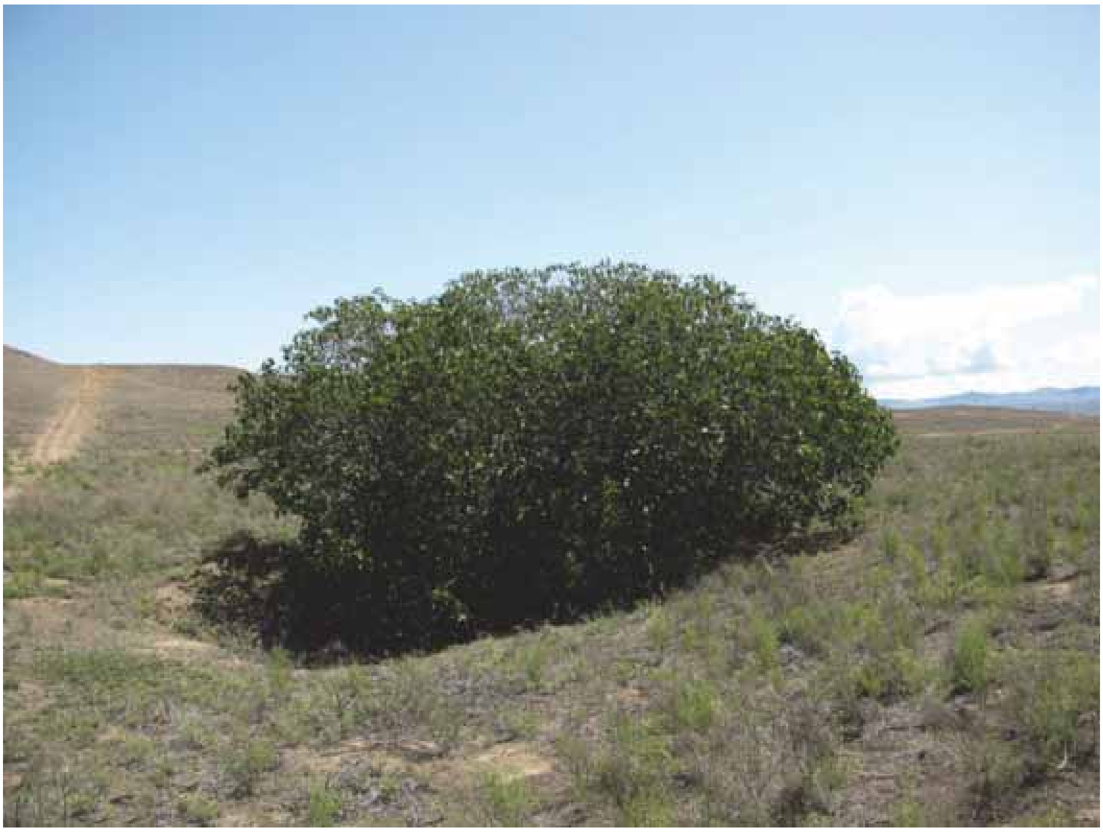


Photo - *Punica granatum*

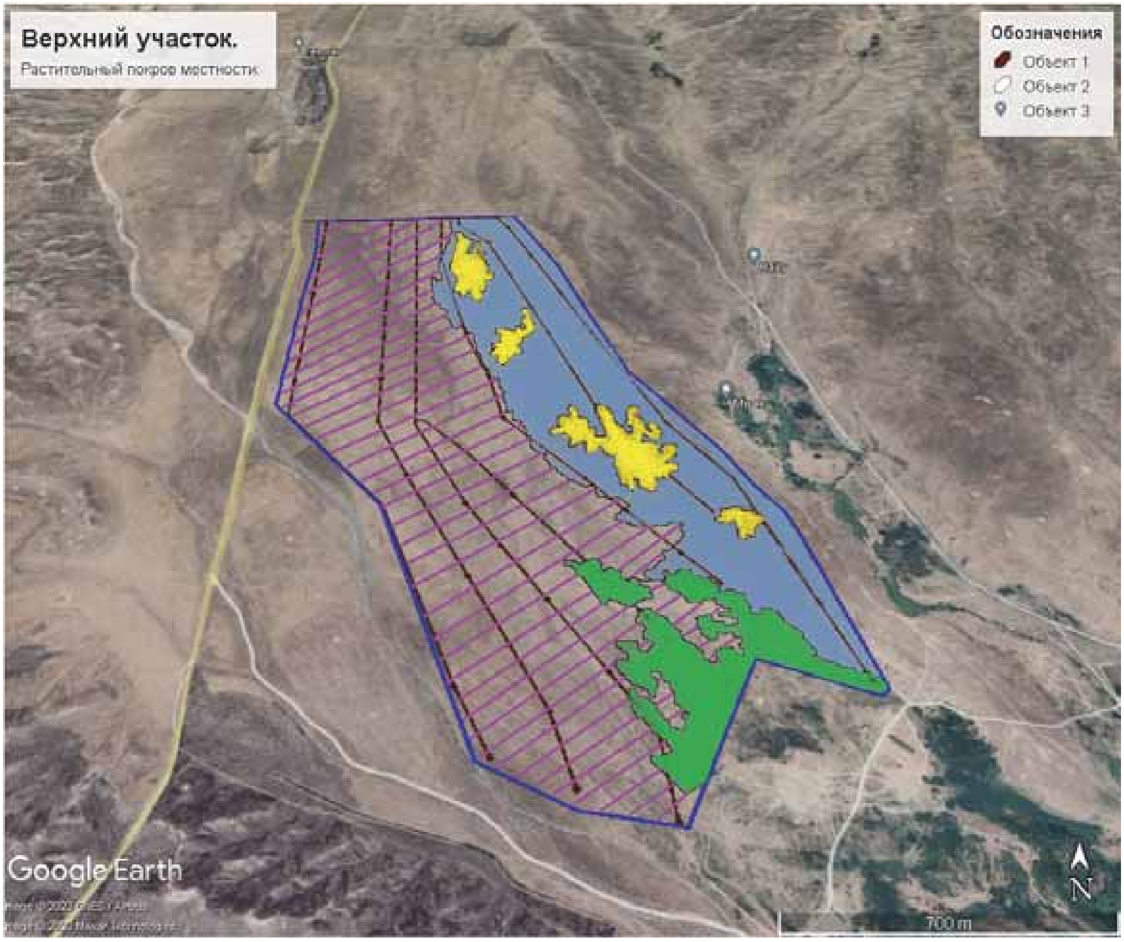
1.3 Vegetation map of study areas:

On the basis of the field work, vegetation cover maps were created for the northern and southern parts. The maps topographically show zonal types of vegetation formations.

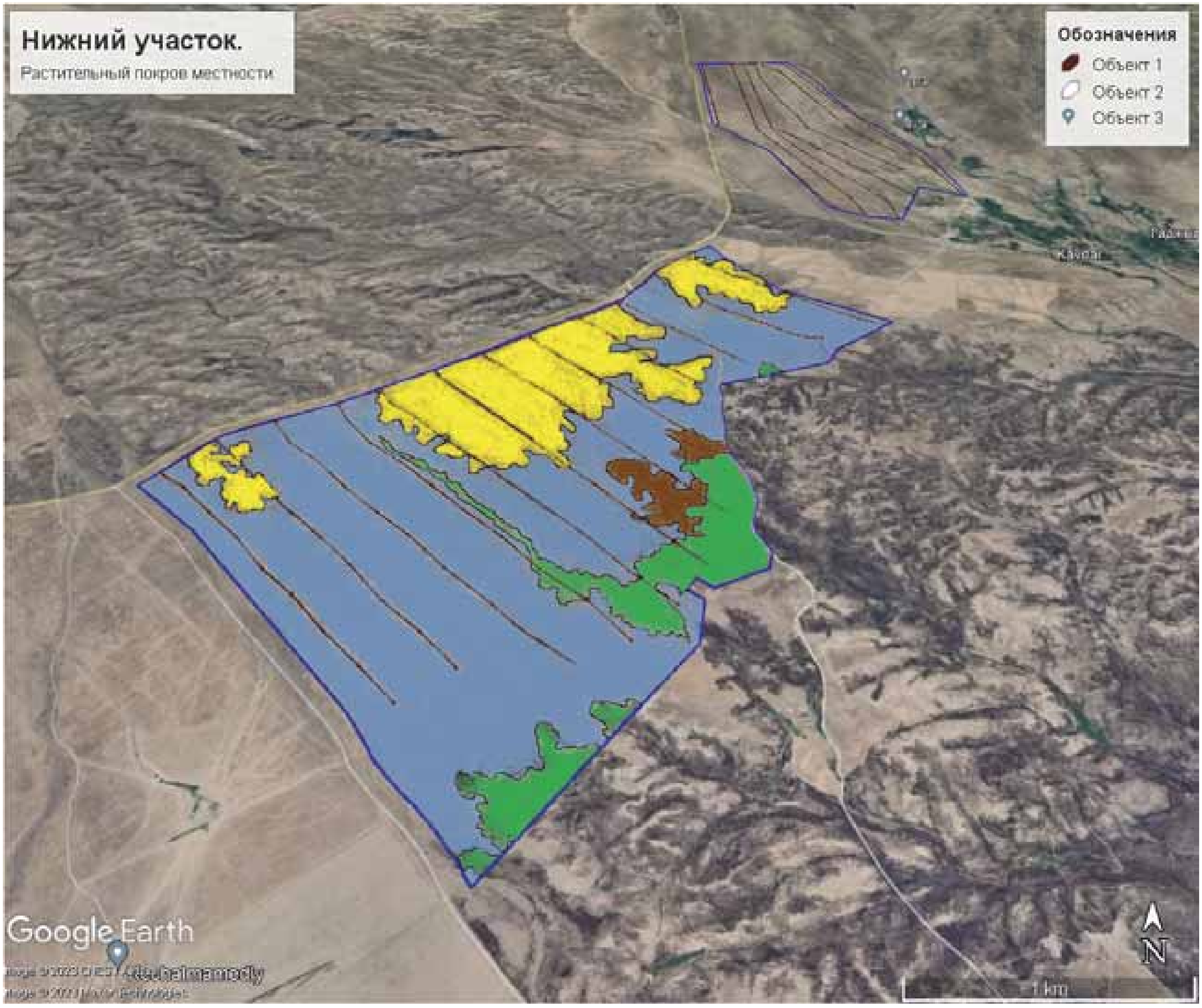
Trees and shrubs are not represented on the maps, because they do not have a zonal distribution and are presented in isolated manner (the exact number of species and their GPS coordinates are indicated in the text above).

Legend for the maps and a comparative analysis have been prepared.

Map of the Northern site



Map of the Southern site



№2. **№5**

№4 **№3.**

<u>Legend</u>

<u>№1. Secondary vegetation</u> – square with purpose stripes

<u>№2. Steppes</u> – yellow square

<u>№3. Lowland meadows</u> – green square

<u>№4. Wormwood semi-deserts</u> –blue square

<u>№5. Saltwort small-shrub semi-deserts</u> – brown square.

1.3.1 Map analysis

A comparative analysis of our maps with the Vegetation Maps of Azerbaijan created in previous years (Прилипко, 1965; Гаджиев В.Д. 1992; Атамов В.В. 1995) was carried out.

In these maps, steppe and meadow vegetation in our sites are not shown. Also, saltwort small-shrub semi-deserts are not indicated in desert type vegetation.

Additionally, secondary vegetation, which occupies the main part of the northern site, is not indicated.

1.4 Recommendations

Potential risks: development of the territory for the construction of service facilities, installation of solar panels for a power plant, construction of roads, movement of heavy equipment can adversely affect the natural vegetation of the area by mechanically disturbing the soil cover and the structure of phytocenoses.

Trees and shrubs, which are already quite few, deserve special attention. Two rare species listed in the Red Book of Azerbaijan* have been found in study: Ficus carica - a tree, Punica granatum - a shrub.

Also, steppe formations require special care. Their phytocenoses are rare and gradually disappear in Azerbaijan.

1.5 Literature used:

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Tofig Guliyev
26.05.2023

2 AUTUMN BOTANY SURVEY (OCTOBER 2023)

2.1 Purpose of work

Research and inventory of vegetation cover and flora during fall, identification of new plant formations, species ranges, rare and protected species of flora not observed in spring.

2.1.1 Upper (northern) section

The main types of vegetation cover, as was noted in the previous spring report, are:

- Secondary vegetation.
- Steppe.
- Semi-desert.
- Lowland meadows.
- Trees and shrubs.

2.1.1.1 Trees and shrubs

New tree species were noted, namely:

Several small trees - *Celtis glabrata* (Nettle-trees) identified in the eastern part, near the edge of the boundary. GPS coordinates: 8677146/4355842 (N 39°19.047‘ E 047°03.174‘) two trees and 8677143/4355853. (N 39°19.053‘ E 047°03.172‘) one tree. Photos No. 1234, 1238 and 1241.

Several small *Celtis glabrata* trees were also noted in the south-eastern area of the site. GPS coordinates: 8677057/4355983 (N 39°19.124‘ E 047°03.114‘) and 8677047/4356012 (N 39°19.140‘ E 047°03.108‘). Photos No. 1251 and 1253.

A single *Celtis glabrata* tree was found in the western zone near the edge of the site boundary, deep in the trench. GPS coordinates: 8675547/4356419 (N 39°19.378‘ E 047°02.071‘). Photos No. 1513 and 1514.

A single tree, *Pistacia mutica* (Pistachio), was noted in the south-eastern part of the site. GPS coordinates: 8675835/4356729 (N 39°19.542‘ E 047°02.276‘). Photo No. 1231.

Two single trees of *Pistacia mutica* were found in the western zone. GPS coordinates: 8675587/4356397 (N 39°19.366‘ E 047°02.099‘) and 8675674/4356361 (N 39°19.346‘ E 047°02.158‘). Photos No. 1515, 1517 and 1520.

2.1.2 Lower (southern) section

The main types of vegetation cover, as was noted in the previous spring report, are:

- Secondary vegetation.
- Steppe.
- Semi-desert.
- Lowland meadows.
- Trees and shrubs.

2.1.2.1 Steppe

Mixed phytocenoses of *Bothriochloa ischaemum* (Yellow bluestem) and *Artemisia lercheana,* with elements of ephemerals characteristic for steppes such as Poa bulbosa, Filago pyramidata, Lepidium perfoliatum, Tanacetum achilleifolium, Erodium ciconium, Bromus japonicus, Aegilops triuncialis, Bupleurum semicompositum, Helichrysum arenarium, Limonium sp. and Astragalus sp.

New formations were identified within steppe phytocenoses, which have an island nature in the form of spots:

GPS coordinates: 8675227/4353668 (N 39º17.896‘ E 047º01.805‘) and 8675380/4353153 (N 39º17.616‘ E 047º01.904‘).Overview photos of the area No. 1271-1276 and 1278.

Xerophytic-shrub steppes. This phytocenotype consists of xerophytic shrubs and bushes with elements of perennial ephemeroids and ephemerals. They are located on the tops of slopes in the central and southern part of the study area, predominantly with rubbly and sandy loam soils.

A mixed formation of shrub ***Ephedra procera*** **and** ***Bothriochloa ischaemum*** was observed, with elements of characteristic steppe species such as *Bassia prostrata, Bromus anatolicus, Koeleria cristata, Teucrium capitatum, Stachys atherocalyx, Onobrychis cyri, Teucrium chamaedrys, Helichrysum arenarium, Achillea millefolium, Agropyron cristatum, Limonium sp.* and *Astragalus microcephalus.*

GPS coordinates: 8674418/4353743 (N 39º17.946‘ E 047º01.244‘) and 8674430/4353695 (N 39º17.920‘ E 047º01.252‘).

GPS coordinates: 8674062/4353105 (N 39º17.606‘ E 047º00.987‘) and 8674155/4352934 (N 39º17.512‘ E 047º01.049‘).

Overview photos of the area No. 1328, 1329, 1334, 1335, 1342, 1346, 1347 and 1357.

This mixed formation was also identified in the central part of the study area, at the top of the slope**.**

GPS coordinates: 8674757/4353927 (N 39º18.041‘ E 047º01.483).

Overview photos of the area No. 1628, 1630-1633.

Photo, fruit-bearing shrub - ***Ephedra procera***.

2.1.2.2 Lowland meadows

In the southern zone of the site, dense mixed or transitional phytocenoses of *Alhagi pseudalhagi* and annual saltwort *Salsola tragus* (Kali tragus) were observed in wet depressions between slopes. The vegetation period of this saltwort starts in July, so this phytocenosis is characteristic of the summer-fall season.

GPS coordinates: 8673819/4352505 and 8674177/4352258 (N 39°17.147‘ E 047°01.054‘).

Overview photos of the area No. 1395, 1396, 1398, 1399, 1407 and 1409.

2.1.2.3 Trees and shrubs

In the southwestern part of the lower section, two single bushes of *Tamarix ramosissima* (Saltcedar) were noted on flat depressions between slopes. GPS coordinates: 8673692/4352928 (N 39°17.514‘ E 047°00.727‘). Photos No. № 1251 and 1253.

In the southern part of the study area, surrounded by wormwood semi-deserts, a small population of the low-growing shrub *Atraphaxis spinosa* (Atraphaxis), which forms an independent formation, was identified. This shrub species was recorded in spring surveys in river channels.

In fall surveys, it was found on the tops of stony hills of the southern zone. The species composition included characteristic semi-desert species such as *Artemisia lercheana, Poa bulbosa, Filago pyramidata, Lepidium perfoliatum, Tanacetum achilleifolium, Erodium ciconium, Bromus japonicus, Aegilops triuncialis, Bupleurum semicompositum, Alyssum turkestanicum desertorum, Delphinium divaricatum.*

GPS coordinates: 8673825/4351562 (N 39°16.776‘ E 047°00.799‘) and 8673489/4351743 (N 39°16.877‘ E 047°00.568‘).

Photos No. № 1437, 1438, 1440, 1442, 1444 and 1453.

Photo, shrub - ***Atraphaxis spinosa***.

2.2 Rare and protected species of flora of Azerbaijan.

The following rare and protected species included in the Red Book of Azerbaijan* were identified in study areas during the spring-fall season*:

- ***Ficus carica*** – tree
- ***Punica granatum*** – shrub
- ***İris sp.*** – perennial herbaceous plant.

During the fall surveys, we discovered a rare species new to the study area: *Iris sp.* - presumably one of two species *Iris lycotis* or *Iris acutiloba*.

Due to the absence of a flower, which is the main morphological distinguishing feature for the exact determination of the species, the species name is given presumptively.

Both species of Iris are characteristic for the given geographical zone and are included in the Red Book of Azerbaijan (2023) and protected.

Taxonomically, these Iris species are grouped into Oncocyclus section. They are usually confined to wormwood semi-desert associations and steppes, on light loamy soils. In foothills, they grow on hills, preferring slopes of southern exposures. These are typical myrmecochores.

The growing season and external habitus of both species are similar.

With the onset of dry and hot summer period, the above-ground organs of Oncocyclus die off completely, life is preserved only in the rhizome. In the fall, when cooler and wetter weather is established, a bundle of leaves develops from it. The plants overwinter in this form. With the onset of warm weather, approximately in mid-February, leaf growth resumes, and in April - early

May, the plants enter the phase of budding and flowering. At a temperature of 23-25°C, the flower lives 4-5 days. The flowering period of the species does not exceed 15-20 days.

Irises in the study area were found in steppe and semi-desert formations, forming small populations on slopes in the form of separate spots (clumps).

Below, the tables for each study area indicate the location of Iris populations, number of individuals, and photos. For the Upper section, the data are given in Table 1 and for the Lower in Table 2.

*** The Red Book of the Republic of Azerbaijan, 2023. Vol. 1, Baku - 2023. Third edition. p. 508**

Table 1. Upper (northern) section - rare and protected species of flora and location

Species	Number	Location	GPS coordinates	GPS coordinates.	Photo No.
Iris sp.	24	Eastern part of the site, on a gentle slope.	8676567 4356698	N 39°19.516‘ E 047°02.784‘	1524, 1527, 1530
Iris sp.	16	Eastern part of the site, on depressions of the gentle slope.	8676419 4356918	N 39°19.636‘ E 047°02.685‘	1533
Iris sp.	8	Eastern part of the site, on depressions of the slope.	8676337 4357004	N 39°19.684‘ E 047°02.630‘	1536
Iris sp.	11	Eastern part of the site, on depressions of a stony slope.	8676384 4356984	N 39°19.672‘ E 047°02.662‘	1538
Iris sp.	18	Eastern part of the site, gravel slope.	8676401 4356982	N 39°19.671‘ E 047°02.674‘	1542
Iris sp.	10	Eastern part of the site, gravel slope.	8676390 4357025	N 39°19.695‘ E 047°02.667‘	1544
Iris sp.	22	Eastern part of the site, on top of a stony slope.	8676380 4357041	N 39°19.704‘ E 047°02.660‘	1549, 1550
Iris sp.	7	Eastern part of the site, on a downward gentle slope.	8676352 4357196	N 39°19.788‘ E 047°02.643‘	1564
Iris sp.	8	Eastern part of the site, on a slope.	8676347 4357235	N 39°19.809‘ E 047°02.640‘	1567
Iris sp.	13	Eastern part of the site, gravel slope.	8676319 4357287	N 39°19.837‘ E 047°02.621‘	1569, 1570
Iris sp.	6	Eastern part of the site, gravel slope.	8676294 4357292	N 39°19.840‘ E 047°02.604‘	1577
Iris sp.	10	Eastern part of the site, on a gentle slope.	8676274 4357306	N 39°19.848‘ E 047°02.591‘	1580
Ficus carica	4 trees and sprouts	Western part of the site, in a dry channel at the border of the study area.	8675376 4356989		0733, 0735 (spring report)

Table 2. Lower (southern) section - rare and protected species of flora and location

Species	Number	Location	GPS coordinates	GPS coordinates.	Photo No.
Iris sp.	56	Southern part of the site, at the top of the slope.	8673812 4351626	N 39º16.810‘ E 047º00.791‘	1412, 1415 - 1418.
Iris sp.	40	Southern part of the site, at the top of the slope.	8673774 4351632	N 39º16.814‘ E 047º00.764‘	1422-1424, 1427.
Iris sp.	7	Southern part of the site, on a gentle slope.	8673801 4351613	N 39º16.803‘ E 047º00.782‘	1429
Iris sp.	46	Southern part of the site, on the depressions of the slope.	8673830 4351599	N 39º16.795‘ E 047º00.802‘	1430 – 1432, 1435.
Iris sp.	16	Southern part of the site, on the sandy/stony top of the slope.	8673846 4351538	N 39º16.762‘ E 047º00.813‘	1447 – 1449, 1451.
Iris sp.	4	Southern part of the site, on the sandy/stony top of the slope.	8673840 4351538	N 39º16.762‘ E 047º00.808‘	1455
Iris sp.	4	Southern part of the site, on the sandy/stony top of the slope.		N 39º16.767‘ E 047º00.917‘	1458
Iris sp.	6	Southern part of the site.	8673456 4351924	N 39º16.975‘ E 047º00.547‘	1463
Iris sp.	4	Southern part of the site.	8673440 4351883	N 39º16.953‘ E 047º00.536‘	
Iris sp.	6	Southern part of the site.	8673580 4351827	N 39º16.922‘ E 047º00.633‘	
Iris sp.	5	Southern part of the site. Gentle slope.	8673840 4351538	N 39º16.762‘ E 047º00.808‘	
Iris sp.	35	Southern part of the site. Gentle slope.	Beginning of population: 8673488 4351971. End of population: 8673471 4351993	Beginning of population: N 39º17.000‘ E 047º00.571‘ End of population: N 39º17.013‘ E 047º00.559‘	1471, 1475, 1477, 1479
Iris sp.	13	Southern part of the site, on the sandy/stony top of the slope.	8673440 4351980	N 39º17.006‘ E 047º00.537‘	1485, 1486
Iris sp.	8	Southern part of the site.	8673397 4352051	N 39º17.044‘ E 047º00.509‘	1493
Iris sp.	5	Southern part of the site. Highest slope of the area.	8673236 4352237	N 39º17.147‘ E 047º00.400‘	1496
Iris sp.	18	Southern part of the site. Highest slope of the area.	8673203 4352238	N 39º17.148‘ E 047º00.377‘	1500, 1502, 1503, sample with dried flower 1504, 1506

Species	Number	Location	GPS coordinates	GPS coordinates.	Photo No.
Iris sp.	3	NW area of the site, on gentle slopes.	8675080 4354311	N 39o18.245‘ E 047o01.714‘	1583
Iris sp.	18	NW area of the site, on slope depressions.	8675302 4354381	N 39o18.280‘ E 047o01.869‘	1585
Iris sp.	10	NW area of the site, on a gravelly slope.	8675242 4354439	N 39o18.312‘ E 047o01.828‘	1592, 1593
Iris sp.	24	NW area of the site, on a gravelly slope.	8674806 4354058	N 39o18.111‘ E 047o01.519‘	1595
Iris sp.	22	NW area of the site, on a gravelly slope.	8674753 4354071	N 39o18.119‘ E 047o01.482‘	1599, 1602, 1603
Iris sp.	18	NW area of the site, on a gravelly slope.	8674738 4354033	N 39o18.099‘ E 047o01.471‘	1606, 1610
Iris sp.	14	NW area of the site, on a slope.	8674742 4354018	N 39o18.091‘ E 047o01.474‘	
Iris sp.	12	NW area of the site, on a slope.	8674743 4354004	N 39o18.083‘ E 047o01.474‘	1625, 1627, 1633, 1637
Iris sp.	12	Central part of the site, on a slope.	8674788 4353845	N 39o17.997‘ E 047o01.503‘	1639, 1641, 1642
Iris sp.	14	Central part of the site, on a slope.	8674793 4353845	N 39o17.997‘ E 047o01.507‘	1643, 1645
Iris sp.	About 42 individuals on 3 m²	Central part of the site, on a slope.	Beginning of population: 8674799 4353841. End of population: 8674802 4353841.	Beginning of population: N 39o17.995‘ E 047o01.511‘ End of population: N 39o17.995‘ E 047o01.513‘	1647 – 1651
Iris sp.	26	Central part of the site, on a slope.	8674887 4353842	N 39o17.994‘ E 047o01.572‘	1652, 1653, 1655, 1656
Iris sp.	About 44 individuals	Central part of the site, on a slope.	Beginning of population: 8674936 4353824. End of population: 8674932 4353827.	Beginning of population: N 39o17.984‘ E 047o01.606‘ End of population: N 39o17.985‘ E 047o01.603‘	1657, 1658, 1660, 1662 Overview photos of the area.
Iris sp.	22	Central eastern part of the site, on a gentle slope.	8675337 4353560	N 39o17.836‘ E 047o01.880‘	1672 – 1674
Iris sp.	11	Eastern area of the site. Gentle slope.	8675448 4353452	N 39o17.777‘ E 047o01.956‘	1675
Iris sp.	5	Eastern area of the site. Gentle slope.	8675364 4353433	N 39o17.767‘ E 047o01.897‘	1677, 1679
Iris sp.	56	Central eastern area of the site. Gentle slope.	8675300 4353371	N 39o17.735‘ E 047o01.851‘	1680, 1682 – 1686

Species	Number	Location	GPS coordinates	GPS coordinates.	Photo No.
Iris sp.	About 44 individuals	Central part of the site, on a slope.	Beginning of population: 8675246 4353568 End of population: 8675245 4353567	Beginning of population: N 39º17.842‘ E 047º01.817‘ End of population: N 39º17.841‘ E 047º01.816‘	1687, 1694, 1694 Overview photos of the area. 1689, 1690, 1692
Iris sp.	About 65 individuals	Central part of the site, on a slope.	Beginning of population: 8675226 4353563 End of population: 8675232 4353558	Beginning of population: N 39º17.839‘ E 047º01.803‘ End of population: N 39º17.837‘ E 047º01.807‘	1695, 1697, 1700, 1701
Ficus carica	3	Central part of the site, in a ravine	8674748 4351886		0976, 0981, 0983 (spring).
Punica granatum	1	Southern part of the site. In a ravine at the height of the slope.	8673828 4351639		0956, 0958 (spring).

2.3 Recommendations

Anticipated risks: development of the territory for the construction of service facilities, installation of solar panels for the power plant, road construction, movement of heavy machinery, all of which may adversely affect the natural vegetation cover of the area and, as a consequence, mechanically disturb the soil cover and the structure of phytocenoses.

Particular attention should be paid to trees and shrubs, which are already found in small numbers. Two species of this group of plants, noted in the Red Book of Azerbaijan - 2023*, have been identified in the study areas: *Ficus carica* - tree, *Punica granatum* - shrub (Location and photos of these species were provided detail in the spring report).

Special care is required for steppe formations, phytocenoses of which are rare and gradually disappearing in Azerbaijan due to anthropogenic factor.

As mentioned above and shown in Tables 1 and 2, there is a rather large area of *Iris sp*. population in study areas – presumably one of two species Iris lycotis or Iris acutiloba.

I believe that one of the effective measures for the protection and preservation of *Iris sp*. population area is the creation of protected fencing zones and reserves taking into account the fact that their habitat is gentle slopes and hill heights. I recommend avoiding the development of the territory and working on hills as much as possible, using the plain zone and depressions between hills.

Unfortunately, as experience and literature sources on *Iris oncocyclus* show, these species are not suitable for rapid introduction and require high costs.

I recommend annual monitoring, based on the results of which it will be possible to give a forecast of the vitality of these populations. If population reduction or threat of extinction are detected, I recommend that local authorities or contractors take specific measures for conservation and maintenance and in some cases providing recommendations on restoration of population components.

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APPENDIX 2F: ZOOLOGY BASELINE REPORT (IBRAHIMOV & MUSTAFAYEV, 2023)

SPRING ZOOLOGY SURVEY (May 2023)

A. LITERATURE REVIEW AND B. RESULTS OF FIELD SURVEY OF FAUNA IN THE CONTRACT AREA OF THE PROPOSED SOLAR POWER PLANT TO BE CONSTRUCTED IN JABRAYIL DISTRICT

A. Literature Review

PhD in Biology, Professor Shaig Ibrahimov

The Contract Area selected for the construction of a solar power plant is located in the plain area near Hajili settlement 5 km south of Jabrayl city in the foothills of Azerbaijan's Jabrayl district. Since Jabrayil district was occupied by the Armed Forces of the Republic of Armenia in 1993, its fauna remained unexplored for more than 30 years. Although Jabrayil district was liberated from occupation by Azerbaijan's Armed Forces in October 2020, it has been extremely difficult to carry out environmental research here because a large part of the district has been mined. For this reason and in order to get an idea of fauna in the Contract Area, it is necessary to refer to literature about the fauna of areas geographically or ecologically similar, as well as information related to Jabrayil district proper. Since the habitat of plants and animals is very similar in and around the area of the future power plant, a literature review provides a fairly complete picture of biological resources in this area. However, this does not preclude the need to confirm the following literature data with short-term field studies.

The characteristics of the fauna expected to be found in the area of the solar power plant as suggested by the literature review are shown below. The study based on literature data reflects the main features of the fauna of terrestrial and aquatic environments, together with the species included in the Red Book of Azerbaijan.

Due to the fact that special research on animals have not been carried out in the territory of the power plant, the following is literature data on the fauna of the areas geographically or ecologically close to it.

1.1 Amphibians

According to available literature data (Алекперов, 1978; Джафарова, 1982; Алиев и Ганиев, 1997; Ганиев и Нуриев, 2000; Qəniyev və Nuriyev, 2004) only two amphibian species mentioned below were recorded near the area:

Group – Anura	
Family – Bufonidae Family – Ranidae	*Bufo viridis* *Pelophylax ridibundus*

One of these two species, *Bufo visidir*, is well adapted to arid climates and can be relatively widespread. The other species, *Pelophylax ridibundus*, can be found only in water bodies, including temporary ones and places close to them. Since both of these species spawn in water, they are not found far from them. Due to the lack of fresh water in most parts of the territory, they are relatively rare in the Contract Area.

1.2 Reptiles

The review of literature (Алиев, 1974; Алекперов, 1978; Ахмедов, 1087; Ахмедов, Щербак, 1987: Алиев и Ганиев, 1997; Алиев и Джафарова, 2000; Əliyev və Cəfərova, 2004; https://az.wikipedia.org/wiki/Azərbaycanda_yayılmış_sürünənlərin_siyahısı) reveals the presence of the following 23 species of reptiles.

Group – Cryptodira	
Family – Geoemydidae	*Mauremis caspica* *Emys orbicularis*
Family – Testudinidae	*Testudo graeca* [Included in the III Edition of the Red Book of the Republic of Azerbaijan (Fauna, 2023)]
Group – Sauria	
Family – Gekkonidae	*Gymnodactylus caspius*
Family – Agamidae	*Laudakia qafqasia* *Phrynocephalus helioscopus*
Family – Anguidae	*Pseudopus apodus*
Family – Scincidae	*Eumeces schneideri* *Trachylepis aurata*
Family – Lacertidae	*Lacerta strigata* *Ophisops elegans* *Eremias strauchi* *E.arguta*
Group – Serpentes	
Family – Typhlopidae	*Typhlops vermicularis*
Family – Boidae	*Eryx jagulus* Family – Colubridae *Natrix tesselata* *Coluber najadum* *Elaphe hohenackeri* *E. quatuorlineata* *E.collaris* *Telescopus fallax* (poisonous) *Malpolon monspeculanis*
Family – Viperidae	*Macrovipera lebetina* (highly poisonous)

1.3 Birds

According to available information (Гамбаров, 1941; Xanmamedov, 1971; Бабаев, 1991; Туаев, 2000; Мустафаев, Султанов, Бабаев, 2000; Mustafayev, Babayev, Sultanov, Musayev, 2004; Sultanov E.Q. və b., 2000; Sultanov, 2004; Mustafayev, Məmmədov, 2006; Mustafayev və Sadıqova, 2005, 2010; Kərimov, 2017, 2021; Karimov and Mamedov, 2019), there are 54 bird species in the area. They are divided in the following groups and families:

Group – Falconiformes	
Family – Accipitridae	***Circus cyaneus*** ***Accipiter nisus*** ***Buteo rufinus*** *B.buteo* *Heliacetus albicilla* [Included in the III Edition of the Red Book of the Republic of Azerbaijan (Fauna, 2023)] *Aquila rapax* *A.eliaca* [Included in the III Edition of the Red Book of the Republic of Azerbaijan (Fauna, 2023)] **Gypaetus barbatus** [Included in the III Edition of the Red Book of the Republic of Azerbaijan (Fauna, 2023)] **Neophron percnopterus** ([Included in the III Edition of the Red Book of the Republic of Azerbaijan (Fauna, 2023)] **Gyps fulvus** [Included in the III Edition of the Red Book of the Republic of Azerbaijan (Fauna, 2023)]
Family – *Falconidae*	*Falco tinnunculus* *F.naumanni*
Group – Galliformes	
Family – Phasanidae	*Francolinus francolinus* [Included in the III Edition of the Red Book of the Republic of Azerbaijan (Fauna, 2023)] *Phasianus colchicus* *Coturnix coturnix* *Perdix perdix* [Included in the III Edition of the Red Book of the Republic of Azerbaijan (Fauna, 2023)]
Family – *Orididae*	*Tetrax tetrax* [Included in the III Edition of the Red Book of the Republic of Azerbaijan (Fauna, 2023)]
Group – Columbiformes	
Family – Columbidae	*Columba livia* *Streptopelia turtur*
Group – Cuculiformes	
Family – Cuculidae	*Cuculus canoris*
Group – Strigiformes	
Family – Strigidae	*Athene 57sabel* *Strix aluco*
Group – Capromulqiformes	
Family – Capromulqidae	*Caprimulgus europaeus*
Group – Apodiformes	
Family – Apodidae	*Apus apus* *A.melba* *A.affinis*
Group – Coraciformes	
Family – Coraciidae	*Coracias qarrulus*

Family – Meropidae	*Merops apiaster* *M. persicus*
Family – Upipidae	*Upupa epops*
Group – Passeriformes	
Family Qaranquşlar – *Hirundinidae*	*Delishon urbica* *Hirundo rustica* Alaudidae *Galerida cristata* *Melanocorypha calandra* *Alauda arvensis*
Family – Motacillidae	*Motacilla alba* *M.flava*
Family – Laniidae	*Lanius cristatus*
Family – Sturnidae	*Sturnus vulgaris*
Family – Corvidae	*Pica pica* *Corvus corone* *C.cornix* *C.frugilegus*
Family – *Sylviidae*	*Hippolaris languidae*
Family – Turdidae	*Turdus merula* *Oenanthe 58sabelline* *O.plescanka* *O.oenanthe*
Family – Passeridae	*Passer domesticus* *P. montanus* *P.hispaniolensis*
Family – Emberizidae	*Emberiza calandra* *E.melanocephala*

1.4 Mammals

According to literature (Верещагин, 1942, 1958, 1959; Алекперов, Эйгелис, Ахвердиев, 1975; Гошуналиев, 1976, 1990; Гидаятов, 1975; Гаджиев, Рахматулина и Гошуналиев, 2000; Hacıyev, Ələkbərov, Rəhmətulina və Qoşunəliyev, 2004; Rəhmətulina, 2005, 2008; Рахматулина, 2005), 27 species of mammals belonging to five groups can be recorded near the area where the power plant is to be built. A taxonomic list of these species is shown below:

Group – Insectivora	
Family – Erinaceidae	*Hemiechinus auritus*
Family – Soricidae	*Crocidura leucodon* *C.gueldenstaedti*
Group – Chiroptera	
Family – Rhinolophidae	*Rhinolophus hipposideros* [Included in the III Edition of the Red Book of the Republic of Azerbaijan (Fauna, 2023)]

	Rh.mehelii [Included in the III Edition of the Red Book of the Republic of Azerbaijan (Fauna, 2023)] Böyük nalburun – *Rh.ferrumequinum* *Myotis mystacinus* *Pipistrellus pipistrellus* *P.kuhli* *Eptesicus serotinus*
Group – Logomorpha	
Family – Leporidae	*Lepus europaeus*
Group – Rodentia	
Family – Dipodidae	*Attactaga williamsi* *A.elater*
Family – Muridae	*Rattus norvegicus* *R.rattus* *Mus musculus*
Family – Cricetidae	*Cricetulus migratorius* *Meriones erythrourus* *M.persicus* *M.blackleri* *Microtus socialis* *M.arvalis*
Group – Carnivora	
Family – Canidae	*Canis aureus* *Canis lupus* *Vulpes vulpes*
Family – Mustelidae	*Vormela peregusna* [Included in the III Edition of the Red Book of the Republic of Azerbaijan (Fauna, 2023)] *Meles canescens*

The area where the Jabrayil solar power station is to be built is located approximately 7 km from the Araz river. In addition, during the construction, the roads located along the Araz river and passing up to 2 km away from the river can be used for the transportation of goods. Therefore, the possible impact on the fauna of the Araz river during construction should be taken into account. Review of literature (Абдурахманов, 1962; Əbdürrəhmanov, 1966; Аббасов и др., 2000; Abbasov və b., 2004; Mustafayev, 2016, 2017; Yusifov et al., 2017; Freyhof et al., 2020) shows that 31 species of fish can be recorded in this part of the Araz river. Below is a classification with the names of groups and families to which these species belong:

Group – SALMONIFORMES	
Family – SALMONIDAE	*Salmo trutta fario*
Group – ESOCIFORMES	
Family – ESOCIDAE	*Esox lucius*

Group – CYPRINIFORMES	
Family – CYPRINIDAE	*Rutilus rutilus caspicus* *Leuciscus cephalus orientalis* *Scardinius erythrophthalmus* *Aspius aspius taeniatus* *Leucaspius delineatus delineatus* *Tinca tinca* *Chondrostoma cyri* *Romanogobio persa* *Capoeta sevangi* *Luciobarbus capito* *L. laserta cyri* *Chalcalburnus chalcoides* *Alburnus filippi* *Alburnoides bipunctatus eichwaldi* *Blicca bjoerkna transcaucasica* *Abramis brama orientalis* *Vimba vimba persa* *Cyprinus carpio* *Carassius auratus gibelio*
Family – BALITORIDAE	*Barbatula angorae*
Family – COBITIDAE	*Sabanejewa aurata*
Group – SILURIFORMES	*Silurus glanis*
Group – CYPRINODONTIFORMES	
Family – POECILIIDAE	*Gambusia affinis*
Group – PERCİFORMES	
Family – PERCİDAE	*Perca fluviatilis* *Sander lucioperca*
Family – GOBİİDAE	*Neogobius melanostomus* *N.platyrostris constructor* *N.fluviatilis pallasi* *N.kessleri gorlap*

Among the mentioned fish, there are two species included in the Red Book of the Republic of Azerbaijan (*Salmo trutta fario* and *Luciobarbus capito*). In addition, among the fish common in this part of the Araz river, *Esox lucius, Rutilus rutilus caspicus, Scardinius erythrophthalmus, Aspius aspius taeniatus, Tinca tinca, Chalcalburnus chalcoides, Abramis brama orientalis, Vimba vimba persa, Cyprinus carpio, Carassius auratus gibelio, Silurus glanis, Perca fluviatilis* and *Sander lucioperca* have commodity value.

In addition, a number of semi-aquatic animal species other than fish can be found in the area and nearby places, in temporary and possibly permanent water bodies, as well as in the part of the Araz river near the Contract Area. These include *Pelophylax ridibundus, Mauremis caspica, Emys orbicularis, Natrix tesselata,* and 25 species of waterfowl listed below:

Group – PODICIFORMES	
Family – PODICIPIDAE	*Podiceps cristatus* *P. ruficollis*
Group – PELECANIFORMES	
Family – PELECANIDAE	*Phalacrocorax carbo* *Ph. pygmaeus*
Group – CICONIFORMES	
Family – ARDEIDAE	*Botaurus stellaris* *Ixobrychus minutus* *Bubulcus ibis* *Egretta alba* *E. garzetta*
Family – CICONIDAE	*Ciconia ciconia*
Group – ANSERIFORMES	
Family – ANATIDAE	*Anser anser* *Anas platyrhynchos* *A. strepera* *Tadorna tadorna*
Group – GRUIFORMES	
Family – RALLIDAE	*Fulica atra* *Rallus aquaticus*
Group – CHARADRIIFORMES	
Family – CHARADRIIDAE	*Gallinago gallinago* *Vanellus vanellus* *Tringa stagnatilis*
Family – LARIDAE	*Larus argentatus* *L. ridibundus* *L. minutus* *Chlidonias hybrida* *Ch. leucoptera* *Sterna hirundo*

Among these bird species, there are no species included in the III Edition of the Red Book of the Republic of Azerbaijan (Fauna, 2023). However, since the mobility of birds is very high, it is necessary to assume that they can fly to the Contract Area.

The closest protected area to the Jabrayil solar power station is the Basitchay State Nature Reserve, which was established in 1974. The reserve covers an area of 107 hectares in the valley of Basitchay of Zangilan district, which is adjacent to Jabrayil district. It was organized to protect the rare eastern sycamore forest. It is 50 km away from Contract Area. The area where the reserve is located is mostly mountainous, with an altitude of 600-800 meters above sea level. Front Asian mabuya, black warbler, partridge, turaj, pigeon and other birds, hedgehogs, rabbits, rodents, horseshoe bat, wolf, wild boar, badger, wild cat, roe deer and other mammals are encountered in and around the reserve (http://eco.gov.az/index.php?pg=102; https://nationalparks.az/haqqimizda/dovlet-tebiet-goruğlari). The unique Basitchay State Nature Reserve, which was under Armenian occupation for almost 30 years, has now been freed from occupation. The monitoring carried out to assess the current state of the reserve shows that more than 42 of the 85 hectares of forest were completely destroyed. Valuable oriental sycamore trees were cut down, various explosives were used to destroy the roots, fires were set in the area, and the administrative building of the reserve was destroyed.

1.5 Conclusion

A review of literature on the fauna of the Contract Area for the solar power plant to be built in Jabrayil district of the Republic of Azerbaijan and adjacent areas showed that 106 species of animals, including 2 species of amphibians, 23 species of reptiles, 54 species of birds and 27 species of mammals are recorded here. Of these, a total of 12 species of animals, including 1 species of reptile, 8 species of birds and 3 species of mammals, were included in the III Edition of the Red Book of the Republic of Azerbaijan (Fauna, 2023).

In addition, it should be taken into account that the Contract Area is located approximately 7 km from the Araz river, and the highway to be used for freight transportation during construction is located approximately 2 km away. In this part of the Araz river, it is possible to find 31 species of fish, 1 species of amphibians, 3 species of reptiles and 27 species of waterfowl. Of these, 2 species, *Salmo trutta fario* and *Luciobarbus capito*, are included in the III Edition of the Red Book of the Republic of Azerbaijan (Fauna, 2023).

The closest protected area to the Contract Area is the Basitchay State Nature Reserve, which is located in a mountainous area up to 50 km away. Due to the great distance, it is not expected that the construction and operation of the solar power station after it is commissioned will have any impact on this nature reserve.

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B. Results of Field Studies, Spring Survey (May 2023)

Ph.D. in Biology, Ass. Prof. Namig Mustafayev

1.1 Overall appearance

The study of the fauna was carried out in two areas located close to each other. The smaller one is located in the northeast and the large one in the southwest of the Contract Area. The study areas are shown on Figure 1.

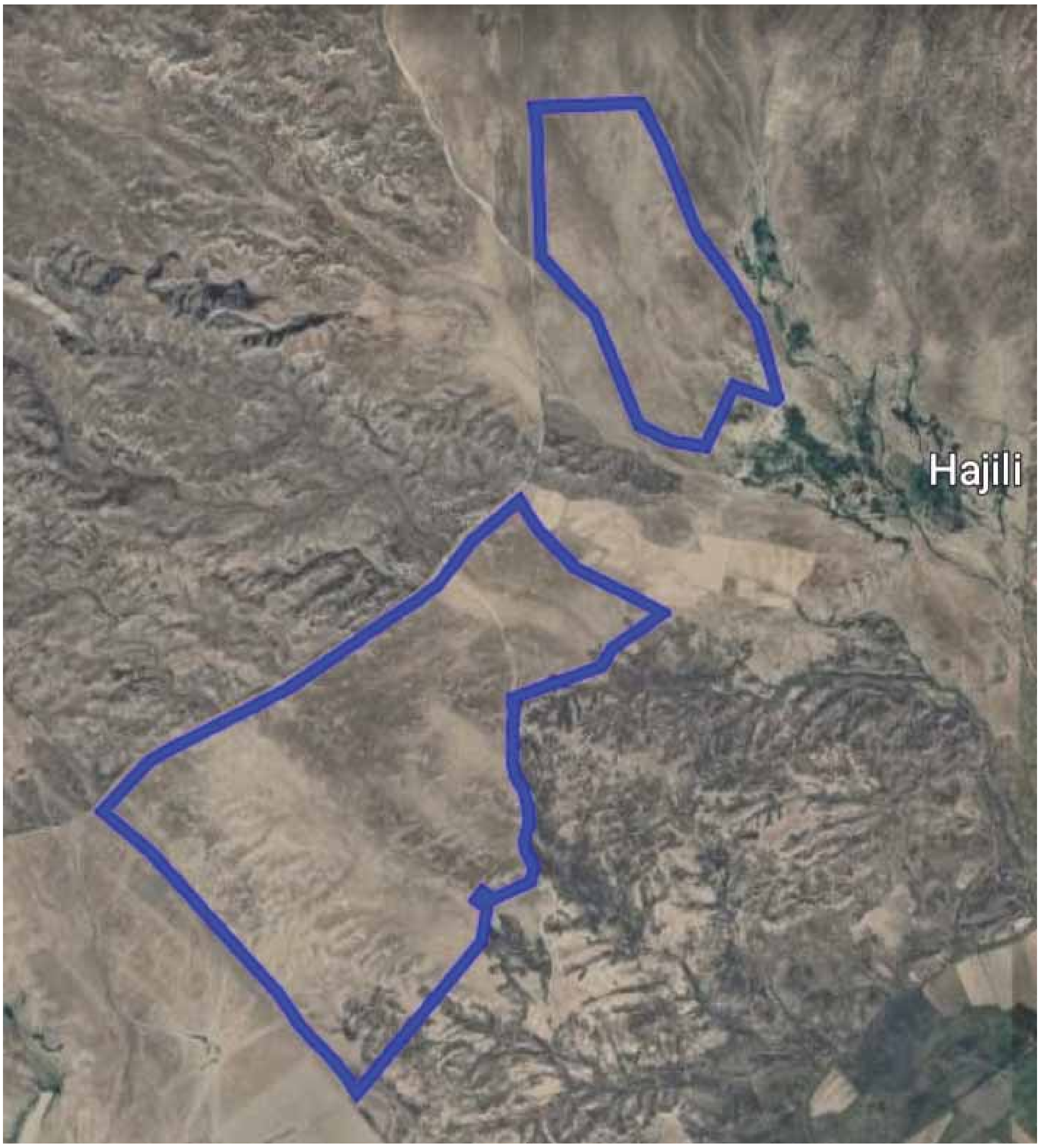

Figure 1. Overview of study areas

The monitoring scheme in the first and second parts of the research area is shown with transects on Figures 2 and 3.

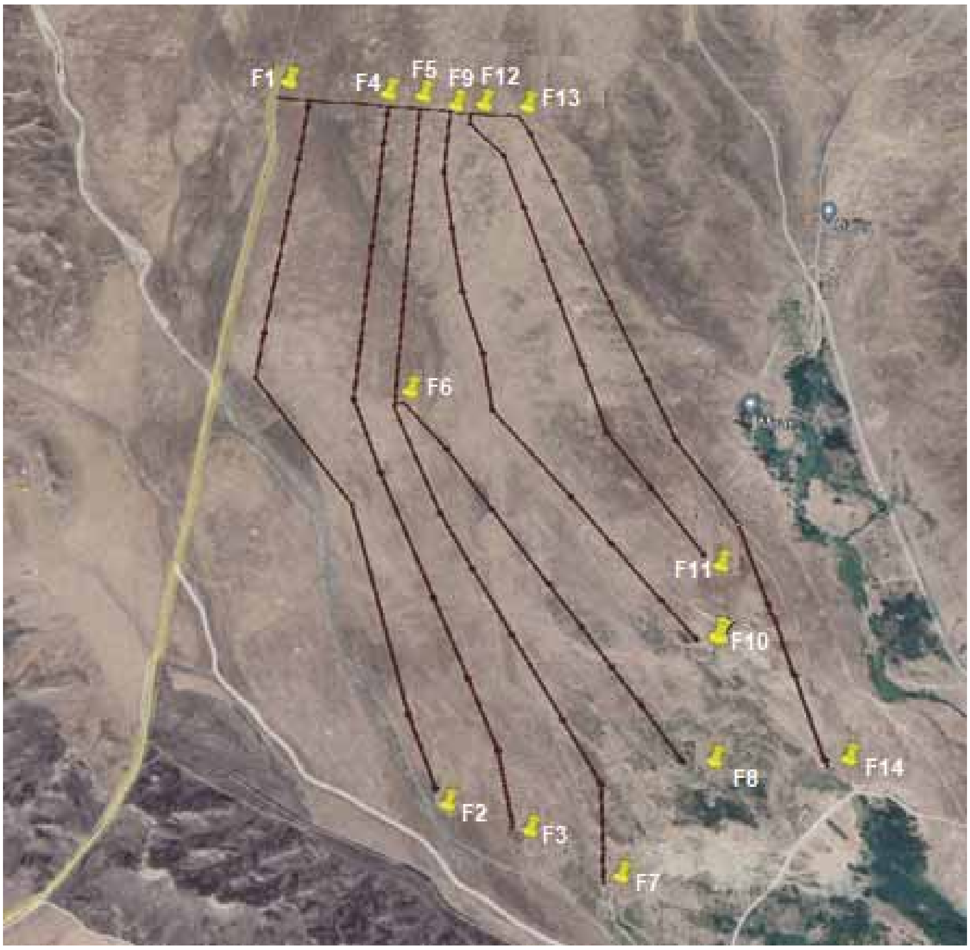

Figure 2. Monitoring scheme in the first part by transects

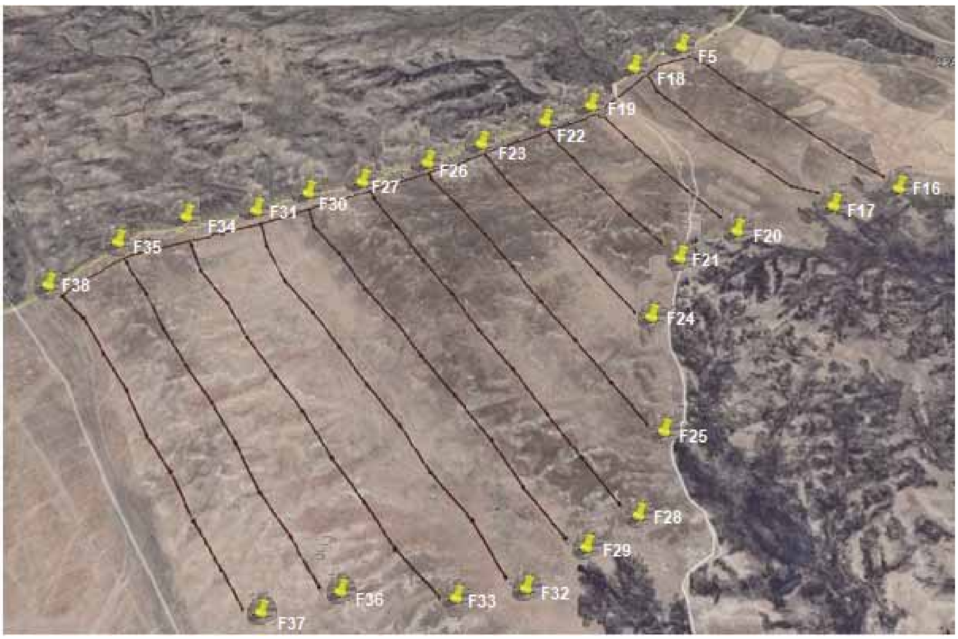

Figure 3. Monitoring scheme in the second part by transects

1.2 Coordinates of monitored places

The coordinates of starting and ending points of monitoring routes for each transect are given in the table below.

Coordinates of starting and ending points of monitoring routes for each transect

Point	Coordinates	Point	Coordinates
First area			
F (fauna)1	39°19'59.16"N 47° 1'57.11"E	F 8	39°18'50.15"N 47° 2'58.16"E
F 2	39°18'44.93"N 47° 2'31.50"E	F 9	39°19'58.38"N 47° 2'19.46"E
F 3	39°18'42.18"N 47° 2'40.72"E	F 10	39°19'1.52"N 39°19'1.52"E
F 4	39°19'59.02"N 47° 2'10.41"E	F 11	39°19'9.82"N 47° 2'58.12"E
F 5	39°19'59.44"N 47° 2'15.10"E	F 12	39°20'1.59"N 47° 2'22.39"E
F 6	39°19'22.42"N 47° 2'20.12"E	F 13	39°20'0.14"N 47° 2'28.35"E
F 7	39°18'39.53"N 47° 2'49.86"E	F 14	39°18'52.02"N 47° 3'10.56"E
Second area			
F 15	39°18'23.58"N 47° 1'47.27"E	F 27	39°17'45.73"N 47° 0'46.61"E
F 16	39°18'1.61"N 47° 2'33.63"E	F 28	39°16'59.02"N 47° 1'48.59"E
F 17	39°17'57.03"N 47° 2'21.37"E	F 29	39°16'52.85"N 47° 1'40.35"E
F 18	39°18'17.52"N 47° 1'38.84"E	F 30	39°17'40.94"N 47° 0'35.45"E
F 19	39°18'7.76"N 47° 1'29.91"E	F 31	39°17'37.40"N 47° 0'26.51"E
F 20	39°17'48.63"N 47° 2'0.89"E	F 32	39°16'46.16"N 47° 1'31.88"E
F 21	39°17'42.81"N 47° 1'48.65"N	F 33	39°16'42.23"N 47° 1'20.97"E
F 22	39°18'1.50"N 47° 1'20.45"E	F 34	39°17'31.77"N 47° 0'14.51"E
F 23	39°17'56.34"N 47° 1'8.67"E	F 35	39°17'27.16"N 47° 0'2.51"E
F 24	39°17'28.76"N 47° 1'46.70"E	F 36	39°16'41.27"N 47° 1'0.63"E
F 25	39°17'10.56"N 47° 1'51.95"E	F 37	39°16'35.60"N 47° 0'50.06"E
F 26	39°17'50.44"N 47° 0'57.00"E	F 38	39°17'19.71"N 46°59'53.30"E

1.3 Classification of animal species recorded in the monitoring area

The classification of fauna species recorded in the monitoring area is as follows:

Class: Amphibians	
Group: Anura	
Family: Ranidae Genus: *Pelophylax*	Species: *Pelophylax ridibundus*
Class: Reptiles	
Group: Testudines	
Family: Testudinidae Genus: *Testudo*	Species: *Testudo graeca*
Family: Emydidae Genus: *Emys*	Species: *Emys orbicularis*
Group: Squam	
Family: Anguidae Genus: *Pseudopus*	Species: *Pseudopus apodus*
Family: Lacertidae Genus: *Lacerta*	Species: *Lacerta strigata*
Group: Serpentes	
Family: Viperidae Genus: *Macrovipera*	Species: *Macrovipera lebetina*
Class: Aves	
Group: Falconiformes	
Family: Accipitridae Genus: Buteo	Species: *Buteo rufinus*
Genus: *Aquila*	Species: *Aquila rapax*
Group: Galliformes	
Family: Phasianidae Genus: *Francolinus*	Species: *Francolinus francolinus*
Genus: *Phasianus*	Species: *Phasianus colchicus*
Genus: *Coturnix*	Species: *Coturnix coturnix*
Group: Columbiformes	
Family: Columbidae Genus: *Columba*	Species: *Columba livia*
Genus: *Streptopelia*	Species: *Streptopelia turtur*
Group: Caprimulgiformes	
Family: Caprimulgidae Genus: *Caprimulgus*	Species: *Caprimulgus europaeus*
Group: Apodiformes	
Family: Apodidae	Species: *Apus apus*

Genus: *Apus*	Species: *A.affinis*
Group: Coraciformes	
Family: Meropidae Genus: *Merops*	Species: *Merops apiaster* Species: *M. persicus*
Family: Upupidae Genus: *Upupa*	Species: *Upupa epops*
Group: Passeriformes	
Family: Hirundinidae Genus: *Hirundo*	Species: *Hirundo rustica*
Family: Alaudidae Genus: *Galerida*	Species: *Galerida cristata*
Genus: *Melanocorypha*	Species: *Melanocorypha calandra*
Genus: *Alauda*	Species: *Alauda arvensis*
Family: Motacillidae Genus: *Motacilla*	Species: *Motacilla flava* Species: *M.alba*
Family: Sturnidae Genus: *Sturnus*	Species: *Sturnus roseus*
Family: Corvidae Genus: *Pica*	Species: *Pica pica*
Genus: *Corvus*	Species: *Corvus corone* Species: *C.cornix*
Family: Turdidae Genus: *Oenanthe*	Species: *Oenanthe isabellina* Species: *O.plescanka* Species: *O.oenanthe*
Family: Passeridae Genus: *Passer*	Species: *Passer montanus*
Class: Mammalia	
Group: Insectivora	
Family: Erinaceidae Genus: *Hemiechinus*	Species: *Hemiechinus auritus*
Group: Rodentia	
Family: Cricetidae Genus: *Microtus*	Species: *Microtus arvalis*
Group: Carnivora	
Family: Canidae Genus: *Canis*	Species: *Canis lupus*
Genus: *Vulpes*	Species: *Vulpes vulpes*

1.4 Animal species recorded in monitoring area by transects

Date	Transect	Fauna	Species included in the Red Book of Azerbaijan
11.05.2023	F1-F2	*Testudo graeca, Pseudopus apodus, Laserta strigata, Buteo rufinus, Columba livia, Streptopelia turtur, Apus apus, A.affinis, Merops apiaster, M. persicus, Upupa epops, Hirundo rustica, Galerida cristata, Melanocorypha calandra, Alauda arvensis, M.alba, C.cornix, Oenanthe isabellina, Passer montanus, Hemiechinus auritus, Microtus arvalis*	*Testudo graeca*
12.05.2023	F3-F4	*Pseudopus apodus, Laserta strigata, Aquila rapax, Coturnix coturnix, Columba livia, Apus apus, A.affinis, Merops apiaster, M. persicus, Upupa epops, Hirundo rustica, Galerida cristata, Melanocorypha calandra, Alauda arvensis, C.cornix, Oenanthe isabellina, O.oenanthe, Passer montanus, Microtus arvalis*	-
	F5-F6	*Testudo graeca, Pseudopus apodus, Laserta strigata, Macrovipera lebetina, Buteo rufinus, Aquila rapax, Columba livia, Streptopelia turtur, Merops apiaster, M. persicus, Hirundo rustica, Galerida cristata, Melanocorypha calandra, Alauda arvensis, M.flava, C.cornix, Oenanthe isabellina, O.plescanka, Passer montanus, Vulpes vulpes*	*Testudo graeca*
	F 6-F 7 F 6-F 8	*Pseudopus apodus, Laserta strigata, Macrovipera lebetina, Coturnix coturnix, Columba livia, Streptopelia turtur, Apus apus, A.affinis, Merops apiaster, M. persicus, Hirundo rustica, Galerida cristata, Melanocorypha calandra, Alauda arvensis, M.flava, M.alba, C.cornix, Oenanthe isabellina, O.plescanka, Passer montanus, Microtus arvalis*	*Testudo graeca*
13.05.2023	F9-F10	*Testudo graeca, Emys orbicularis, Pseudopus apodus, Laserta strigata, Buteo rufinus, Aquila rapax, Francolinus francolinus, Phasianus colchicus, Columba livia, Streptopelia turtur, Caprimulgus europaeus, Apus apus, A.affinis, Merops apiaster, M. persicus, Hirundo rustica, Galerida cristata, Melanocorypha calandra, Alauda arvensis, M.flava, M.alba, Sturnus vulgaris, Pica pica, Corvus corone, C.cornix, Oenanthe isabellina, O.oenanthe, Passer montanus, Microtus arvalis, Canis lupus, Vulpes vulpes*	*Testudo graeca, Francolinus francolinus, Phasianus colchicus*
	F11-F12	*Pelophylax ridibundus, Emys orbicularis, Pseudopus apodus, Laserta strigata, Macrovipera lebetina, Buteo rufinus, Aquila rapax, Francolinus francolinus, Phasianus colchicus, Coturnix coturnix, Columba livia, Streptopelia turtur, Caprimulgus europaeus, Apus apus, A.affinis, Merops apiaster, M. persicus, Upupa epops, Hirundo rustica, Galerida cristata, Melanocorypha calandra, Alauda arvensis, M.flava, M.alba, Sturnus vulgaris, Pica pica, Corvus corone, C.cornix, Oenanthe isabellina, O.plescanka, O.oenanthe, Passer montanus, Microtus arvalis, Vulpes vulpes*	*Francolinus francolinus, Phasianus colchicus*

Date	Transect	Fauna	Species included in the Red Book of Azerbaijan
	F13-F14	*Pelophylax ridibundus, Testudo graeca, Emys orbicularis, Pseudopus apodus, Laserta strigata, Macrovipera lebetina, Buteo rufinus, Aquila rapax, Francolinus francolinus, Phasianus colchicus, Coturnix coturnix, Columba livia, Caprimulgus europaeus, Apus apus, Merops apiaster, M. persicus, Hirundo rustica, Galerida cristata, Melanocorypha calandra, Alauda arvensis, M.alba, Pica pica, Corvus corone, C.cornix, Oenanthe isabellina, O.plescanka, O.oenanthe, Passer montanus, Microtus arvalis*	*Testudo graeca, Francolinus francolinus, Phasianus colchicus*
14.05.2023	F15-F16	*Testudo graeca, Pseudopus apodus, Laserta strigata, Buteo rufinus, Aquila rapax, Francolinus francolinus, Columba livia, Streptopelia turtur, Caprimulgus europaeus, Apus apus, A.affinis, Merops apiaster, M. persicus, Hirundo rustica, Galerida cristata, Melanocorypha calandra, Alauda arvensis, M.alba, Sturnus vulgaris, Pica pica, Corvus corone, C.cornix, Oenanthe isabellina, O.plescanka, O.oenanthe, Passer montanus, Hemiechinus auritus, Microtus arvalis*	*Testudo graeca, Francolinus francolinus*
	F17-F18	*Testudo graeca, Pseudopus apodus, Laserta strigata, Macrovipera lebetina, Buteo rufinus, Aquila rapax, Coturnix coturnix, Streptopelia turtur, Apus apus, A.affinis, M. persicus., Upupa epops, Hirundo rustica, Galerida cristata, Melanocorypha calandra, M.flava, M.alba, Sturnus vulgaris, Corvus corone, C.cornix, Oenanthe isabellina, O.plescanka, O.oenanthe, Passer montanus, Microtus arvalis, Canis lupus*	*Testudo graeca*
	F19-F20	*Testudo graeca, Pseudopus apodus, Laserta strigata, Macrovipera lebetina, Aquila rapax, Coturnix coturnix, Columba livia, Streptopelia turtur, Apus apus, A.affinis, Merops apiaster, M. persicus, Hirundo rustica, Galerida cristata, Melanocorypha calandra, Alauda arvensis, M.flava, Pica pica, Corvus corone, C.cornix, O.plescanka, O.oenanthe, Passer montanus, Microtus arvalis, Vulpes vulpes*	*Testudo graeca*
	F21-F22	*Testudo graeca, Pseudopus apodus, Laserta strigata, Macrovipera lebetina, Buteo rufinus, Aquila rapax, Columba livia, Streptopelia turtur, Apus apus, A.affinis, Merops apiaster, M. persicus, Galerida cristata, Melanocorypha calandra, Alauda arvensis, M.flava, M.alba, Sturnus vulgaris, C.cornix, Oenanthe isabellina, O.plescanka, O.oenanthe, Passer montanus, Microtus arvalis, Vulpes vulpes*	*Testudo graeca*

Date	Transect	Fauna	Species included in the Red Book of Azerbaijan
15.05.2023	F23-F24	*Testudo graeca, Pseudopus apodus, Laserta strigata, Macrovipera lebetina, Buteo rufinus, Aquila rapax, Francolinus francolinus, Columba livia, Streptopelia turtur, Caprimulgus europaeus, Apus apus, A.affinis, Hirundo rustica, Galerida cristata, Melanocorypha calandra, Alauda arvensis, M.flava, M.alba, Pica pica, Corvus corone, C.cornix, Oenanthe isabellina, O.plescanka, O.oenanthe, Passer montanus, Hemiechinus auritus, Microtus arvalis, Vulpes vulpes*	*Testudo graeca, Francolinus francolinus*
	F25-F26	*Pelophylax ridibundus, Testudo graeca, Emys orbicularis, Pseudopus apodus, Laserta strigata, Aquila rapax, Francolinus francolinus, Phasianus colchicus, Coturnix coturnix, Columba livia, Streptopelia turtur, Caprimulgus europaeus, Apus apus, A.affinis, Merops apiaster, M. persicus, Upupa epops, Hirundo rustica, Galerida cristata, Melanocorypha calandra, Alauda arvensis, M.flava, M.alba, Sturnus vulgaris, Corvus corone, C.cornix, Oenanthe isabellina, O.plescanka, O.oenanthe, Passer montanus, Microtus arvalis*	*Testudo graeca, Francolinus francolinus, Phasianus colchicus*
	F27-F28	*Testudo graeca, Pseudopus apodus, Laserta strigata, Macrovipera lebetina, Coturnix coturnix, Apus apus, A.affinis, Merops apiaster, Upupa epops, Hirundo rustica, Galerida cristata, Melanocorypha calandra, Alauda arvensis, M.flava, M.alba, Corvus corone, C.cornix, Oenanthe isabellina, O.plescanka, O.oenanthe, Passer montanus, Microtus arvalis*	*Testudo graeca*
	F29-F30	*Testudo graeca, Pseudopus apodus, Laserta strigata, Macrovipera lebetina, Buteo rufinus, Aquila rapax, Francolinus francolinus, Coturnix coturnix, Columba livia, Streptopelia turtur, Caprimulgus europaeus, Apus apus, A.affinis, Merops apiaster, M. persicus, Upupa epops, Hirundo rustica, Galerida cristata, Melanocorypha calandra, Alauda arvensis, M.flava, M.alba, Corvus corone, C.cornix, Oenanthe isabellina, O.plescanka, O.oenanthe, Passer montanus, Microtus arvalis, Vulpes vulpes*	*Testudo graeca* (frequently encountered), *Francolinus francolinus*
16.05.2023	F31-F32	*Testudo graeca, Pseudopus apodus, Laserta strigata, Macrovipera lebetina, Buteo rufinus, Aquila rapax, Columba livia, Apus apus, A.affinis, Merops apiaster, M. persicus, Hirundo rustica, Galerida cristata, Melanocorypha calandra, M.alba, C.cornix, O.oenanthe, Passer montanus, Microtus arvalis*	*Testudo graeca*

Date	Transect	Fauna	Species included in the Red Book of Azerbaijan
	F33-F34	*Testudo graeca, Pseudopus apodus, Laserta strigata, Macrovipera lebetina, Aquila rapax, Columba livia, Apus apus, A.affinis, Merops apiaster, M. persicus, Hirundo rustica, Galerida cristata, Melanocorypha calandra, Alauda arvensis, M.flava, M.alba, Corvus corone, C.cornix, Oenanthe isabellina, O.plescanka, O.oenanthe, Passer montanus, Microtus arvalis, Vulpes vulpes*	*Testudo graeca* (frequently encountered)
	F35-F36	*Testudo graeca, Pseudopus apodus, Laserta strigata, Macrovipera lebetina, Buteo rufinus, Aquila rapax, Streptopelia turtur, A.affinis, Merops apiaster, M. persicus, Hirundo rustica, Galerida cristata, Melanocorypha calandra, Alauda arvensis, M.flava, M.alba, Corvus corone, C.cornix, Oenanthe isabellina, O.plescanka, O.oenanthe, Passer montanus, Microtus arvalis*	*Testudo graeca* (frequently encountered)
	F37-F38	*Testudo graeca, Pseudopus apodus, Laserta strigata, Macrovipera lebetina, Buteo rufinus, Aquila rapax, Apus apus, A.affinis, Merops apiaster, M. persicus, Upupa epops, Hirundo rustica, Galerida cristata, Melanocorypha calandra, Alauda arvensis, M.flava, Pica pica, Corvus corone, C.cornix, Oenanthe isabellina, O.plescanka, O.oenanthe, Passer montanus, Hemiechinus auritus*	*Testudo graeca* (frequently encountered)

1.5 Conclusion

Thus, monitoring was carried out on the transects between Fauna 1-Fauna 14 points in the first area on May 11-13, 2023, and between Fauna 15-Fauna 38 points in the second area on May 14-16. A total of 36 species were found in both areas. Of these species, 1 species belongs to the class of amphibians (*Pelophylax ridibundus*), 5 species to the class of reptiles (*Testudo graeca, Emys orbicularis, Pseudopus apodus, Laserta strigata, Macrovipera lebetina*), 27 species to the class of birds (*Buteo rufinus, Aquila rapax, Francolinus francolinus, Phasianus colchicus, Coturnix coturnix, Columba livia, Streptopelia turtur, Caprimulgus europaeus, Apus apus, A.affinis, Merops apiaster, M. persicus, Upupa epops, Hirundo rustica, Galerida cristata, Melanocorypha calandra, Alauda arvensis, M.flava, M.alba , Sturnus vulgaris, Pica pica, Corvus corone, C.cornix, Oenanthe isabellina, O.plescanka, O.oenanthe, Passer montanus*), and 4 species belong to the class of mammals (*Hemiechinus auritus, Microtus arvalis, Canis lupus, Vulpes vulpes*).

2 of the recorded species *(Testudo graeca* and *Francolinus francolinus*) are included in the Red Book of Azerbaijan.

It should be noted that *Macrovipera lebetina* snake, which is very poisonous, has also been recorded in the Contract Area. Therefore, it is important to use special clothes that prevent snake bites (long-necked boots, etc.) and have a stock of medicines against the effects of snake venom when any work is carried out in this area in the future.

Note. During the monitoring, heavy traffic of trucks related to construction was observed, which causes the local living beings to be disturbed.

A number of species were not recorded due to the rainy and cold weather during the monitoring. Also, the area is located on the migration route of a number of bird species. Taking into account the above, it is advisable to conduct more monitoring here in late August or early September in order to obtain more accurate information about the vertebrate species.

1.6 Photos of species observed during field studies

Rana ridibunda [Pelophylax ridibundus]

Testudo graeca

Emys orbicularis

Pseudopus apodus

Lacerta strigata

Macrovipera lebetina

Francolinus francolinus

Motacilla flava

Hemiechinus auritus

AUTUMN ZOOLOGY SURVEY (October 2023)

C. Results of the field fauna surveys conducted during October 4-9th in the contract area of the solar power plant to be constructed in Jabrayil district

Doctor of Biological Sciences, Assistant Professor Namig Mustafayev

1.1 General view of the area

The fauna field studies conducted during October 4-9 were carried out on the basis of the scheme applied on May 11-16. The general view of the survey areas and the monitoring scheme based on the transects are given in Figures 1, 2 and 3.

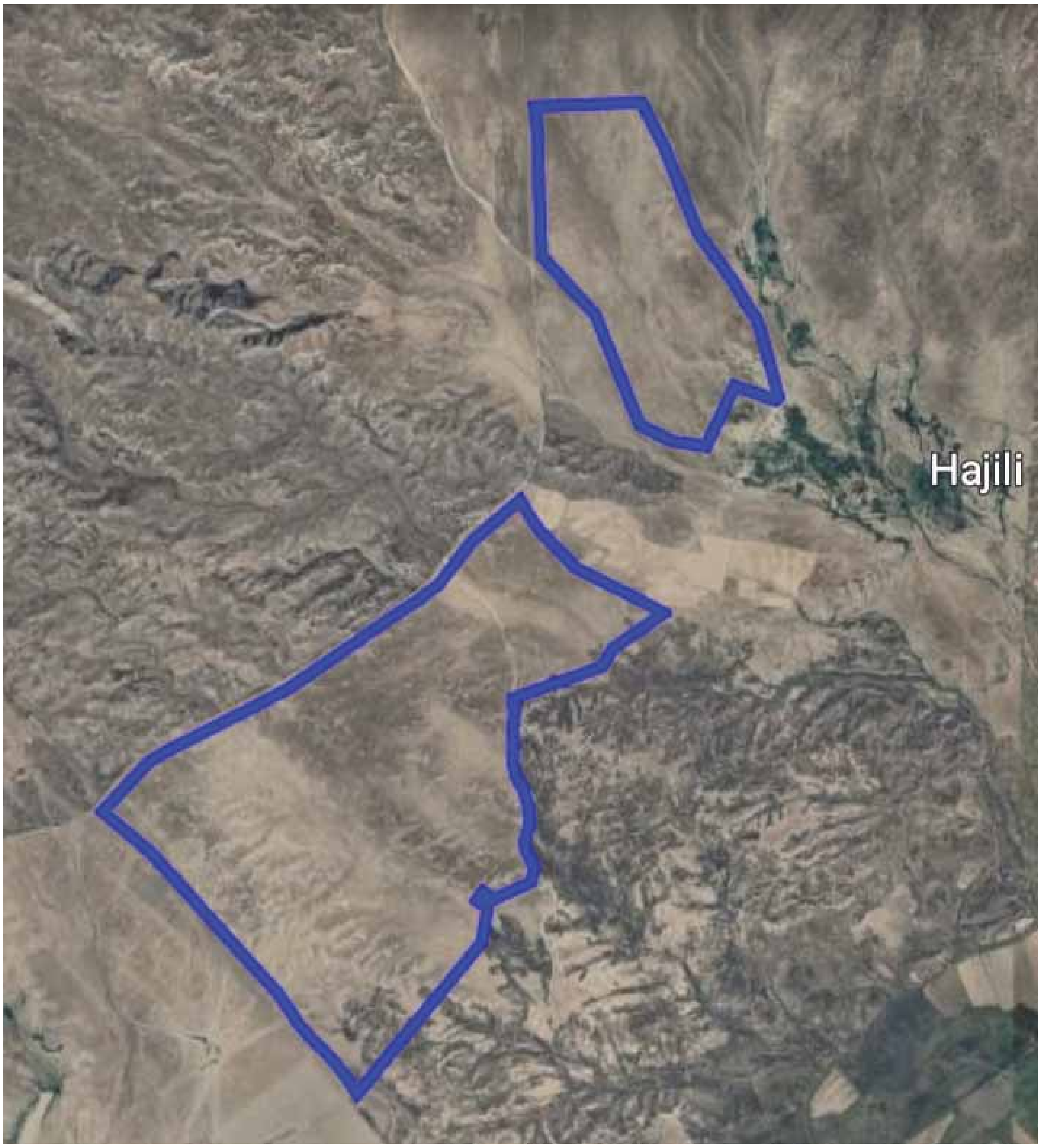

Fig 1. General view of the survey areas.

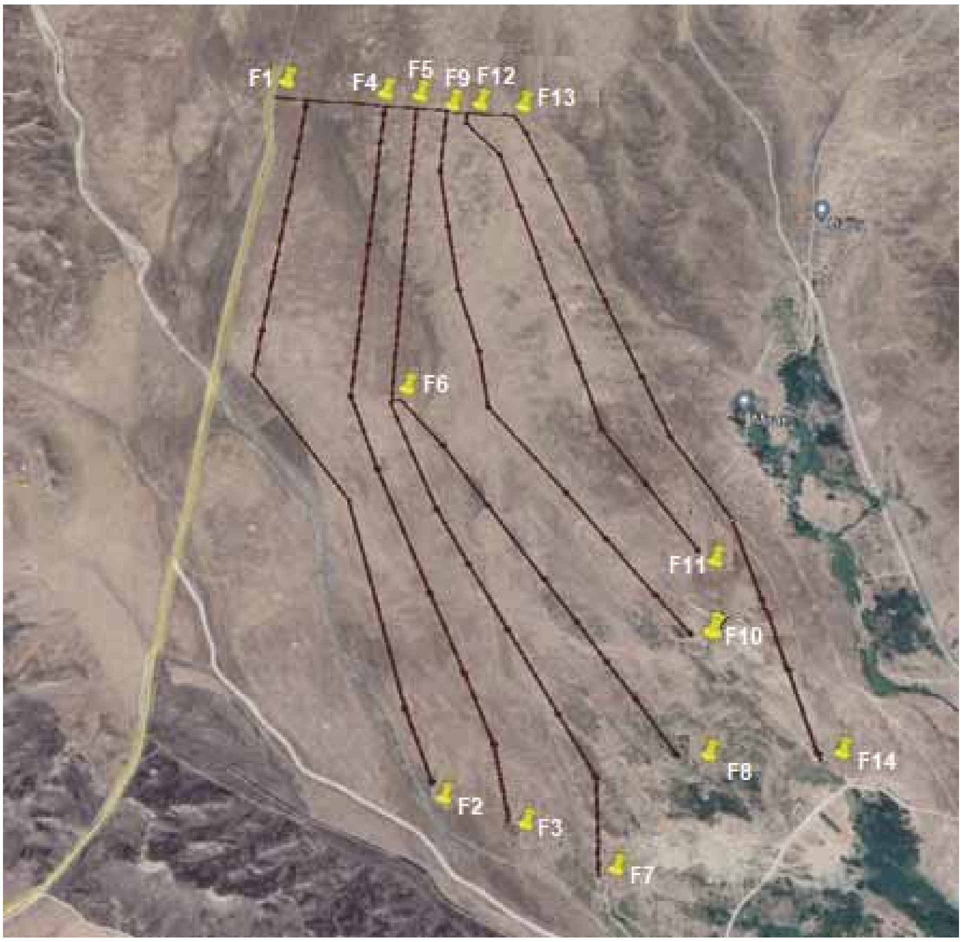

Fig 2. Monitoring scheme based on the transects of the first area.

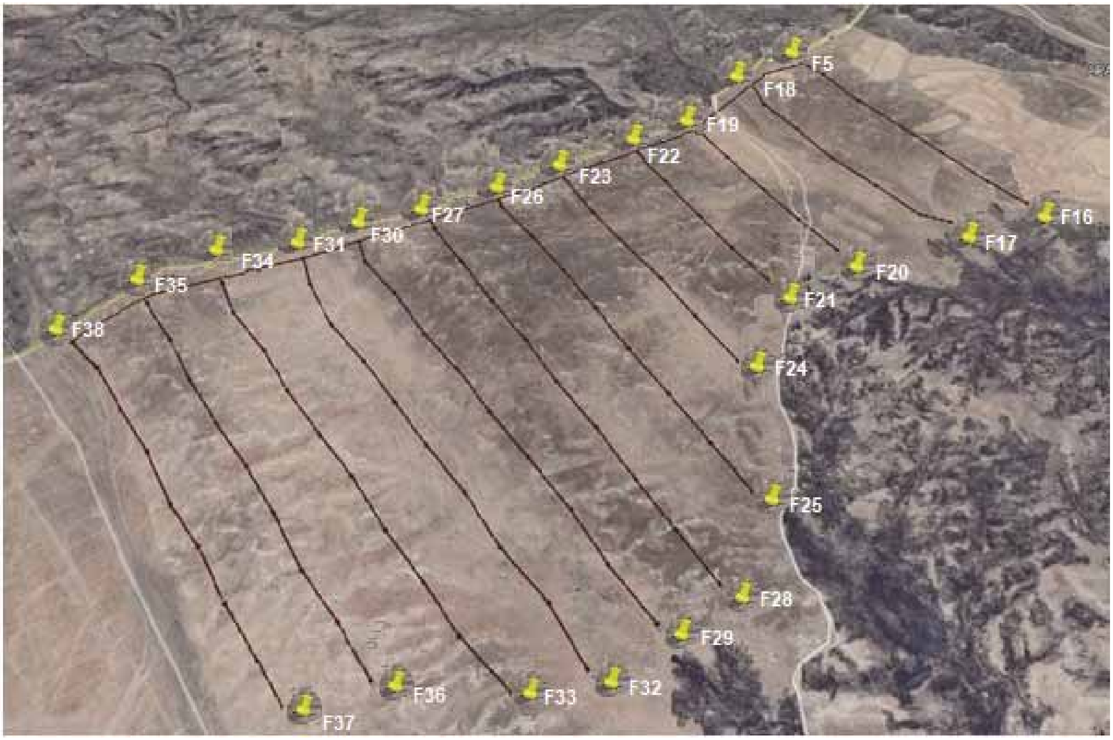

Fig 3. Monitoring scheme based on the transects of the first area

1.2 Coordinates of the monitoring area

The coordinates of the starting and ending points of the movement route for each transect, while monitoring was conducted in the area, are provided in the table below.

Table Coordinates of starting and ending points of transects in the monitoring area

Point	Coordinates	Point	Coordinates
First Area			
F (fauna)1	39°19'59.16"N 47° 1'57.11"E	F 8	39°18'50.15"N 47° 2'58.16"E
F 2	39°18'44.93"N 47° 2'31.50"E	F 9	39°19'58.38"N 47° 2'19.46"E
F 3	39°18'42.18"N 47° 2'40.72"E	F 10	39°19'1.52"N 39°19'1.52"E
F 4	39°19'59.02"N 47° 2'10.41"E	F 11	39°19'9.82"N 47° 2'58.12"E
F 5	39°19'59.44"N 47° 2'15.10"E	F 12	39°20'1.59"N 47° 2'22.39"E
F 6	39°19'22.42"N 47° 2'20.12"E	F 13	39°20'0.14"N 47° 2'28.35"E
F 7	39°18'39.53"N 47° 2'49.86"E	F 14	39°18'52.02"N 47° 3'10.56"E
Second Area			
F 15	39°18'23.58"N 47° 1'47.27"E	F 27	39°17'45.73"N 47° 0'46.61"E
F 16	39°18'1.61"N 47° 2'33.63"E	F 28	39°16'59.02"N 47° 1'48.59"E
F 17	39°17'57.03"N 47° 2'21.37"E	F 29	39°16'52.85"N 47° 1'40.35"E
F 18	39°18'17.52"N 47° 1'38.84"E	F 30	39°17'40.94"N 47° 0'35.45"E
F 19	39°18'7.76"N 47° 1'29.91"E	F 31	39°17'37.40"N 47° 0'26.51"E
F 20	39°17'48.63"N 47° 2'0.89"E	F 32	39°16'46.16"N 47° 1'31.88"E
F 21	39°17'42.81"N 47° 1'48.65"N	F 33	39°16'42.23"N 47° 1'20.97"E
F 22	39°18'1.50"N 47° 1'20.45"E	F 34	39°17'31.77"N 47° 0'14.51"E
F 23	39°17'56.34"N 47° 1'8.67"E	F 35	39°17'27.16"N 47° 0'2.51"E
F 24	39°17'28.76"N 47° 1'46.70"E	F 36	39°16'41.27"N 47° 1'0.63"E
F 25	39°17'10.56"N 47° 1'51.95"E	F 37	39°16'35.60"N 47° 0'50.06"E
F 26	39°17'50.44"N 47° 0'57.00"E	F 38	39°17'19.71"N 46°59'53.30"E

1.3 Animal species observed during field survey

The classification overview of the fauna species recorded in the monitoring area was as follows:

Class: Amphibians – Amphibia	
Order: Tailless amphibians – Anura	
Family: Frogs – Ranidae Genus: Frogs – *Pelophylax*	Species: Marsh frog – *Pelophylax ridibundus*
Class: Reptiles – Reptilia	
Order: Turtles – Tesdudines	
Family: Tortoises – Testudinidae Genus: Tortoises – *Testudo*	Species: Spur thighed tortoise – *Testudo graeca*
Family: Fresh water tortoises – Emydidae Genus: Pond turtles – *Emys*	Species: European pond turtle – *Emys orbicularis*
Order: Squamata – Squam	
Family: Anguids – Anguidae Genus: Anguid lizards – *Pseudopus*	Species: Pallas's glass lizard – *Pseudopus apodus*
Family: True lizards – Lacertidae Genus: Lizards – *Laserta*	Species: Caucasus emerald lizard – *Laserta strigata*
Class: Avians – Aves	
Order: Falcons – Falconiformes	
Family: Hawks – Accipitridae Genus: Buzzards – Buteo	Species: Long-legged buzzard – *Buteo rufinus*
Genus: Eagles – *Aquila*	Species: Steppe eagle – *Aquila rapax* Fəsilə Falcons – *Falconidae*
Genus: Falcon – *Falco*	Species: Common kestrel – *Falco tinnunculus*
Order: Galliformes	
Family: Pheasants – Phasianidae Genus: Francolins – *Francolinus*	Species: Black francolin – *Francolinus francolinus*
Genus: Pheasant – *Phasianus*	Species: Pheasant – *Phasianus colchicus*
Order: Doves – Columdiformes	
Family: Doves – Columbidae Genus: Dove – *Columba*	Species: Rock dove – *Columba livia*
Genus: Pigeons and doves – *Streptopelia*	Species: European turtle dove – *Streptopelia turtur*
Order: Owls – Strigiformes	
Fəsilə True owls – Strigidae Genus: Owls – *Athene*	Species: Little owl – *Athene noctua*
Order: Swifts – Apodiformes	
Family: Swifts – Apodidae Genus: Swifts – *Apus*	Species: Common swift – *Apus apus* Species: Little swift – *A.affinis*

Order: Coraciformes	
Family: Hoopoes – Upupidae Genus: Hoopoes – *Upupa*	Species: Surasian hoopoe – *Upupa epops*
Order: Passerines – Passeriformes	
Family: Larks – Alaudidae Genus: Crested lark – *Galerida*	Species: Crested lark – *Galerida cristata*
Genus: Calandra larks – *Melanocorypha*	Species: Calandra lark – *Melanocorypha calandra*
Genus: Skylarks – *Alauda*	Species: Eurasian skylark – *Alauda arvensis*
Family: Wagtails – Motocillidae Genus: Wagtails – *Motacilla*	Species: Western yellow wagtail – *Motacilla flava* Species: White wagtail – *M.alba*
Family: Corvidae Genus: Magpie – *Pica*	Species: Eurasian magpie – *Pica pica*
Genus: Crows – *Corvus*	Species: Hooded crow – *C.cornix*
Family: Turdines – Turdidae Genus: Wheatears – *Oenanthe*	Species: Isabelline wheatear – *Oenanthe isabellina* Species: Northern whitear – *O.oenanthe*
Family: Passerines – Passeridae Genus: Sparrow – *Passer*	Species: Eurasian tree sparrow – *Passer montanus*
Class: Mammals – Mammalia	
Order: Rodents – Rodentia	
Family: Cricetidae Genus: Voles – *Microtus*	Species: Common vole – *Microtus arvalis*
Order: Carnivores – Carnivora	
Family: Wolves – Canidae Genus: Wolves – *Canis*	Species: Golden jackal – *Canis aureus* Species: Wolf – *Canis lupus*
Genus: Foxes – *Vulpes*	Species: Red fox – *Vulpes vulpes*

Information on which transects and when the mentioned species were observed is provided in the table below.

Table: Distribution of animal species across transects in the monitoring area

Date	**Transect**	**Fauna**	**The species included in the "Red Book" of Azerbaijan**
04.10.2003	F1-F2	Caucasus emerald lizard, Long-legged buzzard, Common kestrel, rock dove, European turtle dove, Little swift, hoopoe, Crested lark, Calandra lark, Hooded crow, Isabelline wheatear, Eurasian tree sparrow, Common vole	-

Date	Transect	Fauna	The species included in the "Red Book" of Azerbaijan
05.10.2003	F3-F4	Spur thighed tortoise, Caucasus emerald lizard, Long-legged buzzard, Steppe eagle, Little swift, Crested lark, Calandra lark, Eurasian skylark, Hooded crow, Eurasian magpie, Isabelline wheatear, Northern whitear, Eurasian tree sparrow	Spur thighed tortoise (transekt boyu yalnız bir dəfə rast gəlindi)
	F5-F6	Caucasus emerald lizard, Long-legged buzzard, Common kestrel, rock dove, European turtle dove, Crested lark, Calandra lark, Eurasian skylark, Western yellow wagtail, Hooded crow, Isabelline wheatear, Pied wheatear, Eurasian tree sparrow, red fox	-
	F 6-F 7 F 6-F 8	Caucasus emerald lizard, Common kestrel, rock dove, European turtle dove, Common swift, Little swift, Crested lark, Calandra lark, Eurasian skylark, Western yellow wagtail, White wagtail, Hooded crow, Isabelline wheatear, Pied wheatear, Eurasian tree sparrow, Common vole	-
06.10.2023	F9-F10	Spur thighed tortoise, European pond turtle (N 39° 18' 33'', E 47° 03' 01''), Pallas's glass lizard, Caucasus emerald lizard, Steppe eagle, turac (N 39° 18' 29'', E 47° 03' 12''), Pheasant (N 39° 18' 36'', E 47° 03' 16''), rock dove, European turtle dove, Crested lark, Calandra lark, Eurasian skylark, Western yellow wagtail, White wagtail, Eurasian magpie, Hooded crow, Isabelline wheatear, Northern whitear, Eurasian tree sparrow, Common vole	Spur thighed tortoise (transekt boyu üç fərdə rast gəlindi), turac
	F11-F12	Marsh frog (N 39° 18' 33'', E 47° 03' 01''), European pond turtle, Pallas's glass lizard, Caucasus emerald lizard, Long-legged buzzard, Steppe eagle, rock dove, European turtle dove, Common swift, Little swift, hoopoe, Barn swallow, Crested lark, Calandra lark, Eurasian skylark, Western yellow wagtail, White wagtail, Eurasian magpie, Hooded crow, Isabelline wheatear, Pied wheatear, Northern whitear, Eurasian tree sparrow, Common vole, wolf	-
	F13-F14	Spur thighed tortoise, Caucasus emerald lizard, viper, Long-legged buzzard, Common kestrel, rock dove, Common swift, Crested lark, Calandra lark, Eurasian skylark, White wagtail, Eurasian magpie, Hooded crow, Northern whitear, Eurasian tree sparrow, Common vole	Spur thighed tortoise (transekt boyu yalnız bir dəfə rast gəlindi)
07.10.2023	F15-F16	Spur thighed tortoise, Caucasus emerald lizard, Long-legged buzzard, Steppe eagle, rock dove, Little swift, Crested lark, Calandra lark, Eurasian skylark, White wagtail, Eurasian magpie, Hooded crow, Isabelline wheatear, Pied wheatear, Northern whitear, Eurasian tree sparrow, Common vole, jackal	Spur thighed tortoise (transekt boyu iki fərdə rast gəlindi)

Date	Transect	Fauna	The species included in the "Red Book" of Azerbaijan
	F17-F18	Spur thighed tortoise, Pallas's glass lizard, Caucasus emerald lizard, Long-legged buzzard, Steppe eagle, Common kestrel, Common swift, Little swift, hoopoe, Crested lark, Calandra lark, Western yellow wagtail, White wagtail, Hooded crow, Isabelline wheatear, Pied wheatear, Northern whitear, Eurasian tree sparrow	Spur thighed tortoise (transekt boyu bir fərdə rast gəlindi)
	F19-F20	Caucasus emerald lizard, Steppe eagle, rock dove, European turtle dove, Common swift, Little swift, Crested lark, Calandra lark, Eurasian skylark, Western yellow wagtail, Eurasian magpie, Hooded crow, Pied wheatear, Northern whitear, Eurasian tree sparrow, red fox	-
	F21-F22	Spur thighed tortoise, Caucasus emerald lizard, Long-legged buzzard, Steppe eagle, rock dove, European turtle dove, Common swift, Little swift, Crested lark, Calandra lark, Western yellow wagtail, Hooded crow, Isabelline wheatear, Pied wheatear, Northern whitear, Eurasian tree sparrow, Common vole, red fox	Spur thighed tortoise (transekt boyu iki fərdə rast gəlindi)
08.10.2023	F23-F24	Caucasus emerald lizard, Common kestrel, Little swift, Crested lark, Calandra lark, Eurasian skylark, Western yellow wagtail, White wagtail, Isabelline wheatear, Pied wheatear, Northern whitear, Eurasian tree sparrow, Common vole, red fox	-
	F25-F26	Spur thighed tortoise, Caucasus emerald lizard, rock dove, European turtle dove, Little swift, hoopoe, Barn swallow, Crested lark, Calandra lark, Eurasian skylark, Western yellow wagtail, Hooded crow, Isabelline wheatear, Pied wheatear, Eurasian tree sparrow, Common vole	Spur thighed tortoise (transekt boyu bir fərdə rast gəlindi)
	F27-F28	Spur thighed tortoise, Pallas's glass lizard, Caucasus emerald lizard, Common swift, Little swift, Crested lark, Calandra lark, Eurasian skylark, Western yellow wagtail, White wagtail, Hooded crow, Isabelline wheatear, Northern whitear, Eurasian tree sparrow, Common vole, jackal	Spur thighed tortoise (transekt boyu iki fərdə rast gəlindi)
	F29-F30	Caucasus emerald lizard, Common kestrel, Steppe eagle, rock dove, European turtle dove, Common swift, Little swift, Crested lark, White wagtail, Hooded crow, Isabelline wheatear, Pied wheatear, Northern whitear, Eurasian tree sparrow, Common vole, red fox	-
09.10.2023	F31-F32	Spur thighed tortoise, Pallas's glass lizard, Caucasus emerald lizard, viper, Long-legged buzzard, Steppe eagle, rock dove, Common swift, Little swift, European bee eater, olive bee eater, Barn swallow, Crested lark, Calandra lark, White wagtail, Hooded crow, Northern whitear, Eurasian tree sparrow, Common vole	Spur thighed tortoise (transekt boyu üç fərdə rast gəlindi)

Date	Transect	Fauna	The species included in the "Red Book" of Azerbaijan
	F33-F34	Pallas's glass lizard, Caucasus emerald lizard, Steppe eagle, Common kestrel, rock dove, Common swift, Little swift, Crested lark, Calandra lark, Eurasian skylark, Western yellow wagtail, White wagtail, Hooded crow, Isabelline wheatear, Pied wheatear, Northern whitear, Eurasian tree sparrow, Common vole, red fox	-
	F35-F36	Caucasus emerald lizard, Long-legged buzzard, Steppe eagle, Common kestrel, Little swift, Crested lark, Calandra lark, Eurasian skylark, Western yellow wagtail, Isabelline wheatear, Eurasian tree sparrow, Common vole	-
	F37-F38	Spur thighed tortoise, Caucasus emerald lizard, Common kestrel, Common swift, hoopoe, Crested lark, Calandra lark, Eurasian skylark, Western yellow wagtail, Eurasian magpie, Hooded crow, Isabelline wheatear, Pied wheatear, Northern whitear, Eurasian tree sparrow, red fox	Spur thighed tortoise (transekt boyu üç fərdə rast gəlindi)

1 reptile species (Blunt nosed viper - Macrovipera lebetina), 8 bird species (Common quail - *Coturnix coturnix*, Common goatsucker - *Caprimulgus europaeus*, European bee eater - *Merops apiaster*, Olive bee eater - *M. supercilisus*, Barn swallow - *Hirundo rustica*, Rosy starling - *Sturnus roseus*, Black crow - *Corvus corone*, Pied wheatear - *Oenanthe pleschanka*) and 1 species of mammal (Long eared hedgehog - *Hemiechinus auritus*) recorded during the last monitoring in the contract area (May 11-16) were not discovered during recent surveys. The viper was not recorded in the area, as it hibernates due to the cold weather. 6 species of birds that were not recorded were the species seasonally migrating short and long distances, therefore, they were not observed either. 2 types of birds (black crow and pied wheatear) were not recorded in the contract area because they feed on grain fields. Although the long eared hedgehog is not discovered in the area, the probability of presence is high.

While conducting surveys in the contract area on October 4-9, we discovered two species of birds (Common kestrel - *Falco tinnunculus*, Little owl - *Athene noctua*) and one mammal (Golden jackal - *Canis aureus*) that we had not recorded in the area during the previous survey (May 11-16). Common kestrel was recorded in both areas, little owl was recorded in the first survey area, near the qanat wells (N 39⁰ 19' 23'', E 47⁰ 02' 04''), and the golden jackal was recorded in the second survey area (N 39⁰ 17' 53'', E 47⁰ 01' 41'').

The number of species recorded in the contract area on October 4-9 was less than those recorded on May 11-16. This was especially more noticable in the the following species: marsh frog - *Pelophylax ridibundus*, Pallas's glass lizard - *Pseudopus apodus*, Spur thighed tortoise - *Testudo graeca*, European turtle dove - *Streptopelia turtur*, Common swift - *Apus apus*, Little swift - *Apus affinis*, Eurasian skylark - *Alauda arvensis*, Western yellow wagtail - *Motacilla flava*, White wagtail – *Motacilla alba*, Isabelline wheatear - *Oenanthe isabellina*, and Northern whitear - *Oenanthe oenanthe*. Caucasus emerald lizard - *Laserta strigata* and Eurasian tree sparrow - *Passer montanus* were among the most common species discovered in the contract area.

On October 7, when we were monitoring the second area, we observed the mating of the Spur thighed tortoise (N 39⁰ 17' 07'', E 47⁰ 01' 57''). Mating of the Spur thighed tortoise usually takes place in April-June. The fact that mating was recorded in October among individuals of this species was probably due to mild weather conditions, despite the fact that it was autumn. I should also mention that this event was not observed in mass in the area. Thus, during 6 days (October 4-9), the Spur thighed tortoise was found 19 times in the area, but mating was observed only once.

1.4 Summary

Monitoring was carried out on the transects between points F1 (fauna)-F14 in the first area on October 4-6, 2023, and between points F15-F38 in the second area on October 7-9. A total of 30 species were found in both areas. Among these species, 1 species belonged to the class of amphibians (marsh frog), 4 species to the class of reptiles (Spur thighed tortoise, European pond turtle, Pallas's glass lizard, Caucasus emerald lizard), 21 species to the class of birds (Long-legged buzzard, steppe eagle, common kestrel, black francolin, pheasant, rock dove, turtle dove, little owl, common swift, little swift, Eurasian hoopoe, crested lark, calandra lark, Eurasian skylark, Western yellow wagtail, white wagtail, magpie, hooded crow, Isabelline wheatear, Northern whitear, field sparrow), and 4 species belonged to the class of mammals (common vole, jackal, wolf, red fox).

2 of the recorded species (Mediterranean turtle and black francolin) are included in the Red Data Book of Azerbaijan.

Although the monitoring was carried out in autumn, the mild weather was reflected in the behavior of the observed animals. So, although Spur thighed tortoises usually mate in spring-summer months (April-June), we recorded the mating of these turtles once in October.

Note. It is unlikely that a lake effect will occur during the installation of solar panels in the area, and that migratory waterfowls will not be in any danger. One of the reasons for this is the absence of medium or large water bodies near the contract area. Another reason is that the contract area does not fall into the intensive migration route of birds. On the other hand, experience shows that no problems have been registered even in the areas that fall into the intensive migration route of birds (for example, Haji Zeynalabidin Taghiyev settlement in Absheron region).

Recommendation. Taking into account the fact that fauna species observed in the contract area in autumn are few and juvenile, it is expedient to carry out construction activities during this period.

1.5 Photographs of species observed during field surveys

Spur thighed tortoise – *Testudo graeca*

Mating spur thighed tortoises

European pond turtle – *Emys orbicularis*

Pallas's glass lizard – *Pseudopus apodus*

Caucasus emerald lizard – *Laserta strigata*

Steppe eagle - *Aquila rapax*

European turtle dove – *Streptopelia turtur*

Common swift – *Apus apus*

Eurasian magpie – *Pica pica*

Crested lark – *Galerida cristata*

Isabelline wheatear – *Oenanthe isabellina*

Golden jackal – *Canis aureus* (died as a result of being hit by a car)

Red fox – *Vulpes vulpes*

APPENDIX 2G: TANGIBLE CULTURAL HERITAGE

Glossary of terms:

Paleolithic: The Paleolithic period covers the period from the development of stone tools by hominids (about 2.5 million years ago) to the beginning of agriculture (12-10th millennia BC).

Mesolithic: It started in the 12th millennium BC and lasted until the 8th millennium. Arrows and bows were invented, resulting in the development of hunting. The foundation of primary animal husbandry and agriculture was laid.

Neolithic: It started in the 7th millennium BC and lasted until the 6th millennium. This was when agriculture, cattle breeding, weaving and pottery were created. This is historically called the Neolithic Revolution. People moved to sedentary life.

Chalcolithic (Eneolithic): Chalcolithic (Eneolithic), or Copper Age, is a time when the Iron Age started. It covers the 6,000-4,000 BC period.

Bronze Age: It started in the late 4th millennium BC and lasted until the late 2nd millennium.

Iron Age: It covers the 11-7th centuries BC. During this period, writing emerged and the 3rd social division of labor emerged.

Antiquity: It covers the period from the 4th century BC to the 3rd century AD.

Middle Ages: The period from the 4th to the 18th centuries went down in history as Middle Ages or an era of feudalism.

Summary: *This document has been prepared in relation to the possible pre-construction identification of the presence of archaeological sites in the immediate vicinity of construction and in the project area due to the implementation of the Jabrayil solar energy project. The document is based on a preliminary archaeological survey of the area, field studies, results of archaeological excavations carried out in the region so far, visual archaeological observations and existing archaeological literature. The assessment document was drawn up in accordance with archeological programs and procedures for new construction sites and it is considered expedient to continue this program in the future.*

1.1 General overview of the archaeological heritage of Jabrayil district, historical and archaeological characteristics of the area, material culture monuments.

Jabrayil district, which is included in the Eastern Zangezur region of Azerbaijan, is one of the areas distinguished by the wealth of material cultural monuments. Dozens of historical and archeological sites, including settlements, shelters, castles belonging to early farming and cattle-breeding tribes, settlements and cemeteries belonging to the Bronze, Early Iron and Middle Ages were registered in Jabrayil and some of them were studied [1; 3].

The maps showing the marches of Scythian tribes from Eastern Asia to the north and vice versa mention the Araz river valley, including the territory of the current Jabrayil district, as one of the main directions of movement [3; 5]. In antiquity and Early Middle Ages, the territory of the current Jabrayil district was one of the important points on the southern borders of Albania, one of the oldest and longest-lived Azerbaijani states [4; 10]. Due to its strategic location, this region retained its importance even later – during the existence of Azerbaijani states of Sajis, Salaris and Shaddads, which arose as a result of the collapse of the Arab Caliphate, during the Seljuks and Atabays, during the Mongolian Hulakul state, and during the Garagoyunlu, Aghgoyunlu and Safavid states.

Archaeological excavations in Jabrayl started in the 1970s. At that time, an expedition was established to study the archaeological monuments in Jabrayil and Zangilan districts due to the construction of two large water reservoirs (Khudafarin and Giz Galasi) on the Araz River [2]. As a result of survey, the expedition registered more than 20 settlements, mounds, castles, tombs, medieval cemeteries of different periods, carried out excavations in several of them, discovered artifacts from the Paleolithic period in the caves in Dag Tumas and Shikhlar villages [2; 3; 6; 7; 9].

Archaeological surveys were carried out in the ancient settlements of Karkhulu, Jinli Dara and Injirli, belonging to the early Bronze Age (IV-III millennia BC). About 25 Bronze Age mounds were recorded around Karkhulu, Jinli Dara and Injirli [3, p. 8-12]. Their diameter is 8-12 meters and height 0.5-1.5 meters. Two of them were opened and studied. Bronze buttons and other decorative items, clay pots typical of the Late Bronze and Early Iron ages (latter half of the II millennium and early I millennium BC) were discovered from the first burial mound [3, p. 10].

Archaeological finds from the Early Iron Age discovered in the village of Molla Hasanli in Jabrayil district in 1950 are distinguished by their beauty and scientific value – bronze topaz, pin, zoomorphic clay pot – are preserved and exhibited in the Archaeological Fund of the National Museum of Azerbaijan History (inv. No. 3139).

To the south of the village of Shukurbayli, on the right side of the Jabrayil-Zangilan road, a unique multi-layered settlement called “Toraghay yali” belonging to the Bronze, Early Iron, Antiquity and Early Middle Ages, with a height of up to 25 meters in some places and a cultural layer 10 meters thick, was found [2, page 21]. In the territory of Jabrayil district, the settlements of Galajik and Gishlag belonging to the early Iron Age, mounds near the villages of Niftalilar, Gishlag, Hovuslu and Shikhlar were recorded. A vast mound steppe located on the right side of the Jabrayil-Sirik highway, on the left bank of the Chakhmakhli river, is also worthy of note [3; 8; 9]. Some of these mounds were destroyed during the planting of vineyards, and some of the items found in them were collected and delivered to the regional local history museum. These materials include bronze and iron weapons, dagger tips, arrowheads, knives and daggers, battle mace, etc. In 1989, one of the Niftali burial mounds was excavated. It was a mound with a height of 1.2 meters and a diameter of 6 meters, it was made of clay and small stones with a little soil mixture [3, p. 32]. Grave items consist of black polished and balloon-shaped clay vessels (one of which has a lid with four legs), two bronze dagger pommels, fragments of a bronze belt, paste and marble-like rock crystal beads, and other ornaments. A comparative analysis of these samples shows that the mound belongs to the Early Iron Age.

Three defense structures were recorded in the territory of Jabrayil district: 1) Sirik fortress on the top of Tey mountain on the left bank of Chakhmagli river, about 2 km north of Sirik village; 2) a fortress called Gizil Gaya near the village of Tatar on the top of Mount Tey, and 3) Galadag fortress south of the village of Galajik, on the side of the road to the village of Sirik [9, p. 201].

In 1989, during archaeological studies in Jabrayil district, information was collected about the settlements of the Late Middle Ages (Duluskhana and Hasanli plain), Shikhlar and Khobyarli tombs, the Bashikasik dome, religious building complexes in Chalabi where Molla Vali Vidadi was a teacher at the time. The so-called “Turkish cemetery” of Khobyarli, which is rich in monuments of Islamic culture (cemetery and tombs of the Middle Ages), was studied as well. In the old city cemetery, a fragment of a board with ancient runic inscriptions and two headstones (from the 14-15th centuries) engraved with animal images (mountain goats) and various symbols reminiscent of Gobustan petroglyphs were discovered [2; 3; 8; 9].

There are also Khudaferin bridges of 8-9th centuries, mausoleums of Mazannana and Marmarnana in Khalafli village, various tombs of the 13-16th centuries in the village of Dagtumas, the tomb of Shikhbaba (14th century) in the village of Shikhlar, a 16th century octagonal tomb in the village of Khobyarli and dozens of other historical and religious architectural examples in Jabrayil district.

1.2 Brief overview of the natural and geographical terrain conditions of the area where the Jabrayil solar power stations are located

The project area intended for the construction of the Jabrayil solar power stations is located in the southeast of the Lesser Caucasus mountains, in an area called Gayan plain. North of the project area is the Karabakh range. The area where the project site is located borders in the south on the plain along the Araz river and a low-density forest strip. According to the information available to archeologists, the total area of both project areas, large and small, is about 700 hectares. Most of the smaller area is located in a plain, and the northern part consists of low, sloping and in some places relatively high hills (pictures 1-2). In terms of terrain, it is uneven, and the areas between the hills are conducive to the flow of rainwater. The part of the small project area close to the road was used as a vineyard farm until the 1990s. This is clearly evidenced in the upper layers of the soil observed during archaeological observations. The larger project area consists entirely of sloping, flat, sometimes low and sometimes steep hills and a low mountain massif (pictures 3-4). The lowland soils of both parts are dark soils with high fertility, covered with sparse shrub vegetation.

1.3 Archaeological landscape of the project area and results of preliminary exploration

Before the archaeological exploration in the area started, ANAMA personnel provided some guidance. It was recommended that observations be conducted only in the designated areas. It should be noted that both project areas where the solar power plants will be located have been completely cleared of mines and unexploded ordnance, and therefore there were no problems in conducting archaeological exploration.

The topography of the area is 95 percent untouched with sparse vegetation cover. This means that surface signs of any archaeological sites we may find are visible.

The area covering both project areas (large and small) is plain and located in foothills, with moderate temperatures and poor water supply. Plants are mainly fed by rainwater. This area traditionally serves as grazing grounds of semi-nomadic cattle breeders. People grazing their animals are less likely to interfere with archaeological sites because archeological sites are covered with a thick layer of soil building up over centuries, and agricultural activity is not carried out on them. The risk of destruction of archaeological sites is greater during planting. In some places, it was observed that stones were placed together by herders grazing animals or people collecting stone for building purposes. But these are clearly artificial stone structures.

1.3.1 Chance finds

During preliminary archaeological exploration and visual observations, no archaeological sites of local, national or international importance were recorded in project areas. Neither are there any such archaeological sites in the register.

The smaller project area was completely walked by step counting and inspections were carried out in parallel. Small ceramic fragments (shards of clay vessels) were found in several places in this area (N39°19/43.8//; E047°02/15.3//: N39°18/41.5//; E047°02/21.2//). These were discovered individually, in a scattered form, as if they were thrown away. These ceramic samples do not represent any archeological value. They are ceramic samples brought here from outside or discarded by the population engaged in animal husbandry (picture 9). The ceramic samples found in areas where no settlements or necropolises were found (about 2-3 places) belong to the Late Middle Ages, and this type of ceramics is also found in various outlying areas.

During archaeological excavations in the smaller project area, 1 small grain stone and 1 flint cutting tool were found (N39°19/51.4//; E047°02/17.8//). It is not a local archaeological find. They should be seen as having been brought here because there are no archaeological monuments in the vicinity of the area where the artifacts were found. Artifacts of this type do not belong to the place they were found in and have a certain meaning, but they do not have any significance in terms of territorial affiliation.

Most of the larger project area was walked by step counting, but due to the large area, visual archaeological observations were preferred due to time constraints. In this area as well, no visible archaeological remains were found. Only one site – an old cemetery – was recorded in the larger project area (N39°16/54; E047°01/42).

A small number of partly and fully destroyed building remains from the mid to late 20th century were found in both project areas (pictures 5-8). The remains of these large and medium-sized river-stone buildings were used as stables for seasonal animal husbandry by semi-nomadic population. These buildings have no archaeological or historical significance.

1.3.2 Cemetery

This cemetery of Muslim graves (GPS-measured area approximately 3,680 m^2) is located approximately in the southeastern part of the larger project area, near project site boundary (pictures 10-11). In order not to touch and destroy the historical and cultural heritage, it is likely that the project boundary was moved a little back. Some graves were damaged during the construction of the ground road. The gravestone with an inscription was broken by machinery and left about 2-3 meters away from where it belongs. There are graves under the ground road as well. This is an area of a large cemetery. The direction of the tombstones and the inscriptions on some of them suggest that this is a Muslim cemetery. There are descriptions on three graves, which are in the old Azerbaijani script based on the Arabic alphabet.

The cemetery was established at the foot of and on a relatively sloping hill in an area originating from a plain. We identified about 40-50 graves. Written images were found on only three tombstones made of gray tuff stone (pictures 12-14). On other graves, only a small chest stone (usually river stone) was placed (pictures 15-17). There are also graves with surface features in the form of a dented soil layer above them, and such graves constitute a majority (pictures 18-19). From the hijri-lunar calendar on the graves, it is evident that burials were carried out here in the 1830-60s. There is a possibility that the graves distinguished only by the soil cover are 40-50 years old. Some graves in the field were numbered and GPS coordinates of each one were taken separately. Here are some of them:

- N39°16′57.0″ ; E047°01′46.9″
- N39°16′57.1″ ; E047°01′46.8″
- N39°16′57.5″ ; E047°01′46.4″
- N39°16′57.0″ ; E047°01′47.2″
- N39°16′57.3″ ; E047°01′47.7″

- N39°16′57.3″ ; E047°01′47.8″
- N39°16′57.6″ ; E047°01′47.2″
- N39°16′57.5″ ; E047°01′47.1″
- N39°16′57.4″ ; E047°01′47.0″
- N39°16′57.2″ ; E047°01′47.0″
- N39°16′57.2″ ; E047°01′46.5″
- N39°16′57.1″ ; E047°01′46.6″
- N39°16′57.1″ ; E047°01′46.4″
- N39°16′57.2″ ; E047°01′46.4″
- N39°16′57.4″ ; E047°01′46.6″

The ground road built to demarcate the project site actually divides the cemetery into two parts. Currently, there is one gravestone with an inscription and about 20 graves with only soil cover features in the project area. On the other side of the ground road, there is the larger part of the cemetery. There are more graves here. It should be noted that the graves in this cemetery are very close to each other. It is likely that there used to be a village in the immediate vicinity to the cemetery.

1.4 Proposals

1. Archaeological sites of significant importance have not been identified in the project area. Such places were not observed during exploration either. Therefore, the area is not an archaeological risk zone. At the same time, there is a possibility that during excavation and construction work, sites of unknown surface characteristics may be found in deeper layers of the soil. As is the case with any new construction project, it is important that a specified number of archaeologists supervise the earthworks according to archaeological procedure (taking into account the size of the site and hardware to be deployed). The presence of archaeologists will protect potential sites from the danger of being destroyed and enable archaeological examination. At the same time, archaeologists conducting observation and monitoring will regularly inform and instruct construction workers about the archaeological procedure.
2. It is necessary to move the Muslim graves away from the project area. The ground road divides it into two parts. The location of some graves damaged during the construction of the road should be determined and the broken headstones should be collected. According to preliminary calculations, up to 20 grave sites were identified in the project area. The relocation of these graves before the construction works with the participation of two archaeologists and a small number of workers is possible in a short time. No additional procedure is required because there is a large part of the cemetery outside the project area and the graves can be moved here.

   Alternatively, the boundary of the project area could be slightly adjusted not to affect the graves. This could be done under the supervision of an archaeologist. Because there are graves with little-known above-ground signs and it is possible to determine their location based on expert opinion. If the boundaries of the project area are moved a little (about 200-300 meters inward) and the destroyed graves are partially restored, then the cemetery will not be affected and the impact of the project on the historical and cultural heritage in this area will be minimized.

1.5 Regulatory framework

Architectural and archaeological monuments are provided with state protection in Azerbaijan. At present, 6,308 (six thousand three hundred and eight) archaeological monuments are under state protection in Azerbaijan. The Cabinet of Ministers of the Republic of Azerbaijan has approved the list of monuments that are divided into three classes in accordance with their importance. These are monuments of world and national importance, and those of local significance.

A number of national reserves have been established by the Order of the Cabinet of Ministers of the Republic of Azerbaijan. There are currently 27 (twenty-seven) historical-and-architectural, historical-and-archaeological, historical-and-cultural, and historical-and-ethnographical reserves.

Portable artefacts are also protected and are the property of the State.

The Project Area does not fall within any national reserve.

Cultural heritage and archaeological finds and artefacts are legally protected in the Republic of Azerbaijan by national legislation which is supported by the various international conventions and recommendations ratified and/or acceded by the Republic. These include the Convention on the Protection of World Cultural and Natural Heritage (Paris, 1972), the European Convention on the Protection of the Archaeological Heritage (Valletta, 1992) and UNESCO Convention on the Protection and Promotion of the Diversity of Cultural Expressions.

The Law “On the Protection and Utilization of Cultural and Historical Monuments” signed by the President of the Republic of Azerbaijan (Baku, 10 April 1998) regulates matters related to the protection, study and utilization of monuments. Two articles of this law define the obligations and sensitivity conditions for new construction sites.

Article 13. Protection of monuments discovered during construction and other economic activities.

Article 14. Archeological research on new construction sites.

These articles of the Law require the promoter of a new project to apply to a relevant government agency at the stage of feasibility study and arrange for the study of the archaeological monument at its own expense. If any archaeological features are encountered, it is prohibited to carry out construction without adequate scientific measures and permission from relevant government agencies.

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Photos

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Figure 1-2: Overview of the 1st (small) project area


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Figure 3-4: General view from the 2^{nd} (larger) project area


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Figure 5-8: Building remains of modern age found in the project area

Figure 9: Random samples of ceramics from the Late Middle Ages found at the project site

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Figure 10-11: General view of the cemetery

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Figure 12-14. Gravestones No. 1, 2, 3 with inscriptions on them

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Figure 15-17. Graves with chest stones

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Figure 18-19. Surface features of graves only

APPENDIX 2H: HYDROMETEOROLOGICAL DATA

1.1 Daily mean temperature in Jabrayil region (2021-2023)

Daily mean temperature (°C) in Jabrayil region between 01/11/2021-30/11/2023

Year	Month	Day																														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
2021	11	10.5	12.0	12.9	13.5	12.5	9.3	9.1	8.9	9.2	9.8	7.4	5.8	6.3	6.4	10.6	6.4	6.5	3.6	3.0	5.3	9.0	8.5	8.9	11.9	7.1	6.3	5.6	7.6	10.3	11.3	
	12	10.6	9.9	5.7	4.2	4.8	10.6	7.4	8.5	8.2	9.6	5.9	6.4	8.7	8.6	9.4	6.4	6.9	4.6	6.8	5.4	10.8	7.2	2.5	0.0	0.1	1.6	4.6	5.6	3.0	2.8	0.9
2022	1	1.8	5.7	5.6	4.1	6.7	5.0	3.7	6.4	7.0	3.9	8.6	5.6	4.9	5.8	3.7	3.5	1.1	-1.1	2.4	1.4	-0.6	-0.7	1.5	4.2	3.4	3.6	2.6	4.3	2.7	3.2	4.8
	2	5.1	5.2	8.7	8.7	6.5	2.0	3.3	3.3	8.6	7.1	4.9	4.4	6.7	2.6	3.6	3.7	4.0	4.4	8.3	6.5	5.7	9.0	7.7	5.8	6.0	7.6	10.1	7.5			
	3	8.5	9.6	10.0	9.3	7.9	7.4	3.9	5.5	4.9	6.2	2.2	3.5	1.5	1.7	1.9	2.9	2.3	3.2	2.6	2.4	0.0	0.5	2.9	2.2	5.5	5.4	6.3	7.3	6.4	8.9	14.7
	4	12.9	14.6	19.8	17.4	14.0	13.7	11.3	10.7	14.4	13.3	15.4	15.6	13.6	12.0	13.1	11.3	12.6	12.1	13.6	16.3	15.7	14.2	13.3	13.2	16.7	16.9	19.6	20.8	19.6	17.6	
	5	17.7	17.1	16.2	15.4	14.9	15.4	13.9	12.4	15.5	12.9	14.8	14.7	15.5	17.9	21.7	18.0	16.6	19.3	19.8	17.4	15.5	18.4	20.2	16.8	14.1	16.2	18.2	17.1	18.3	22.4	23.2
	6	22.1	23.6	23.5	24.7	23.7	24.1	25.0	21.9	23.5	22.3	19.9	23.2	24.9	23.1	23.1	24.3	23.8	24.5	22.5	23.0	25.6	26.5	25.1	25.5	26.4	23.8	26.2	28.1	27.9	27.0	
	7	25.5	26.9	24.3	23.2	23.8	21.4	23.0	22.7	25.8	26.2	24.9	28.1	26.8	27.5	27.8	25.3	28.7	29.4	29.5	26.9	24.8	27.3	23.2	24.6	23.1	23.0	25.0	27.3	26.5	25.4	27.0
	8	27.3	27.0	27.5	28.6	26.8	27.0	23.6	25.8	26.7	25.7	25.0	27.9	27.1	26.8	25.6	27.6	25.9	25.4	26.4	25.4	26.1	25.4	24.4	23.1	23.2	22.6	24.1	24.5	23.7	25.0	25.6
	9	23.2	25.6	25.3	22.8	22.5	18.4	16.0	17.0	19.0	19.1	19.1	20.3	19.8	22.6	21.2	20.0	20.2	20.8	22.8	21.3	21.6	20.7	20.5	20.4	17.3	16.2	17.5	17.9	18.6	20.7	
	10	21.6	20.8	20.0	20.7	20.9	19.8	19.3	17.4	19.2	19.5	19.4	17.7	17.9	15.4	16.6	17.2	18.3	16.4	12.8	16.3	15.4	12.6	11.7	11.3	13.0	12.0	14.5	15.3	12.7	11.1	10.9
	11	11.8	11.4	10.3	10.6	11.5	8.4	6.9	8.6	7.5	6.4	9.3	9.2	9.7	10.1	12.0	10.2	11.1	11.4	11.2	11.9	11.8	10.8	14.1	10.3	7.4	10.1	10.8	9.4	9.4	7.2	
	12	4.5	6.3	7.0	4.5	2.8	2.7	3.9	4.9	5.1	5.9	4.7	6.1	6.4	6.1	6.8	7.7	7.9	8.4	7.6	6.0	5.3	3.2	2.9	2.3	5.0	4.8	6.2	1.8	5.9	4.9	2.3
2023	1	2.7	3.7	3.4	6.0	4.1	5.3	7.6	2.8	0.2	0.3	-0.4	1.0	1.2	1.1	1.0	0.7	1.0	0.4	0.5	3.9	5.4	5.1	3.0	1.9	1.4	2.0	2.0	-0.1	0.5	3.9	3.6
	2	5.8	3.4	4.7	3.3	2.3	0.2	3.6	5.0	1.4	0.8	1.4	-0.5	1.7	1.2	1.6	2.1	1.0	3.3	6.7	10.5	9.8	9.3	7.1	2.2	1.4	4.1	9.2	8.5			
	3	9.9	7.9	7.9	9.0	7.6	10.2	10.9	5.8	6.8	9.3	11.7	13.2	14.5	11.5	9.7	9.4	12.5	13.7	12.2	10.2	12.1	12.3	11.2	11.9	12.5	12.3	11.6	13.6	15.9	15.4	6.6
	4	4.4	7.6	8.3	11.6	11.6	14.3	13.5	12.7	13.0	9.5	13.0	15.6	19.6	14.5	15.4	10.3	7.4	11.4	13.5	16.1	17.0	16.9	16.9	16.4	18.3	17.0	18.2	18.1	18.0	19.2	
	5	17.2	16.3	12.1	12.9	15.2	17.0	15.9	18.3	19.8	17.2	18.2	16.7	14.3	14.6	13.1	15.5	15.0	16.1	17.4	18.3	17.2	21.7	23.6	25.5	24.1	23.9	24.5	23.1	20.6	24.1	24.1
	6	21.0	21.9	23.6	25.5	24.1	23.3	21.7	19.5	21.3	22.8	22.3	26.3	27.1	24.2	23.9	22.9	23.4	25.9	21.5	19.7	22.3	22.7	21.3	23.8	25.0	24.2	25.3	26.5	26.0	26.9	
	7	21.5	23.6	24.4	26.2	27.0	25.5	27.7	25.1	28.9	28.5	23.9	24.4	25.2	25.9	26.6	25.3	20.4	21.5	23.5	23.7	24.8	27.0	26.3	28.9	27.6	24.9	26.6	27.3	28.1	24.3	26.9
	8	28.3	29.1	29.4	28.2	26.1	28.5	27.3	30.1	30.3	28.3	28.5	29.4	28.1	29.6	26.7	26.7	24.0	22.9	26.4	27.2	27.2	27.1	28.9	27.7	25.5	24.9	24.1	25.0	25.3	23.2	23.0
	9	23.4	24.6	24.0	22.2	23.5	25.0	25.2	22.1	18.2	20.3	13.1	12.3	13.2	15.9	17.2	18.4	18.2	14.5	14.0	16.4	17.4	18.7	19.5	18.1	18.1	19.3	16.1	15.2	15.6	15.4	
	10	20.2	19.4	19.4	17.3	16.2	15.7	16.8	17.7	19.5	13.7	14.5	13.4	13.3	12.4	13.3	14.4	16.4	13.7	11.9	14.7	13.8	15.8	15.5	15.5	17.7	16.1	18.0	20.1	20.1	17.1	14.3
	11	13.4	15.0	15.2	16.8	14.4	13.8	16.3	15.4	13.4	11.9	12.4	11.7	16.4	13.7	15.4	16.4	14.4	9.2	9.1	8.4	9.2	8.2	8.0	7.9	7.8	14.8	15.9	9.3	4.4	6.7	

1.2 Daily amount of precipitation in Jabrayil region (2021-2023)

Daily amount of precipitation (mm) in Jabrayil region between 01/11/2021-30/11/2023																																
Year	Month	Day																														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
2021	11	0.0	0.0	0.3	1.0	6.5	0.0	0.0	0.0	0.0	0.0	5.4	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	12	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2022	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	5.6	4.8	6.7	8.4	5.3	0.0	0.7	21.6	6.6	0.0	0.0	0.8	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	4	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	5	0.0	0.0	0.0	0.0	0.0	0.0	2.2	2.7	0.0	4.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.3	0.0	0.0	3.6	16.3	0.0	0.0	0.0	0.0	0.0	0.0
	6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	2.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0
	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	9	0.0	0.0	0.0	0.0	0.0	0.0	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	4.1	2.3	1.0	0.0	2.1	0.0	0.0	0.0	4.1	2.8	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0
	11	0.0	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	7.8	3.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	0.0	0.0	1.2	0.0
	12	9.1	0.9	5.1	3.0	0.0	1.7	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2023	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	3.5	0.7	5.6	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.7
	2	0.0	0.0	0.9	0.0	0.0	0.8	2.6	0.1	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1
	4	9.8	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	5	1.7	7.0	21.2	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	1.0	14.9	0.0	0.0	0.0	0.0	3.1	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.4	0.0
	6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	1.0	0.0	2.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	7	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	19.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.5	0.0	0.0	0.0	0.0	0.0
	9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	2.5	14.6	8.9	8.4	4.5	0.0	0.0	0.0	19.4	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0
	10	0.0	0.0	2.8	2.9	16.7	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.0	1.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.5	0.0	0.0	0.0	0.0	0.0	0.0	1.8	0.0	0.0	0.0

1.3 Daily maximum wind speed in the Jabrayil region (2021-2023)

Daily maximum wind speed (m/s) in Jabrayil region between 01/11/2021-01/11/2023																																
Year	Month	Day																														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
2021	11	1	1	1	2	2	3	1	1	1	3	10	2	1	3	1	20	14	1	1	1	4	2	1	4	8	1	1	1	1	1	
	12	4	6	3	2	1	1	1	3	1	1	1	1	1	1	1	1	3	1	1	1	4	2	3	2	1	2	1	1	1	1	1
2022	1	2	1	2	2	2	1	2	4	8	1	1	2	2	4	3	3	2	1	1	1	2	2	1	1	2	3	1	1	2	1	1
	2	1	1	1	1	8	1	6	1	2	6	4	1	10	20	2	1	2	1	1	2	1	2	1	1	2	1	1	2			
	3	2	2	1	8	6	3	6	1	8	6	10	1	8	4	1	1	2	6	2	6	6	2	6	1	1	2	2	6	4	2	1
	4	1	2	2	18	12	1	10	2	2	2	2	18	18	4	6	3	1	2	2	3	6	4	2	1	1	2	3	2	2	6	
	5	8	6	3	4	4	6	4	4	2	2	1	6	4	2	1	6	2	1	1	12	2	1	4	8	4	2	1	4	1	2	1
	6	4	1	1	3	1	2	16	6	4	8	8	1	6	3	3	2	6	15	2	2	4	1	6	6	2	3	1	2	4	8	
	7	3	1	10	8	1	12	10	1	1	2	1	4	1	1	8	2	2	2	4	6	3	3	1	4	2	3	2	6	6	3	3
	8	2	1	4	2	2	1	4	3	3	3	2	2	4	3	2	3	4	2	3	2	3	4	4	2	4	3	2	2	4	3	2
	9	2	1	2	2	12	10	4	1	2	3	2	2	2	8	4	3	1	2	2	4	1	3	1	6	6	2	1	3	5	3	
	10	1	2	2	2	2	3	8	4	1	8	4	1	1	1	1	6	3	2	2	2	6	3	2	1	2	2	1	4	3	1	1
	11	2	3	1	2	1	10	5	1	1	1	1	1	1	2	2	1	1	2	2	1	1	1	2	2	1	3	2	2	2	4	
	12	1	1	1	2	3	1	1	1	1	1	1	2	1	1	1	1	1	1	1	8	6	1	1	1	1	1	2	1	4	2	1
2023	1	1	1	1	1	1	1	8	10	1	2	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1
	2	1	1	1	1	1	1	1	3	8	10	1	1	6	10	3	3	3	2	2	3	10	4	6	10	2	1	2	1			
	3	3	8	9	2	4	5	18	2	2	4	1	1	8	18	3	2	1	5	4	1	4	3	1	1	6	3	1	4	3	8	10
	4	1	1	4	1	2	4	4	5	2	2	3	3	18	6	3	8	6	3	2	1	14	4	6	4	2	4	4	3	1	3	
	5	8	3	2	1	3	1	4	3	6	3	4	8	6	3	5	1	7	2	4	2	2	2	2	3	4	2	1	3	4	2	7
	6	3	3	2	1	3	4	3	6	1	2	2	1	2	3	1	2	3	8	8	3	2	3	6	2	1	4	2	6	4	5	
	7	12	2	1	1	2	1	1	3	1	4	16	2	4	1	2	4	6	1	1	1	1	1	1	1	4	4	2	4	16	12	2
	8	2	1	1	16	6	1	1	2	3	3	1	4	2	1	3	2	1	4	3	3	3	3	1	4	6	2	4	4	2	6	2
	9	1	4	8	2	1	2	8	8	3	16	8	2	1	1	1	2	5	6	2	1	1	1	1	1	3	2	1	2	3	1	
	10	2	3	2	6	2	1	1	4	10	10	3	8	3	1	2	3	8	10	3	1	2	1	2	1	4	2	2	1	2	10	3
	11	1	2	1	2	1	1	12	6	1	4	10	2	1	2	2	1	8	4	1	2	2	4	2	2	1	3	12	3	1	1	

1.4 Daily wind direction in the Jabrayil region (2021-2023)

Wind direction in Jabrayil region between 01/11/2021-01/11/2023																																
Year	Month	Day																														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
2021	11	SW	N, SE	N, NW	N, SE	N, SE	SE	S	NE	N, NW	N	SE	N, SE	NE	SE	N	S, SE	SE	W, SW	W, NW	NE	W, NW	W, NW	N, SE	N, SE	N, SE	NW	S	SE	N	NW	
	12	W, NW	W, NW	SE	N	S	N	SW	N	S	S	N	N	N	W, NW	N	W	W, NW	N	S	N	N	W, NW	N, SE	S	S	NE	S	SW	W	N	W
2022	1	N	N	N, NW	S, SW	N, NE	W	N	N, SE	N, SE	N	N	N, NW	N	W	N, NW	S	S	W, NW	N	W	S, SE	SW	N	W	NE	SE	N	S, SE	NW	SW	N
	2	N	NW	S	S	NW	SW	N, NW	W	N, NW	N, SE	N, SE	N	SE	SE	W, NW	S	W, NW	SE	N	N, SE	N	SE	N	W	NW	N	N	W, NW			
	3	NE	N	N	W, NW	N	N	N	N	N, SE	N, SE	N, SE	S	N	SE	N	N	N	N, SE	N	S	N, SE	S	S	N	N, SE	W	N, NW	N	N, SE	W, NW	S, SW
	4	N	NE	SW	N, SE	N, SE	N, SE	N, SE	N, NW	W, NW	NW	N, SE	N	N, NW	W, NW	NW	N, SE	S, SW	NW	N	N, NW	S	N, SE	N, SE	N	N	N	N, SE	N	N	SE	
	5	N, SE	N, SE	N, SE	N	NW	W, NW	S, SE	N	N, SE	N, NW	S, SW	SE	N, SE	S	W	N, NW	W, NW	N	N	NW	N, SE	S	W, NW	W	N, SE	N, SE	N, SE	N, SE	NE	N	N
	6	NE	N, SE	W, NW	N	SE	N, NW	N, SE	N, SE	SE	SE	N, SE	N, NE	N	N, NW	S, SE	N, NW	N	N, SE	N, SE	N, SE	N	N	N	N, SE	NE	N	N, SE	W, NW	N	N, SE	
	7	N, SE	S, SE	N, SE	N, SE	N, SE	N, SE	N, SE	N, SE	N	N	N	N	N	N, SE	N, SE	N	S, SE	S	N	S, SE	N	N	N	N	N, SE	S, SW	N	N, SE	N	N	N
	8	N	N	N, SE	SE	SE	S, SE	N	SE	N	N, SE	N, SE	N	N	N	NE	N, SE	N	N	N, SE	N, SE	N	N	N, SE	N, SE	N, NE	N	NE	N	N, NE	NE	N, NE
	9	N	N	N, NE	N	N, SE	N, SE	N	N	N	SE	SE	SE	S	W, NW	N, NW	N, NE	SW	N	N, NW	N, NE	N	W, NW	N	SE	NW	N, SE	NW	NW	S, SE	N, SE	
	10	N	SE	NW	NE	SE	N, SE	N, SE	N	S, SE	W, NW	N, NW	N, NW	N	NW	N, SE	N, SE	N	N	W, NW	SW	N	N, SE	S	S	N	N	W	W, NW	SE	NW	S
	11	N, SE	N	N, SE	N	N	SE	SE	W, NW	N	N	S, SW	S, SE	S	N	S	N	N	N, NW	SW	N	N	SW	S, SW	W, NW	N	NW	NW	N, SE	N	N, SE	
	12	N, SE	N	N	SE	N	N, SE	N	NW	SE	W, NW	N	NW	S	N	N	N, NW	NW	S, SE	N	SE	SE	W, NW	W	S	NW	W, NW	SW	N	S	S, SE	N
2023	1	NE	SW	N	N	N	S, SE	W, NW	N, SE	N, SE	SE	N, SE	N, NW	NW	S, SE	N, SE	N	NW	N, SE	N	W, NW	N	N	N	N	NE	S, SE	S	N	N	N, SE	W, NW
	2	NE	NW	NW	N, NW	W, NW	NW	N, SE	N, SE	SE	SE	N	W, NW	W, SW	N, NW	S	W, NW	N	NW	N, SE	N	NW	NW	SE	SE	SE	N	NW	N			
	3	W, NW	W, NW	SW	W, NW	N	N	N	NW	W, NW	N	S, SW	S, SW	W, NW	W, NW	SW	W, NW	W, NW	SW	SW	W, NW	NW	S	S	W, NW	W, NW	W, NW	W, NW	W, NW	W, NW	NW	SW
	4	W, NW	W, NW	W, NW	W, NW	W, NW	W, NW	NW	SW	W, NW	W, NW	NW	W, NW	W, NW	W, NW	N	W, NW	W, NW	W, NW	W, NW	SW	N	N	NW	W, NW	S, SW	W, NW	W, NW	NW	W, NW	W	
	5	NW	W, NW	W, NW	W, NW	W, NW	S, SW	W, NW	N	W, NW	W, NW	W, NW	W, NW	W, NW	W, NW	S, SW	W, NW	SW	SW	W, NW	W, NW	NW	SW	W, NW	W, NW	W, NW	W, NW	W, NW	W, NW	W, NW	W	W, NW
	6	W, NW	W, NW	W, NW	W, NW	W, NW	S, SW	S	W, NW	SW	W, NW	W, NW	W, NW	W, NW	NW	W, NW	S	W, NW	W, NW	W, NW	SW	W, NW	N	SW	W, NW	W, NW	SW	SW	W, NW	W, NW	W, NW	
	7	NW	W, NW	W, NW	S, SW	N	W, NW	S, SW	W, NW	N	W	W, NW	W, NW	W, NW	W, NW	N	S	S, SW	S	W, NW	N	W, NW	S	W, NW	W, NW	W, NW	W, NW	W, NW	N	W, NW	W, NW	W, NW
	8	W, NW	W, NW	S	W, NW	W, NW	S	W, NW	W, NW	N	W, NW	W, NW	N	W, NW	W, NW	SW	N	W, NW	SW	W, NW	W, NW	SW	W, NW	W, NW	SW	SW	W, NW	W, NW	W, NW	W, NW	SW	W, NW
	9	W, NW	W, NW	W, NW	W, NW	NW	W, NW	W, NW	W, NW	NW	W, NW	W, NW	W, NW	W, NW	S, SW	W, NW	W, NW	W, NW	SW	W, NW	W, NW	W, NW	W, NW	W, NW	W, NW	W, NW	W, NW	W, NW	W, NW	W, NW	NW	
	10	NW	NW	W, NW	W, NW	S	W, NW	S	W, NW	S, SW	W, NW	SW	W, NW	W, NW	W, NW	W, NW	NW	W, NW	W, NW	NW	W, NW	W, NW	S	W, NW	W, NW	W, NW	W, NW	SW	SW	W, NW	W, NW	W, NW
	11	W, NW	W, NW	W, NW	W, NW	W, NW	W, NW	NW	W, NW	W	W, NW	W, NW	NW	SW	W, NW	W, NW	SW	W, NW	NW	N	NW	NW	W, NW	NW	W, NW	W, NW	N	SW	W, NW	W	W, NW	

APPENDIX 2I: LANDSCAPE PHOTOS – VIEWPOINTS

VP1


NORTH


EAST


SOUTH


WEST

VP2

NORTH

EAST

SOUTH

WEST

VP3

NORTH

EAST

SOUTH

WEST

VP4

NORTH

EAST

SOUTH

WEST

VP5

NORTH

EAST

SOUTH

WEST

VP7


NORTH


EAST

(photo not available)
SOUTH


WEST

APPENDIX 3 – CONSTRUCTION DUST ASSESSMENT METHODOLOGY

This appendix contains the construction dust assessment methodology used in the assessment.

To assess the potential impacts, construction activities are divided into demolition, earthworks, construction and trackout. The descriptors included in this section are based upon the IAQM construction dust guidance (IAQM, 2023). The assessment follows the steps recommended in the guidance.

Step 1: Screen the requirement for assessment

The first step is to screen out the requirement for a construction dust assessment, this is usually a somewhat conservative level of screening. An assessment is usually required where there is:

- a ‘human receptor’ within:
  - 250m of the boundary of the site; or
  - 50m of the route used by construction vehicles on the public highway, up to 250m from the site entrance(s).
- an ‘ecological receptor’:
  - 50m of the boundary of the site; or
  - 50m of the route(s) used by construction vehicles on the public highway, up to 250m from the site entrance(s).

Step 2A: Defining the Potential Dust Emission Magnitude

Demolition

The dust emission magnitude category for demolition is varied for each site in terms of timing, building type, duration and scale. Examples of the potential dust emission classes are provided in the guidance as follows:

- **Large**: Total building volume >75,000 m^3, potentially dusty construction material (e.g., concrete), on-site crushing and screening, demolition activities >12 m above ground level;
- **Medium**: Total building volume 12,000 m^3 – 75,000 m^3, potentially dusty construction material, demolition activities 6 m – 12 m above ground level; and
- **Small**: Total building volume <12,000 m^3, construction material with low potential for dust release (e.g., metal cladding or timber), demolition activities <6 m above ground, demolition during wetter months.

Earthworks

The dust emission magnitude category for earthworks is varied for each site in terms of timing, geology, topography and duration. Examples of the potential dust emission classes are provided in the guidance as follows:

- **Large**: Total site area >110,000 m^2, potentially dusty soil type (e.g., clay), >10 heavy earth moving vehicles active at any one time, formation of bunds >6 m in height;

- **Medium**: Total site area 18,000 – 110,000 m^2, moderately dusty soil type (e.g., silt), 5 – 10 heavy earth moving vehicles active at any one time, formation of bunds 4 – 6 m in height; and
- **Small**: Total site area < 18,000 m^2, soil type with large grain size (e.g., sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height.

Construction

The dust emission magnitude category for construction is varied for each site in terms of timing, building type, duration, and scale. Examples of the potential dust emissions classes are provided in the guidance as follows:

- **Large**: Total building volume >75,000 m^3, on site concrete batching, sandblasting;
- **Medium**: Total building volume 12,000 – 75,000 m^3, potentially dusty construction material (e.g., concrete), on site concrete batching; and
- **Small**: Total building volume <12,000 m^3, construction material with low potential for dust release (e.g., metal cladding or timber).

Trackout

Factors which determine the dust emission magnitude class of trackout activities are vehicle size, vehicle speed, vehicle number, geology and duration. Examples of the potential dust emissions classes are provided in the guidance as follows:

- **Large**: >50 HDV (>3.5 t) outward movements in any one day, potentially dusty surface material (e.g., high clay content), unpaved road length >100 m;
- **Medium**: 20 – 50 HDV (>3.5 t) outward movements in any one day, moderately dusty surface material (e.g., high clay content), unpaved road length 50 – 100 m; and
- **Small**: <20 HDV (>3.5 t) outward movements in any one day, surface material with low potential for dust release, unpaved road length <50 m.

Step 2B: Defining the Sensitivity of the Area

The sensitivity of the area is defined for dust soiling, human health and ecosystems. The sensitivity of the area takes into account the following factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM_{10}, the local background concentration; and
- site-specific factors, such as whether here are natural shelters such as trees, to reduce the risk of wind-blown dust.

Table A3.1 has been used to define the sensitivity of different types of receptors to dust soiling, health effects and ecological effects.

Based on the sensitivities assigned of the different types of receptors surrounding the site and numbers of receptors within certain distances of the site, a sensitivity classification for the area can be defined for each. Tables A3.2 to A3.4 indicate the method used to determine the sensitivity of the area for dust soiling, human health and ecological impacts, respectively.

For trackout, as per the guidance, it is only considered necessary to consider trackout impacts up to 50m from the edge of the road.

Table A3.1: Sensitivity of the area surrounding the site

Sensitivity of Area	Dust Soiling	Human Receptors	Ecological Receptors
High	• Users can reasonably expect an enjoyment of a high level of amenity. • The appearance, aesthetics or value of their property would be diminished by soiling. • The people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. • Examples include dwellings, museums and other culturally important collections, medium and long term car parks and car showrooms.	• Locations where members of the public are exposed over a time period relevant to the air quality objective for pm_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day) • Examples include residential properties, hospitals, schools and residential care homes should also be considered as having equal sensitivity to residential areas for the purposes of this assessment.	• Locations with an international or national designation and the designated features may be affected by dust soiling. • Locations where there is a community of a particularly dust sensitive species such as vascular species included in the red data list for Great Britain. • Examples include a special area of conservation (sac) designated for acid heathlands or a local site designated for lichens adjacent to the demolition of a large site containing concrete (alkali) buildings.
Medium	• Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home. • The appearance, aesthetics or value of their property could be diminished by soiling. • The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land. • Examples include parks and places of work.	• Locations where the people exposed are workers and exposure is over a time period relevant to the air quality objective for pm10 (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day). • Examples include office and shop workers, but will generally not include workers occupationally exposed to pm10, as protection is covered by health and safety at work legislation.	• Locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown. • Locations with a national designation where the features may be affected by dust deposition. • Example is a site of special scientific interest (sssi) with dust sensitive features.

Sensitivity of Area	Dust Soiling	Human Receptors	Ecological Receptors
Low	• The enjoyment of amenity would not reasonably be expected. • Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling. • There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land. • Examples include playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.	• Locations where human exposure is transient. • Indicative examples include public footpaths, playing fields, parks and shopping streets.	• Locations with a local designation where the features may be affected by dust deposition. • Example is a local nature reserve with dust sensitive features.

Table A3.2: Sensitivity of the area to dust soiling effects on people and property

Receptor sensitivity	Number of receptors	Distance from the source (m)			
		<20	<50	<100	<350
High	>100	High	High	Low	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Table A3.3: Sensitivity of the area to human impacts

Receptor sensitivity	Annual mean PM_{10} concentrations	Number of receptors	Distance from the source (m)				
			<20	<50	<100	<200	<350
High	>32µg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	28-32µg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	24-28µg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<24µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>32µg/m^3	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	28-32µg/m^3	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	24-28µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<24µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Table A3.4: Sensitivity of the area to ecological impacts

Receptor sensitivity	Dust Emissions Magnitude	
	Large	Medium
High	High	Medium
Medium	Medium	Low
Low	Low	Low

Step 2C: Defining the Risk of Impacts

The final step is to use both the dust emission magnitude classification with the sensitivity of the area, to determine a potential risk of impacts for each construction activity, before the application of mitigation. Tables A3.5 to A3.7 indicate the method used to assign the level of risk for each construction activity.

Table A3.5: Risk of dust impacts from demolition

Receptor sensitivity	Dust Emissions Magnitude		
	Large	Medium	Small
High	High risk	Medium risk	Medium risk
Medium	High risk	Medium risk	Low risk
Low	Medium risk	Low risk	Negligible

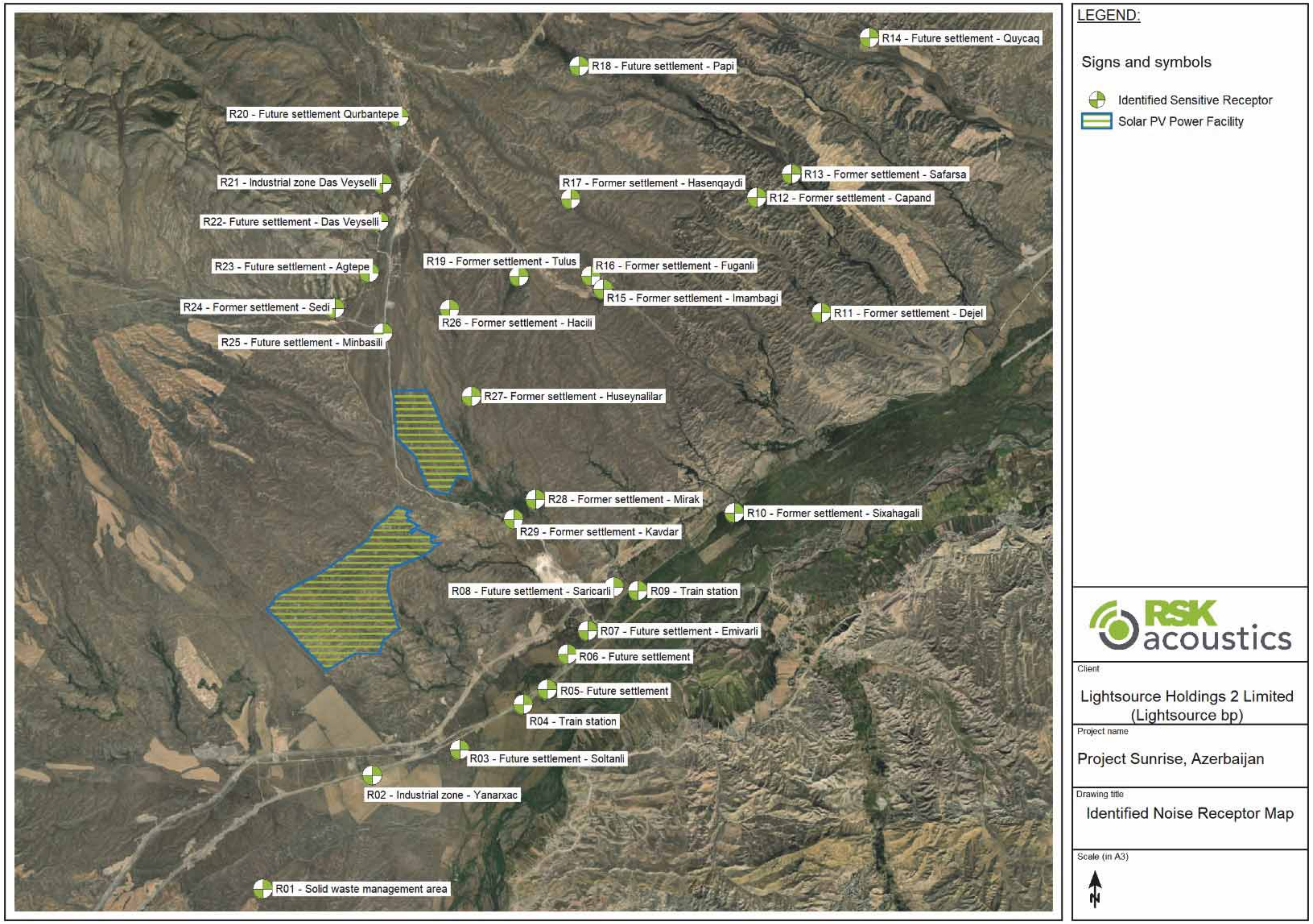
Table A3.6: Risk of dust impacts from earthworks/construction

Receptor sensitivity	Dust Emissions Magnitude		
	Large	Medium	Small
High	High risk	Medium risk	Low risk
Medium	Medium risk	Medium risk	Low risk
Low	Low risk	Low risk	Negligible

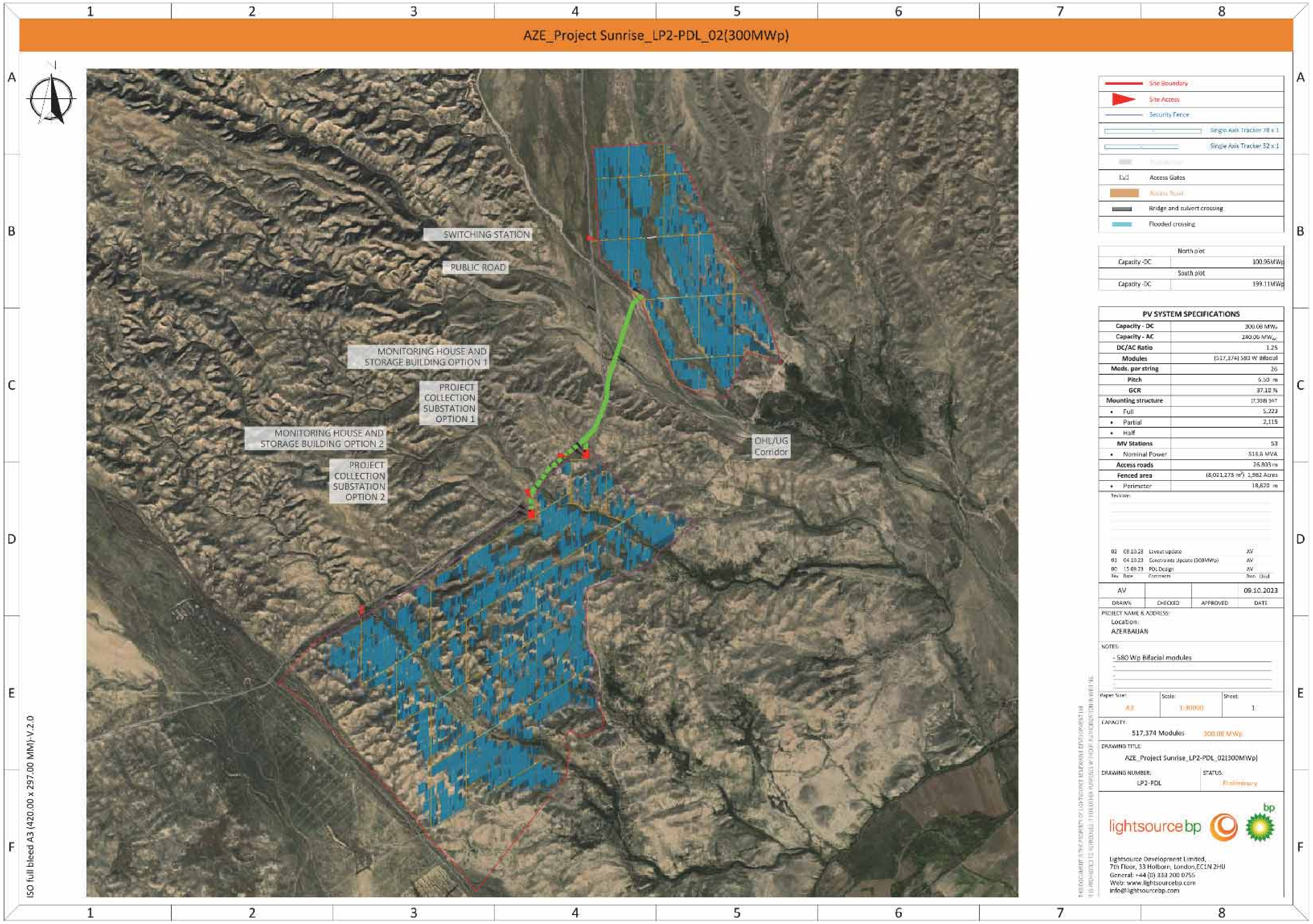
Table A3.7: Risk of dust impacts from trackout

Receptor sensitivity	Dust Emissions Magnitude		
	Large	Medium	Small
High	High risk	Medium risk	Low risk
Medium	Medium risk	Low risk	Negligible
Low	Low risk	Low risk	Negligible

APPENDIX 4A
ACOUSTIC ASSESSMENT RECEPTOR MAP



APPENDIX 4B
LAYOUT: LP2-PDL, AS PER AZE_PROJECT SUNRISE_LP2-PDL_02(300MWP)



APPENDIX 5 – ENVIRONMENTAL AND SOCIAL COMMITMENTS REGISTER

Reference	Potential impact	Summary of Key Measures Outlined in ESIA Report	Monitoring and Frequency	Project phase			Responsibility
				Construction	Operations	Decommissioning	
ESIA Chapter 8 Section 8.1.1 Air Quality Section 8.1.1.1 Construction Section 8.1.1.3 Decommissioning	Increased dust emissions	Display the name and contact details of people accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Display Lightsource bp contact information.	Weekly site walkovers	✓		✓	Lightsource bp EPC contractor Decommissioning contractor
		Develop and implement a Pollution Prevention Plan within the project ESMP that includes measures to control dust and other emissions, to be approved by Lightsource bp.	Approval of Pollution Prevention Plan Weekly site walkovers	✓		✓	Lightsource bp EPC contractor Decommissioning contractor
		Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.	Grievance register to be reviewed monthly	✓		✓	Lightsource bp EPC contractor Decommissioning contractor
		Make the complaints log available to Lightsource bp and external stakeholders if requested.	Grievance register to be reviewed monthly	✓		✓	Lightsource bp EPC contractor Decommissioning contractor
		Record any exceptional incidents that cause dust and/or air emissions, either on- or off site and the action taken to resolve the situation in the logbook.	Grievance register to be reviewed monthly	✓		✓	EPC contractor Decommissioning contractor
		Carry out regular site inspections to monitor compliance with the ESMP, record results, and make the action log available to Lightsource bp and external stakeholders if requested	Weekly site walkovers Action log updated weekly	✓		✓	EPC contractor Decommissioning contractor
		Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions	Daily site walkovers as a minimum during dust-generating activities and prolonged dry or windy conditions	✓		✓	EPC contractor Decommissioning contractor
		Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Avoid site runoff of water or mud.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Keep site fencing, barriers and scaffolding clean using wet methods, where practicable.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Cover, seed or fence stockpiles to prevent wind whipping.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor

Reference	Potential impact	Summary of Key Measures Outlined in ESIA Report	Monitoring and Frequency	Project phase			Responsibility
		Ensure all vehicles switch off engines when stationary - no idling vehicles.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Impose and signpost a maximum-speed-limit of 30 kph on surfaced and 20 kph on unsurfaced site roads and within work areas.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Use covered skips.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Minimise drop heights from loading or handling equipment and use fine water sprays on such equipment wherever appropriate	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Maintain robust waste management practices at site in line with the Waste Management Plan	Weekly site walkovers	✓	✓	✓	All contractors
		Segregate hazardous and non-hazardous waste	Weekly site walkovers	✓	✓	✓	All contractors
		Avoid bonfires and burning of waste materials.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Use hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Only remove the cover in small areas during work and not all at once.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Avoid any dry sweeping of large areas.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor

Reference	Potential impact	Summary of Key Measures Outlined in ESIA Report	Monitoring and Frequency	Project phase			Responsibility
		Record all inspections of haul routes and any subsequent action in a site log book.	Keep site log book up to date with inspections carried out, log book to be checked monthly	✓		✓	EPC contractor Decommissioning contractor
		Implement a washout station wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
ESIA Chapter 8 Section 8.1.1 Air Quality Section 8.1.1.1 Construction Section 8.1.1.2 Operation Section 8.1.1.3 Decommissioning	Increased exhaust emissions	All plant, equipment, and vehicles used during the works shall be regularly serviced and fitted with appropriate emission control equipment, where practicable, to ensure optimum performance and that no excess exhaust emissions are emitted	Keep a log of equipment and vehicles, including dates of inspections. Log book to be checked monthly Equipment and vehicles to be inspected monthly	✓	✓	✓	All contractors
		Develop and implement a transport strategy that maximises the use of efficient transport methods	N/A	✓		✓	Lightsource bp EPC contractor Decommissioning contractor
		Plant, equipment, and vehicles shall be maintained in accordance with manufacturer's specifications to achieve effective combustion	Keep a log of equipment and vehicles, including dates of inspections. Log book to be checked monthly Equipment and vehicles to be inspected monthly	✓	✓	✓	All contractors
		Implementation of a Community Grievance Management Procedure.	Grievances to be reviewed monthly	✓		✓	EPC contractor Decommissioning contractor
		Sites and corresponding infrastructure shall be designed, constructed, and operated with the intention of minimising emissions of key pollutants where practicable.	Weekly site walkovers	✓	✓	✓	Lightsource bp All contractors
		Vehicle movements should be restricted to designated roads (existing roads and tracks where possible) and approved routes and shall comply with the projects' road rules and speed limits.	Weekly site walkovers		✓		O&M contractor
ESIA Chapter 8 Section 8.1.2 GHG Section 8.1.2.1 Construction	Increase in GHG emissions	Implement measures to decrease fuel use by maximising energy efficiencies, for example to ensure all vehicles switch off engines when stationary and ensure construction vehicles are well maintained and conform to current emissions standards	Weekly site walkovers	✓			EPC contractor
		Promoting the use of sustainable fuels in construction vehicles	Monthly review of fuel consumption records	✓			EPC contractor
		Liaise with construction staff to minimise GHG emissions associated with commute to site, including provision of staff minibuses, and promoting of lower carbon modes of travel such as car sharing options.	N/A	✓			Lightsource bp EPC contractor
		Promoting the use of locally sourced and/or produced materials. The use of recycled aggregates, where appropriate, for foundations, subbase and hard-standings.	Keep a database of suppliers and review every six months	✓			EPC contractor
		Promoting the recycling of materials by segregating construction waste to be re-used and recycled where practical.	Weekly inspection of site waste facilities	✓			EPC contractor

Reference	Potential impact	Summary of Key Measures Outlined in ESIA Report	Monitoring and Frequency	Project phase			Responsibility
ESIA Section 8 Section 8.1.3 Noise Section 8.1.3.2 Construction Section 8.1.3.4 Decommissioning	Noise generated by construction vehicles and equipment	Ensure all vehicles switch off engines when stationary - no idling vehicles.	Weekly site walkovers	✓		✓	EPC contractor Decommissioning contractor
		Locate temporary worker accommodation facilities outside the exclusion zones for night works to achieve noise levels below 40 dB LAeq, 1hr.	Project design	✓		✓	EPC contractor Decommissioning contractor
ESIA Chapter 8 Section 8.1.4 Soils Section 8.1.4.1 Construction Section 8.1.6 Surface Water Section 8.1.6.1 Construction	Compaction and changes to soil structure Sedimentation of surface water bodies	Vehicle movements will be restricted to defined access routes and demarcated working areas (unless in the event of an emergency)	Weekly site walkovers	✓			EPC contractor
		Driving and other work will not be permitted in excessively wet conditions	Weekly site walkovers	✓			EPC contractor
		Topsoil will be stored outside the running track used by construction plant, equipment and vehicles	Weekly site walkovers	✓			EPC contractor
		Load-bearing materials, such as bog mats and geotextile membranes, will be used to support heavy loads in areas of soft ground	Weekly site walkovers	✓			EPC contractor
		Temporary drainage will be provided where necessary to prevent ponding or waterlogging of the working area	Weekly site walkovers	✓			EPC contractor
		Back-fill material will be adequately (but not excessively) compacted to prevent future settlement.	Weekly site walkovers	✓			EPC contractor
ESIA Chapter 8 Section 8.1.4 Soils Section 8.1.4.1 Construction Section 8.1.6 Surface Water Section 8.1.6.1 Construction	Erosion and soil loss Sedimentation of surface water bodies	An Erosion, Sediment Control and Reinstatement Plan will be produced within the ESMP.	Approval of Erosion, Sediment Control and Reinstatement Plan Weekly site walkovers	✓			Lightsource bp EPC contractor
ESIA Chapter 8 Section 8.1.4 Soils Section 8.1.4.1 Construction	Erosion and soil loss	The site will be inspected regularly for signs of erosion and sediment run-off. the frequency of these inspections will be increased in sensitive areas.	Weekly site walkovers	✓			EPC contractor
		Where the ground is considered sufficiently steep (generally greater than 25%), topsoil stockpiles will be protected with silt fence to help reduce washout and loss of topsoil during heavy rains	Weekly site walkovers	✓			EPC contractor
		The topsoil and subsoil stack surface will be compacted sufficiently with the aim of preventing erosion, without leading to the development of anaerobic conditions	Weekly site walkovers	✓			EPC contractor
		Topsoil stacks will be regularly inspected for erosion; corrective measures will be implemented if compaction or erosion is identified	Weekly site walkovers	✓			EPC contractor
		Sediment control fencing (or low berms), drainage channels and trench barriers will be installed where appropriate.	Weekly site walkovers	✓			EPC contractor
		In areas where machinery is not able to achieve the topsoil strip depth and there is a risk of subsoil mixing, stripping by other means, such as by using hand tools, will be implemented.	Weekly site walkovers	✓			EPC contractor
		Stripped topsoil in sensitive (thin) topsoil areas shall be stored separately in designated areas	Weekly site walkovers	✓			EPC contractor
		Consideration will be given to covering topsoil piles where topsoil is very thin and at risk of wind and water erosion	Weekly site walkovers	✓			EPC contractor
		If significant amounts of topsoil are lost due to poor topsoil handling, then it may be required to replace it with topsoil of similar chemical, biological and physical characteristics	Weekly site walkovers	✓			EPC contractor
		Protection measures will be put in place to prevent any run-off water used for dust suppression from causing sedimentation in nearby watercourses.	Weekly site walkovers	✓			EPC contractor

Reference	Potential impact	Summary of Key Measures Outlined in ESIA Report	Monitoring and Frequency	Project phase			Responsibility
ESIA Chapter 8 Section 8.1.4 Soils Section 8.1.4.1 Construction	Mobilisation of contamination	If contaminated soil is encountered during construction, the soil will be segregated from uncontaminated materials and stored at least 50 m away from any surface water or seasonal surface water beds. Any contaminated soil storage areas will be provided with containment measures (bunds ditches, impermeable base membranes, covers) to help minimise run off and airborne soil loss.	Weekly site walkovers Weekly check of contaminated soil/materials storage areas	✓			EPC contractor
		The project workforce involved in soil handling and earthworks will be provided with gloves and goggles to reduce direct contact with the soil.	Weekly site walkovers	✓			EPC contractor
		Training will be provided to the EPC contractor on soil contamination as part of the HSSE plan.	Regular audit of awareness programs sessions and other training for the project workforce	✓			Lightsource bp
		Dust suppression measures, such as fine water misting, will be implemented to reduce dust generation and preventing inhalation and ingestion of soil dust by project workforce.	Weekly site walkovers	✓			EPC contractor
ESIA Chapter 8 Section 8.1.5 Groundwater Section 8.1.5.1 Construction Section 8.1.5.1 Operation Section 8.1.6 Surface Water Section 8.1.6.1 Construction Section 8.1.6.2 Operation	Groundwater abstraction Surface water abstraction	Groundwater and surface water will be sourced offsite from an existing source that has adequate capacity to accommodate the project's water needs.	Permits/authorisation provided and source approved by Lightsource bp before use	✓	✓		EPC contractor O&M contractor
		No local groundwater or surface water abstraction.	Monthly review of water supply and consumption records	✓	✓		EPC contractor O&M contractor
ESIA Chapter 8 Section 8.1.5 Groundwater Section 8.1.5.1 Construction Section 8.1.6 Surface Water Section 8.1.6.1 Construction	Groundwater contamination Surface water contamination	Develop a project Waste Management Plan within the ESMP and manage waste in accordance with this plan	Approval of Waste Management Plan Weekly inspection of site waste facilities	✓			Lightsource bp EPC contractor
		Include emergency response procedures for spills or releases of hazardous waste within the Waste Management Plan	Weekly inspection of site waste facilities	✓			Lightsource bp EPC contractor
		Share the Waste Management Plan with MENR in advance of project commencement	Acknowledgement of submission to MENR and MENR receipt of Waste Management Plan	✓			Lightsource bp
		Apply good pollution prevention practices across the project sites	Weekly site walkovers	✓			EPC contractor
		No local groundwater abstraction.	Monthly review of water supply and consumption records				O&M contractor
		No local surface water abstraction.	Monthly review of water supply and consumption records				EPC contractor
ESIA Chapter 8 Section 8.1.6 Surface Water Section 8.1.6.1 Construction	Surface water contamination	Implement the Pollution Prevention Plan	Weekly site walkovers	✓			EPC contractor
		Implement the Groundwater and Surface Water Management Plan	Weekly site walkovers	✓			EPC contractor

Reference	Potential impact	Summary of Key Measures Outlined in ESIA Report	Monitoring and Frequency	Project phase			Responsibility
ESIA Chapter 8 Section 8.1.9 Biodiversity Section 8.1.9.1 Construction	Exploitation or illegal logging pressures on protected areas	Prohibit construction site staff and contractors from hunting, fishing, buying, or trading of wildlife as well as the collection of aquatic resources, timber, and other resources to help conserve existing fauna and forestry resources.	Regular audit of awareness programs sessions and other training for the project workforce	✓			EPC contractor
		Conduct environmental education and awareness programs for all Project staff and contractors (e.g. through staff inductions). This will aim to ensure understanding of the importance of native resources, and ensure that the prohibitions and penalties regarding hunting, wildlife trade and the collection of other forestry resources are widely known	Regular audit of awareness programs sessions and other training for the project workforce	✓			Lightsource bp EPC contractor
ESIA Chapter 8 Section 8.1.9 Biodiversity Section 8.1.9.1 Construction Section 8.1.9.2 Operation	Generalised degradation of surrounding habitats as well as choking hazards to fauna species mistaking waste as food	All waste should be managed in accordance with the Waste Management Plan which should include the following requirements and shared with MENR in advance of project commencement: - segregation and storage in appropriate and labelled bins/skips - disposal of food and plastic waste in an appropriate organic waste/recycling facility or removal from site by a registered waste management contractor - recording waste generated and transported according to cradle -to -grave and duty of care principles - waste management self verification (site inspections) - waste management training for staff and contractors.	Weekly inspection of site waste facilities	✓	✓		EPC contractor O&M contractor
		Bins and skips shall be covered to prevent wind-blown litter, odours, and to limit access by native fauna and pest species.	Weekly inspection of site waste facilities	✓			EPC contractor
ESIA Chapter 8 Section 8.1.9 Biodiversity Section 8.1.9.1 Construction	Loss of surface vegetation and native flora	Avoid removal of vegetation and sections/patches which will not be directly replaced by project infrastructure, where feasible.	Weekly site walkovers	✓			EPC contractor
		Areas to be cleared will be delineated and vegetation removal will be restricted to these designated areas only.	Weekly site walkovers	✓			EPC contractor
		Avoid the use of pesticides and fire to clear vegetation.	N/A	✓			EPC contractor
		Limit access and disturbance to any additional natural areas outside of demarcated clearance zones.	Weekly site walkovers	✓			EPC contractor
		Identify, retain and/or relocate mature specimens of conservation importance, such as Ficus carica and Punica granatum.	Keep log of ecological features relocated and retained, log book to be checked weekly	✓			EPC contractor
		Conduct a survey in the optimum period (March) immediately prior to site preparation works to identify and record the location of Iris spp. bulbs present within the northern and southern clusters. Retain those that will not be disturbed during construction and protect with permanent fencing. Engage with specialists to plan the translocation of bulbs from within construction areas to the closest fenced protected zones within the project footprint during the optimum period for translocation (January/February).	Keep log of ecological features relocated and retained, log book to be checked weekly	✓			Lightsource bp
		Engage an ecologist to clearly mark protected vegetation (e.g., using flagging tape or fencing) and instruct personnel and contractors in the requirement to protect vegetation that has been marked.	Weekly site walkovers	✓			EPC contractor
		Engage an ecologist to conduct pre-clearance surveys to check for the presence of priority flora within habitats to be cleared and identify and relocate young flora specimens during land clearance.	PCS reports Keep log of ecological features relocated and retained, log book to be checked weekly	✓			EPC contractor
		Where feasible, avoid areas of native vegetation with large numbers of threatened flora during land clearance.	Weekly site walkovers	✓			EPC contractor
		Replanting of native flora following construction in cleared areas which still exhibit suitable conditions (sunlight, rainfall etc.) to sustain the original vegetative communities.	Keep log of ecological features relocated and retained, log book to be checked weekly	✓			EPC contractor
		Minimise access, disturbance to land and clearing of vegetation to prevent unnecessary ground disturbance and to protect areas of known high biodiversity conservation.	Weekly site walkovers	✓			EPC contractor

Reference	Potential impact	Summary of Key Measures Outlined in ESIA Report	Monitoring and Frequency	Project phase			Responsibility
ESIA Chapter 8 Section 8.1.9 Biodiversity Section 8.1.9.1 Construction	Reduction in water quality in waterways, soil erosion and increased siltation	Retention of natural sediment traps	Weekly site walkovers	✓			EPC contractor
		Retention of wetlands and existing drainage channels	Weekly site walkovers	✓			EPC contractor
		Stabilise landforms and implement erosion prevention measures during construction	Weekly site walkovers	✓			EPC contractor
		Enabling works will be conducted during the dry season, thus reducing the pathway for impact to the Araz River	Weekly site walkovers	✓			EPC contractor
		All enabling works in riverbeds will be confined to the smallest area possible	Weekly site walkovers	✓			EPC contractor
		Maintain root systems (wherever practical) to maintain soil stability by cutting vegetation at ground level, thereby minimising soil erosion	Weekly site walkovers	✓			EPC contractor
		Install sediment traps to capture suspended sediments in drainage systems or channels susceptible to erosion.	Weekly site walkovers	✓			EPC contractor
		Areas to be cleared will be delineated and vegetation removal will be restricted to these designated areas only	Weekly site walkovers	✓			EPC contractor
ESIA Chapter 8 Section 8.1.9 Biodiversity Section 8.1.9.1 Construction	Reduction in water quality in waterways and habitat degradation	Waste natural materials (i.e., soil/rock) from the construction process to be utilised as fill where feasible, with a zero dumping policy for catchment areas and waterways.	Weekly inspection of site waste facilities Weekly site walkovers	✓			EPC contractor
		All liquid pollutants and wastes stored within secondary containment and hard stand flooring, a minimum of 100 m from open water bodies and surface water courses (ephemeral streams).	Weekly inspection of site waste facilities	✓			EPC contractor
		All solid and liquid fuel stores placed within secondary containment and hard stand flooring, a minimum of 100 m from open water bodies and surface water courses (ephemeral streams).	Weekly inspection of site waste facilities	✓			EPC contractor
		All liquid hazardous material and waste storage facilities to be equipped with appropriate spill kits and containment instructions for unplanned spills.	Weekly inspection of site waste facilities	✓			EPC contractor
		Develop a fit-for-purpose Emergency Response Plan and Spill Response Plan, including training for all on-site personnel, as part of the projects ESMP.	Periodic review of plan and of personnel training records	✓			EPC contractor
		All solid waste stores to have appropriate covers to prevent wind blown materials entering the environment.	Weekly inspection of site waste facilities	✓			EPC contractor
ESIA Chapter 8 Section 8.1.9 Biodiversity Section 8.1.9.1 Construction	Generational reduction in populations and genetic diversity	Implement an eradication programme to remove existing and new introduced and/or invasive species, particularly along roadsides and construction sites within the project footprint area * This includes non-native species in the northern cluster, introduced through historical agricultural practices in the wider area.	Weekly site walkovers Log of invasive species encountered and removed	✓			EPC contractor
		Regular inspections within new and existing disturbed areas and newly disturbed areas for seedlings of AIS species	Weekly site walkovers Log of invasive species encountered and removed	✓			EPC contractor
		Control measures for weed management will include wash down facilities, controlled access to designated areas, ongoing monitoring, and personnel training	Weekly site walkovers Periodic review of plan and of personnel training records	✓			EPC contractor
		Eradication programs will be considered with regards to pest fauna species. *Where pest management has been identified as required (e.g., feral cats, rats, etc.), control measures will be considered include trapping, eradication, relocation, and baiting. These programs will be supported by relevant training and awareness of employees and contractors.	Weekly site walkovers Periodic review of personnel training records	✓			EPC contractor
		Waste storage bins/skips shall be routinely covered to prevent wind-blown litter, odours, and to limit access by native fauna and pest species.	Weekly inspection of site waste facilities	✓			EPC contractor
		Project waste will be covered and removed regularly to limit the exposure to fauna and potential of diseases being spread.	Weekly inspection of site waste facilities	✓			EPC contractor
		Waste should only be collected in receptacles in designated areas, which will be emptied regularly and waste transported to the final disposal location.	Weekly inspection of site waste facilities	✓			EPC contractor
		Continuous awareness raising, training and site inspections regarding introduction and invasion of alien fauna and spread of diseases.	Periodic review of personnel training records	✓			EPC contractor

Reference	Potential impact	Summary of Key Measures Outlined in ESIA Report	Monitoring and Frequency	Project phase			Responsibility
ESIA Chapter 8 Section 8.1.9 Biodiversity Section 8.1.9.1 Construction	Smothering impact from dust rise during construction activities (flora)	Confine vehicle movement to designated access routes and roads.	Weekly site walkovers	✓			EPC contractor
		Minimise dust and pollution emission using equipment with industry standard reduction systems and comply with applicable standards, where practicable.	Periodic review and maintenance of equipment to ensure compliance with industry standard reduction systems	✓			EPC contractor
		Minimise dust lift through watering roads and cleared areas, especially during the dry season.	Weekly site walkovers	✓			EPC contractor
ESIA Chapter 8 Section 8.1.9 Biodiversity Section 8.1.9.1 Construction	Loss of fertile topsoil to support vegetation recovery	Preservation and translocation of topsoil and seed bank as part of site rehabilitation/revegetation process.	Weekly site walkovers	✓			EPC contractor
		All topsoil removed to be stockpiled and maintained for use in re-vegetation of undeveloped areas, fringes, embankments and surrounds.	Weekly site walkovers	✓			EPC contractor
ESIA Chapter 8 Section 8.1.9 Biodiversity Section 8.1.9.1 Construction	Dust, noise and vibrations resulting in avoidance or behavioural changes by mobile fauna species	Avoid works during particularly windy conditions.	Weekly site walkovers	✓			EPC contractor
		Confine vehicle movement to designated access routes and roads.	Weekly site walkovers	✓			EPC contractor
		Minimise dust and pollution emissions using equipment with industry standard reduction systems and comply with applicable standards, where practicable.	Periodic review and maintenance of equipment to ensure compliance with industry standard reduction systems	✓			EPC contractor
		Minimise dust through watering roads and cleared areas, especially during the dry season.	Weekly site walkovers	✓			EPC contractor
		Maintain all machinery to ensure both air and noise emissions are minimised and below health safety levels.	Weekly site walkovers	✓			EPC contractor
ESIA Chapter 8 Section 8.1.9 Biodiversity Section 8.1.9.1 Construction	Permanent destruction of habitats and subsequent loss or displacement of their native fauna	Clearance to be conducted under supervision by a trained and qualified ecologist can capture, remove and relocate individual specimens of Spur-thighed Tortoise (Testudo graeca) when identified ahead of the active enabling works.	Weekly site walkovers Periodic review of personnel training records	✓			EPC contractor
		Engage an ecologist to supervise vegetation clearance, where possible, outside of the breeding season for Black Francolin (Francolinus francolinus) March to July (Cornell BOTW, 2023). During the breeding season, any nest sites identified by the ECoW ecologist should be given a 50m buffer and only cleared once the chicks have fledged.	Weekly site walkovers	✓			EPC contractor
		Engage an ecologist to conduct pre-clearance checks for any other non mobile species, with capture and relocation of individuals to adjacent suitable habitats where feasible.	Weekly site walkovers Keep log of specimens relocated and retained	✓			EPC contractor
		Sensitive, and soft-start, approach to vegetation clearance will be employed to enable fauna to disperse into surrounding habitats, starting at one end and working in a single direction.	Weekly site walkovers	✓			EPC contractor
		Avoid removal of large sections/patches, where feasible.	Weekly site walkovers	✓			EPC contractor
ESIA Chapter 8 Section 8.1.9 Biodiversity Section 8.1.9.1 Construction	Habitat fragmentation	Minimise clearance of natural vegetation and habitats at the fringe of the sites, to allow for greater connectivity of habitat.	Weekly site walkovers	✓			EPC contractor
		Design of fencing to allow for passage of small mammals and reptiles through the site where possible.	Weekly site walkovers	✓			EPC contractor
		Use of native flora of local providence to replant any denuded areas which are not directly beneath the footprint of the PV power facility (i.e., PV modules).	Weekly site walkovers	✓			EPC contractor
ESIA Chapter 8 Section 8.1.9 Biodiversity Section 8.1.9.2 Operation	Accumulation of wind-blown litter	Operational waste disposal protocols should be kept in line with the requirements of the waste management plan.	Weekly inspection of site waste facilities		✓		O&M contractor
		Disposable food and plastic waste should be temporarily stored in labelled, secure bins and skips before being disposed of at an approved location	Weekly inspection of site waste facilities		✓		O&M contractor
		Bins and skips shall be covered to prevent wind-blown litter, odours, and to limit access by native fauna and pest species.	Weekly inspection of site waste facilities		✓		O&M contractor

Reference	Potential impact	Summary of Key Measures Outlined in ESIA Report	Monitoring and Frequency	Project phase			Responsibility
ESIA Chapter 8 Section 8.2.1 Economy Section 8.2.1.1 Construction	Benefits to local businesses	Develop and implement a Labour Management Plan within the ESMP and manage labour and employment in accordance with this plan.	Keep a database of suppliers and review every six months Regular audit of awareness programs sessions and other training for the project workforce	✓			Lightsource bp EPC contractor
		All contractors, including sub-contractors, to develop a Labour Management Plan for approval by Lightsource bp.	Approval of Labour Management Plan	✓			EPC contractor
		Embed specific local content reporting requirements (procurement, recruitment and capacity building) for contractors in contracts, covering both workforce and procurement.	Six monthly review of KPIs embedded in contracts	✓			Lightsource bp EPC contractor
ESIA Chapter 8 Section 8.2.1 Economy Section 8.2.1.1 Construction	Local inflation	Develop and implement a Social Management Plan to monitor socioeconomic changes in the district, including population size of communities and arrival of economic migrants.	Regular liaison with local community/district representatives Monthly review of socioeconomic KPIs	✓			EPC contractor
		Conduct price survey/market monitoring at businesses that reflect the markets/businesses that communities (including vulnerable groups) within the AOI purchase from.	Six monthly audits of contractor and subcontractor systems	✓			EPC contractor
		Develop and implement a Labour Management Plan to include measures to support mitigation of inflationary pressure.	Regular liaison with local community/district representatives Monthly review of KPI related to socio-economic factors	✓			Lightsource bp EPC contractor
ESIA Chapter 8 Section 8.2.1 Economy Section 8.2.1.1 Construction	Escalating potential local corruption	Develop and implement a Labour Management Plan and manage labour and employment in accordance with this plan.	Approval of Labour Management Plan	✓			EPC contractor
		Develop and implement a separate procedure to ensure fair distribution of opportunities especially for semi-skilled and unskilled labour within the AOI.	Six monthly audits of contractor and subcontractor systems	✓			EPC contractor
		Lightsource bp will implement contractor/sub-contractor pre-qualification and due diligence processes.		✓	✓	✓	Lightsource bp
		Audit contractors and suppliers for compliance with Lightsource bp Code of Conduct requirements.	Six monthly audits of contractor and subcontractor systems	✓	✓	✓	Lightsource bp EPC contractor O&M contractor Decommissioning contractor
		Communicate labour management procedures widely with potential contractors, suppliers and job applicants and other affected or interested stakeholders.	Six monthly audits of contractor and subcontractor systems	✓			EPC contractor
		Implement a Community Grievance Management Procedure.	Grievance register to be reviewed monthly	✓			EPC contractor
		If a review of the Community Grievance Management Procedure indicates there have been claims of corruption in recruitment processes, Lightsource bp will consider the option to engage a third-party observer to monitor and audit the recruitment processes, procurement of goods and services, and applications for any permits as appropriate.	Grievance register to be reviewed monthly	✓			Lightsource bp
ESIA Chapter 8 Section 8.2.2 Employment and Skills Development Section 8.2.2.1 Construction	Generation of local employment opportunities	All jobs, skilled and unskilled, company or contractor will have well defined and clear job descriptions that include skills or qualification requirements and clear terms and conditions in line with national labour laws, with remuneration consistent with the level of expertise and experience.	Six monthly audits of contractor and subcontractor systems	✓			Lightsource bp EPC contractor
		Develop and implement a Labour Management Plan and manage labour and employment in accordance with this plan.	Six monthly audits of contractor and subcontractor systems	✓			Lightsource bp EPC contractor
		Implement a Community Grievance Management Procedure.	Grievance register to be reviewed monthly	✓			Lightsource bp EPC contractor
		Justify how contractor has attempted to fill positions with Azerbaijani citizens before recruiting expatriate staff.	Log of employee data, reviewed every six months	✓			Lightsource bp EPC contractor

Reference	Potential impact	Summary of Key Measures Outlined in ESIA Report	Monitoring and Frequency	Project phase			Responsibility
ESIA Chapter 8 Section 8.2.2 Employment and Skills Development Section 8.2.2.1 Construction	Training and skills development	Coordinate with Ministry of Labour and Social Protection to understand vocational training centres next to the district to understand training courses, skills and opportunities for Persons with disabilities	Regular audit of awareness programs sessions and other training for the project workforce	✓			Lightsource bp EPC contractor
		Provide all workers with end of labour certificates and/or references, as appropriate to support skills development and skills/experience recognition, as appropriate	Log of employee data, reviewed every six months	✓			Lightsource bp EPC contractor
		Agree specific targets for contractor worker training programmes	Six monthly audits of contractor and subcontractor systems	✓			Lightsource bp EPC contractor
		Set out worker demobilisation planning within the Labour Management Plan that includes the use of references and handover processes to identify well performing personnel from construction so that they may market themselves to future projects in the region.	Log of employee data, reviewed every six months	✓			Lightsource bp EPC contractor
		Provide all contractors training records to Lightsource bp.	Monthly review of training records	✓			Lightsource bp EPC contractor
ESIA Chapter 8 Section 8.2.2 Employment and Skills Development Section 8.2.2.1 Construction	Termination of employment contracts	Provide all workers with end of labour certificates and/or references, as appropriate to support skills development and skills/experience recognition	Six monthly audits of contractor and subcontractor systems	✓			EPC contractor
		Develop and implement a Labour Management Plan including the requirement to ensure clear terms (including contract duration) and conditions for workers are provided at the onset of employment.	Six monthly audits of contractor and subcontractor systems	✓			EPC contractor
		Develop and implement a Labour Management Plan that includes the procedures for workforce demobilisation.	Six monthly audits of contractor and subcontractor systems	✓			EPC contractor
		Provide regular communication and awareness sessions around employment needs and the short-term nature of the work to ensure workers have realistic expectations.	Grievance register to be reviewed monthly	✓			Lightsource bp EPC contractor
		Develop and implement a Worker Grievance Management Procedure. The grievance procedure will allow workers hired by contractors and sub-contractors to raise issues that cause problems during the demobilisation process.	Grievance register to be reviewed monthly	✓			Lightsource bp EPC contractor
ESIA Chapter 8 Section 8.2.3 - Labour and working conditions Section 8.2.3.1 Construction	Violation of labour rights by contractors and sub-contractors and in supply chain	Provide training for all contractor and sub-contractor workers during the induction process on basic worker rights and the Worker Grievance Management Procedure, with emphasis on no disciplinary action for reporting credible grievances, including those specific to gender-based violence and harassment.	Regular audit of awareness programs sessions and other training for the project workforce Grievance register to be reviewed monthly	✓			Lightsource bp EPC contractor
		Provide periodic refresher training on the above topics through toolbox talks, documenting attendance and topics discussed.	Regular audit of awareness programs sessions and other training for the project workforce	✓			Lightsource bp EPC contractor
		All jobs, skilled and unskilled, company or contractor will have well defined and clear job descriptions that include skills or qualification requirements and clear terms and conditions in line with national labour laws, with remuneration consistent with the level of expertise and experience.	Six monthly audits of contractor and subcontractor systems	✓			Lightsource bp EPC contractor
		Provide training for all contractor and sub-contractor workers on basic health and safety requirements that must be met within the workplace.	Monthly review of training records	✓			Lightsource bp EPC contractor
ESIA Chapter 8 Section 8.2.3 Labour and working conditions Section 8.2.3.1 Construction	Failure of contractors and sub-contractors to provide adequate accommodation	Provide training for all contractor and sub-contractor workers during the induction process on basic worker rights and the Worker Grievance Management Procedure, with emphasis on no disciplinary action for reporting credible grievances, including those specific to gender-based violence and harassment.	Regular audit of awareness programs sessions and other training for the project workforce Grievances to be reviewed monthly	✓			Lightsource bp EPC contractor
		Provide temporary workforce accommodation that meets the requirements of the IFC and EBRD guidance note, 'Workers' accommodation: processes and standards' (IFC & EBRD, 2009) which includes provisions for female staff.	Audit of contractor accommodation facilities every six months	✓			EPC contractor
		Leisure areas designed to be attractive to all workers (male or female).	Audit of contractor accommodation facilities every six months	✓			EPC contractor

Reference	Potential impact	Summary of Key Measures Outlined in ESIA Report	Monitoring and Frequency	Project phase			Responsibility
ESIA Chapter 8 Section 8.2.4 Community Safety, Security and Welfare Section 8.2.4.1 Construction	Negative interactions between members of the public and project security personnel, leading to conflict and potentially the inappropriate use of force	Develop and implement a Health, Safety, Security and Environment (HSSE) Management Plan that includes requirements for provision of security in line with the Voluntry Principles of Security and Human Rights.	Approval of the HSSE Management Plan	✓			Lightsource bp EPC contractor
ESIA Chapter 8 Section 8.2.4 Safety, Security and Welfare Section 8.2.4.2 Decommissioning	Unmet expectations regarding scale of local employment opportunities	All jobs, skilled and unskilled, company or contractor will have well defined and clear job descriptions that include skills or qualification requirements and clear terms and conditions in line with national labour laws, with remuneration consistent with the level of expertise and experience.	Six monthly audits of contractor and subcontractor systems			✓	Lightsource bp
		Develop and implement a Labour Management Plan and manage labour and employment in accordance with this plan.	Approval of Labour Management Plan			✓	Lightsource bp EPC contractor
		Implementation of a Community Grievance Management Procedure.	Grievances to be reviewed monthly			✓	EPC contractor
		Justify how contractor has attempted to fill positions with Azerbaijani citizens before recruiting expatriate staff.	Log of employee data, reviewed every six months			✓	EPC contractor
ESIA Chapter 8 Section 8.2.4 Safety, Security and Welfare Section 8.2.4.2 Decommissioning	Resentment between those who are employed and those who's applications are unsuccessful	Develop and implement a Labour Management Plan and manage labour and employment in accordance with this plan.	Approval of Labour Management Plan			✓	Lightsource bp Decommissioning contractor
		Implementation of a Community Grievance Management Procedure.	Grievances to be reviewed monthly			✓	Decommissioning contractor
		Contractor(s) will be required to justify how they have attempted to fill positions with Azerbaijani citizens before recruiting expatriate staff.	Log of employee data, reviewed every six months			✓	Decommissioning contractor
ESIA Chapter 8 Section 8.2.4 Safety, Security and Welfare Section 8.2.4.2 Decommissioning	Increase in air emissions leading to nuisance and worsening of existing conditions	Display the name and contact details of people accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.	Weekly site walkovers			✓	Decommissioning contractor
		Display Lightsource bp contact information.	Weekly site walkovers			✓	Decommissioning contractor
		Develop and implement a Pollution Prevention Plan within the project ESMP that includes measures to control dust and other emissions, to be approved by Lightsource bp. The level of detail will depend on the risk and should include at a minimum the highly recommended measures. The desirable measures should be included as appropriate for the site.	Approval of Pollution Prevention Plan Weekly site walkovers			✓	Decommissioning contractor
		Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.	Grievances to be reviewed monthly			✓	Decommissioning contractor
		Make the complaints log available to Lightsource bp and external stakeholders if requested.	Grievances to be reviewed monthly			✓	Decommissioning contractor
		Record any exceptional incidents that cause dust and/or air emissions, either on- or off site and the action taken to resolve the situation in the logbook.	Grievances to be reviewed monthly			✓	Decommissioning contractor
		Carry out regular site inspections to monitor compliance with the ESMP, record results, and make the action log available to Lightsource bp and external stakeholders if requested.	Weekly site walkovers Action log updated weekly	✓		✓	EPC contractor Decommissioning contractor
		Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.	Daily site walkovers as a minimum during dust-generating activities and prolonged dry or windy conditions	✓		✓	EPC contractor Decommissioning contractor
		Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.	Weekly site walkovers			✓	Decommissioning contractor
		Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site	Weekly site walkovers			✓	Decommissioning contractor

Reference	Potential impact	Summary of Key Measures Outlined in ESIA Report	Monitoring and Frequency	Project phase			Responsibility
		Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period.	Weekly site walkovers			✓	Decommissioning contractor
		Avoid site runoff of water or mud.	Weekly site walkovers			✓	Decommissioning contractor
		Keep site fencing, barriers and scaffolding clean using wet methods.	Weekly site walkovers			✓	Decommissioning contractor
		Cover, seed or fence stockpiles to prevent wind whipping.	Weekly site walkovers			✓	Decommissioning contractor
		Ensure all vehicles switch off engines when stationary - no idling vehicles.	Weekly site walkovers			✓	Decommissioning contractor
		Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.	Weekly site walkovers			✓	Decommissioning contractor
		Impose and signpost a maximum-speed-limit of 30 kph on surfaced and 20 kph on unsurfaced site roads and within work areas.	Weekly site walkovers			✓	Decommissioning contractor
		Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.	Weekly site walkovers			✓	Decommissioning contractor
		Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.	Weekly site walkovers			✓	Decommissioning contractor
		Use covered skips.	Weekly site walkovers			✓	Decommissioning contractor
		Minimise drop heights from loading or handling equipment and use fine water sprays on such equipment wherever appropriate	Weekly site walkovers			✓	Decommissioning contractor
		Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.	Weekly site walkovers			✓	Decommissioning contractor
		Avoid bonfires and burning of waste materials.	Weekly site walkovers			✓	Decommissioning contractor
		Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.	Weekly site walkovers			✓	Decommissioning contractor
		Use hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.	Weekly site walkovers			✓	Decommissioning contractor
		Only remove the cover in small areas during work and not all at once.	Weekly site walkovers			✓	Decommissioning contractor
		Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site.	Weekly site walkovers			✓	Decommissioning contractor
		Avoid any dry sweeping of large areas.	Weekly site walkovers			✓	Decommissioning contractor
		Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.	Weekly site walkovers			✓	Decommissioning contractor
		Record all inspections of haul routes and any subsequent action in a site log book.	Keep site log book up to date with inspections carried out, log book to be checked monthly			✓	Decommissioning contractor
		Implement a washout station wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).	Weekly site walkovers			✓	Decommissioning contractor
ESIA Chapter 8 Section 8.2.5 Cultural Heritage Section 8.2.5.1 Construction	Impacts on unknown tangible cultural heritage	Develop and implement a Cultural Heritage Management Plan (CHMP) within the ESMP. All findings will be reported to the Ministry of Culture, and any archaeologists or experts engaged through the Ministry.	Approval of CHMP	✓			Lightsource bp
		Prepare a Chance Finds Procedure (CFP) as part of the CHMP	Approval of CFP	✓			Lightsource bp
		Report any cultural heritage artefacts found to the worksite supervisor, the site environmental manager and Lightsource bp as required by the CFP.	Keep a log of artefact encountered and review monthly	✓			EPC contractor
ESIA Chapter 8 Section 8.2.5 Cultural Heritage Section 8.2.5.1	Loss of access to known tangible cultural heritage sites	300 m buffer zone around the known graves be fenced to prohibit enabling works and construction plant working in the cemetery areas.	Weekly site walkovers	✓			EPC contractor
		Ensure active observations are made during earthworks in the vicinity of sites CH01, CH02, CH03, CH05, CH06 (an archeological watching brief).	Weekly site walkovers	✓			EPC contractor
		Develop and implement a Cultural Heritage Management Plan (CHMP) within the ESMP.	Approval of CHMP	✓			EPC contractor

Reference	Potential impact	Summary of Key Measures Outlined in ESIA Report	Monitoring and Frequency	Project phase			Responsibility
Construction		Develop and implement a Chance Finds Procedure (CFP) as part of the CHMP	Approval of CHMP	✓			EPC contractor
		Report any cultural heritage artefacts found to the worksite supervisor, the site environmental manager and Lightsource bp as required by the CFP.	Keep a log of artefact encountered and review monthly	✓			EPC contractor
ESIA Chapter 8 Section 8.2.5 Cultural Heritage Section 8.2.5.2 Operation	Disturbance during maintenance works during the operations phase	Develop and implement an operations phase CHMP within ESMP. The plan will include details of all known cultural heritage features identified and managed before and during construction.	Approval of CHMP		✓		O&M contractor
ESIA Chapter 8 Section 8.2.5 Cultural Heritage Section 8.2.5.2 Decommissioning	Disturbance during decommissioning works	Develop and implement a decommissioning phase CHMP. The plan will include details of all known cultural heritage features identified and managed before and during construction and operations.	Approval of CHMP			✓	Decommissioning contractor
ESIA Chapter 8 Section 8.4 Impact Assessment for Unplanned Events	Accidental loss of containment or spillage of hazardous materials during storage, handling or use results in contamination of soil and/or water resources.	Regularly inspect and maintain plant, equipment, and vehicles for leaks of diesel or chemicals.	Weekly site walkovers	✓	✓	✓	All Contractors
		Hazardous materials storage areas shall have secondary containment within a berm perimeter able to contain 110% of the largest tank volume.	Weekly site walkovers	✓	✓	✓	All Contractors
		Regularly inspect storage areas for any leakage or spillage of diesel or chemicals.	Weekly site walkovers	✓	✓	✓	All Contractors
		Locate drip collection trays at refuelling areas.	Weekly site walkovers	✓	✓	✓	All Contractors
		Locate spill clean-up kits at strategic locations and replace/replenish as required.	Weekly site walkovers	✓	✓	✓	All Contractors
		Develop and implement a Pollution Prevention Plan within the ESMP.	Approval of Pollution Prevention Plan	✓	✓	✓	All Contractors
		Develop and implement a Spill Response Plan within the ESMP.	Approval of Pollution Prevention Plan	✓	✓	✓	All Contractors
ESIA Chapter 8 Section 8.4 Impact Assessment for Unplanned Events	Flooding events could result in the accidental release of hazardous materials from storage areas, vehicles and machinery and hazardous waste areas should these areas be damaged or submerged by floodwaters resulting in contamination of surface water bodies.	Design project site layouts taking into consideration the flood risk assessment study conducted for the project and location storage areas for hazardous materials, hazardous waste and vehicle and machinery outside of flood risk zones.	Project design	✓	✓	✓	Lightsource bp All Contractors
		Regularly review weather forecasts and move vehicles, machinery and any hazardous materials to safe areas should heavy rainfall or storm events be forecast.	Pre-weather event inspections	✓	✓	✓	All Contractors
		Do not store hazardous materials, hazardous wastes, vehicles or machinery on bridges or culvert crossings.	Weekly site walkovers	✓	✓	✓	All Contractors
		Develop and implement a Pollution Prevention Plan within the ESMP.	Approval of Pollution Prevention Plan	✓	✓	✓	All Contractors
		Develop and implement a Spill Response Plan within the ESMP.	Approval of Pollution Prevention Plan	✓	✓	✓	All Contractors
ESIA Chapter 8 Section 8.4 Impact Assessment for Unplanned Events	Direct mortality of fauna from collisions with vehicles and machinery	Construct barriers around work sites to prevent the entry of fauna prior to construction activities.	Weekly site walkovers	✓	✓	✓	All Contractors
		Vehicle movements should be restricted to designated roads and approved routes.	Weekly site walkovers	✓	✓	✓	All Contractors
		Drivers will be trained in and comply with the established road rules and speed limits for the project.	Monthly review of training records	✓	✓	✓	All Contractors
		Develop and implement a Biodiversity Management Plan within the ESMP that includes fauna protection measures and an injured wildlife procedure.	Approval of Biodiversity Management Plan	✓	✓	✓	All Contractors
ESIA Chapter 8 Section 8.4	Traffic accidents resulting in material damage,	Develop and implement public safety communications protocols (including awareness building and emergency response) to mitigate risks to communities from accidents such as those related to traffic and unauthorised access.	Approval of Traffic Management Plan	✓	✓	✓	All Contractors

Reference	Potential impact	Summary of Key Measures Outlined in ESIA Report	Monitoring and Frequency	Project phase			Responsibility
Impact Assessment for Unplanned Events	injury or fatality of another road user or pedestrian	Undertake a pre-construction survey of the roads to be used by project traffic and identify community hazards. Actions will then be taken to minimise community safety risks at these locations.	Six monthly audits of contractor and subcontractor systems	✓	✓	✓	All Contractors
ESIA Chapter 8 Section 8.4 Impact Assessment for Unplanned Events	Traffic accidents resulting in material damage to third party property or injury or fatality of livestock	Develop and implement a Traffic Management Plan within the ESMP.	Approval of Traffic Management Plan	✓	✓	✓	All Contractors
		Monitor Community Grievance Management Procedure for issues and concerns related to traffic management to ensure any credible and verified injury or death of livestock or damage to property as a result of a project accident is reported and appropriate redress provided to livestock/property owner.	Grievance register to be reviewed monthly	✓	✓	✓	All Contractors
		Post culturally appropriate safety signage and information in communities near roads used by the project. This includes information for communities on incident investigations processes and lessons learned where appropriate.	Monthly inspections	✓	✓	✓	All Contractors
ESIA Chapter 8 Section 8.4 Impact Assessment for Unplanned Events	The potential failure of the contractor(s) and sub-contractors working on the PV power facility to meet requisite occupational health and safety standards increases the risk of unsafe workplaces and conditions that could lead to workplace injuries and/or fatalities	Implement a robust contractor pre-qualification and due diligence process that includes a review of contractor's health and safety policies to ascertain whether prospective contractors meet required standards.	Six monthly audits of contractor and subcontractor systems	✓	✓	✓	Lightsource bp All Contractors
		Provide occupational health and safety training to the entire workforce as part of the induction process.	Regular audit of awareness programs, sessions and other training for the project workforce	✓	✓	✓	All Contractors
		Develop and implement a comprehensive Health, Safety, Security and Environmental (HSSE) Management Plan	Approval of HSSE Plan	✓	✓	✓	All Contractors
ESIA Chapter 8 Section 8.4 Impact Assessment for Unplanned Events	Although the project sites have been surveyed and cleared of ERW and mines by ANAMA there remains a risk that unknown ERW maybe accidently unearthed which could lead to an explosion and cause injury or death to a worker or third party	Develop and implement an ERW accidental risk mitigation procedure when unidentified ERW is found.	Approval of ERW risk management procedure	✓			Lightsource bp All Contractors
		Provide ERW hazard and risk training to the entire workforce as part of the induction process.	Regular audit of awareness programs, sessions and other training for the project workforce	✓			All Contractors