SURKHANDARYA (1600 MW)

CCPP PROJECT

Environmental & Social Impact Assessment Report

ASE-UZA-571-REP-ESA-0001-09

Rev	Date	Purpose of issue	Issuer	Checker	Approver
0	15/10/2021	Initial issuance	U. GÜNGÖR	H. BEKAR	A. PONSARDIN
1	15/11/2021	Revised as per the Client's comments	U. GÜNGÖR	H. BEKAR	A. PONSARDIN
2	16/12/2021	Revised as per the Client's comments	U. GÜNGÖR	H. BEKAR	A. PONSARDIN
3	29/04/2022	Revised as per the Client's comments	U. GÜNGÖR	H. BEKAR	A. PONSARDIN
4	25/07/2022	Revised as per the Lenders' comments	B. KADIOĞLU M. ACIRLI	H. BEKAR	A. PONSARDIN
5	16/09/2022	Revised as per the Lenders' comments	B. KADIOĞLU M. ACIRLI	H. BEKAR	A. PONSARDIN
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7	17/03/2023	Revised as per the Lenders' comments	B. KADIOĞLU A. HELLAÇ	H. BEKAR	A. PONSARDIN
8	02/05/2023	Revised as per the Client's and Lender's comments	B. KADIOĞLU A. HELLAÇ	H. BEKAR	A. PONSARDIN
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Abbreviations & Definitions

AELs	Air Emission Limits
%	Percent
°C	Centigrade Degree
AAS	Atomic Absorption Spectrometry
ACC	Air-Cooled Condenser
AEL	Air Emission Limits
AIIB	Asian Infrastructure Investment Bank
AQMS	Air Quality Monitoring Station
As	Arsenic
B	Boron
Ba	Barium
BAT	Best Available Techniques
BERN	Berne Convention on the Conservation of European Wildlife and Natural Habitats
BOD	Biochemical Oxygen Demand
BPI	Biotic Periphyton Index
BREFs	Eu Best Available Techniques Reference Documents
BWO	Basin Water Office
CA	Competent Authority
CAREC	Central Asia Regional Economic Cooperation
CCGT	Combined Cycle Gas Turbine
Cd	Cadmium
CE	Critically Endangered
CH_4	Methane
CITES	Convention On International Trade In Endangered Species Of Wild Fauna And Flora
CM	The Cabinet Of Ministers
cm	Centimeter
CO	Carbon Monoxide
CO_2	Carbon dioxide
COD	Chemical Oxygen Demand
Conductivity	A Measure of A Material's Ability To Conduct An Electric Current
Cr	Chromium
CR	Critical

CT	Cooling Tower
Cu	Copper
dB	Decibel
DCS	Distributed Control System
DD	Data Deficient
deg	Degree
dm	Decimeter
E	East
E&S	Environmental and Social
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EN	Endangered
EP	Equator Principles
ESIA	Environmental and Social Impact Assessment
ESMS	Environmental and Social Management System
ESP	Environmental and Social Policy
ESS	Environmental and Social Standards
EU	European Union
EU BAT	European Union Best Available Techniques
EW	Extinct In The Wild
EX	Extinct
F	Fluoride
FC "SCE-QUVVAT" LLC CCPP	Stone City Energy- Quvvat-Combined Cycle Power Plant Joint
FGD	Focus Group Discussions
g	Gram
GBV	Gender Based Violation
g/dm^3	Gram Per Cubic Decimeter
GIIP	Good International Industry Practice
GIP	Good International Practice
GN	Guidance Notes
GRP	Gross Regional Product
Goskompriroda	State Committee For Nature Protection
GOST	Gosudarstvennyy Standart
GOU	Government Of The Republic Of Uzbekistan
GSE	General Secondary Education

GT	Gas Turbine
HAZMAT	Hazardous Material
ha	Hectare (1 Ha = 10,000 M2)
HES	Higher Education System
HFCs	Hydrofluorocarbons
Hg	Mercury
HRSG	Heat Recovery Steam Generator
Hz	Hertz
IAQM	UK's Institute of Air Quality Management
IBA	International Bird Area
ICWC	Interstate Coordination Water Commission Of Central Asia
IEC	International Electrotechnical Comity
IFC-PS's	International Finance Corporation Project Standards
IFI	International Financial Institutions
ILO	International Labor Organization
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization It Is a Worldwide Federation of National Standards Bodies (ISO Member Bodies). The Work of Preparing International Standards Is Normally Carried Out Through ISO Technical Committees.
IT	Information Technology
IUCN	International Union for Conservation Of Nature
IWWTS	Industrial Wastewater Treatment System
JSC "Uztransgaz	Uzbekistan gas supplier ad gas transportation company
KBA	Key Biodiversity Area
kg	Kilogram
Khokim	The Heads of Local District, City and Regional Administrator Appointed by The Central Government (Governor Of Region)
KMK/SHNK	National acronym for Construction Norms and Regulations
LA_{eq}	Equivalent Continuous Sound Level
LA_{max}	Maximum Equivalent Continuous Sound Level
LC	Least Concern
LCP	Large Combustion Plant
LRP	Livelihood Restoration Plan
m	Meter
m/s	Meter Per Second
MAC	Maximum Allowable Concentration
MAE	Maximum Allowed Emissions

MBI	Modified Biotic Index
MCR	Maximum Continuous Rating It is defined as the maximum output (mw) that an electric power generating station is capable of producing continuously under normal conditions over a year. under ideal conditions, the actual output could be higher than the MCR
mg/m³	Milligram Per Cubic Meter
min	Minute
MELR	Ministry of Employment and Labour Relations
mln m³	Million cubic meter
mm	Millimeter
mmHg	Millimeter of Mercury
Mn	Manganese
MPC	Maximum Permissible Concentration
MPD	Maximum Permissible Discharges
MPE	Maximum Permissible Emission
MPI	Methodology of The Accredited Laboratuvar
MSDS	Material Safety Data Sheet
MVI	Methodology Of The Accredited Laboratuvar
MW	Megawatt Watt Is A Unit Of Power In The International System Of Units (1 MW = 106 Watt)
N	North
NE	Northeast
NE	Not Evaluated
NEGU	National Electric Grid of Uzbekistan
N_2O	Nitrous Oxide
NO_3-N	Nitrate Nitrogen
NT	Near Threatened
NW	Northwest
O'z DSt	Uzbekistan State Standard
O'z O'U	Uzbekistan O'lchov Uslubiyati
O_2	Oxygen
OHL	Overhead Transmission Line
OHSAS	Occupational Health and Safety Assessment Series
OHS	Occupational Health and Safety
OM	Oliy Majlis Supreme Assembly of Parliament of Uzbekistan
OVOS	OVOS National Acronym for EIA
P	Phosphorus

PAPs	Project Affected Persons
Pb	Lead
PDS	National Acronym of The Ecological Normative Regarding Water
PDV	National Acronym of The Ecological Normative Regarding Air
PFCs	Perfluorocarbons
pH	A Scale Used to Specify The Acidity Or Basicity Of An Aqueous Solution
PLC	Power Line Control
POWTS	Plant Oily Water Treatment System
PPE	Personal Protective Equipment
Project	Stone City Energy 1600 MW-Combined Cycle Power Plant
PS	Performance Standard
PSEI	Preliminary Statement of The Environmental Impact
PZVOS	National Acronym of The Concept Statement On Environmental Impact
Resolution	Resolution of The President of the Republic of Uzbekistan Dated 04.10.2019 No. PP-4477
Reservoir	Uchkizil Reservoir
RUz	Republic of Uzbekistan
S	Sulfur
SanPin	Sanitary Norms and Regulations Of The Russian Federation
Sb	Antimony
SC	State Committee
SCE-CCPP	Stone City Energy-1600 Mw Combined Cycle Power Plant
SCEEP	The State Committee on Ecology and Environmental Protection
SCNP	The Main Governmental Organization Responsible For Nature Protection In Uzbekistan
Se	Selenium
SE	Southeast
sec	Second
SEC	Statement on Environmental Consequences
SEA/SH	Sexual Exploitation and Abuse and Sexual Harrassment
SEE	State Environmental Expertise
SF6	Sulfur Hexafluoride
SEP	Stakeholder Engagement Plan
SIA	Social Impact Assessment
SO_2	Sulfur Dioxide
SPT	Standard Test Method for Standard Penetration Test
ST	Steam Turbine

STD	Sexually Transmitted Diseases
STI	Sexually Transmitted Illnesses
SS	Substation
SSVE	Secondary Specialized Vocational Education
SW	Southwest
TKN	Total Kjeldahl Nitrogen
Total-N	Total Nitrogen
TSEL	Approximately Safe Exposure Levels
Uchkizil	Uchkizil Reservoir
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
UNGP	United Nations Guiding Principles on Business And Human Rights
UzRDB	Uzbekistan Red Data Book
Viloyat	Region
VOC	Volatile Organic Compounds
VR	Vulnerable
VU	Vulnerable
W	West
WBG	World Bank Group
ZEP	National Acronym of The Statement on Environmental Consequences
Zn	Zinc
ZVOS	National Acronym of The Statement on Environmental Impact

EXECUTIVE SUMMARY

The Need for the Project

The Government of the Republic of Uzbekistan aims to modernize and increase electricity production in the country to foster economic growth. Uzbekistan would like to increase the amount of gas exported to the region, and so any reduction in domestic gas consumption means that there is more gas available for export. In line with the national energy strategy, the Ministry of Energy has signed an agreement with Stone City Energy for designing, financing, building, commissioning, operating, and managing the 1,600MW power plant for 25 years.

Stone City Energy (hereinafter referred as the Project Company) B.V. is a special purpose company, which operates in the fields of electricity generation and distribution. The launch is scheduled for 2025 and the project will introduce the latest technologies, including advanced HL class steam-gas units of the HL class (manufactured by Siemens Energy) with an efficiency of 63%.

The CCPP will allow saving 1.1 billion cubic meters of natural gas against an annual consumption of 2.2 billion cubic meters.

The Surkhandarya CCCP 1600 MW Project is considered as Category I of environmental impact with a high risk according to the Law "On Environmental Expertise" and the Decree of the Cabinet of Ministers of 07.09.2020 No. 541 on "further improvement of the mechanism of environmental impact assessment". Hence, first stage of the Environmental Impact Assessment report (national acronym - PZVOS) was developed for this facility and a positive Conclusion of the State Environmental Expertise of the Republic of Uzbekistan No.04-01/10-08-1655 dated September 29, 2021 was obtained. As the Stage III of national EIA process the 'Statement on Environmental Consequences' ('ZEP' is the national acronym) represents the final stage of national EIA process and it will be conducted before the project is commissioned.

UzAssystem has been appointed by the Project Company in June 2021 to undertake an Environmental and Social Impact Assessment Report (ESIA) in compliance with the Asian Infrastructure Investment Bank (AIIB) Environmental and Social Policy (ESP) and International Finance Corporation (IFC) Standards for the Project.

In line with the international standards the Project is considered as "Category A" and the ESIA Report has been prepared by Uzassystem based on the outcomes of the Scoping Report (finalized in July 2021), technical Project documentation provided by the Project Company, publicly available information, outcomes of the stakeholder consultations, findings of the baseline studies performed in 2021 – 2022 and assessment of Project's likely impacts and/or risks in accordance with internationally accepted methodologies as part of the ESIA process.

As part of the ESIA study, a stand-alone Stakeholder Engagement Plan is developed.

The Project Company will be responsible to implement described measures to mitigate the potential impacts in the ESIA Report. In addition, the Project Company is in charge to comply with the relevant national legislation, IFC PSs and AIIB Environmental and Social Policy and

to ensure that all contractors that provide services to the Project Company duly follow these requirements throughout the project life.

According to the 1998 Land Code of the Republic of Uzbekistan, all land in Uzbekistan is state property and permits for use of land are granted and monitored by the State through the rayon and oblast administrations. The official letter of the Surkhandarya Region Khokin, dated 30 August 2021, the Project area is allocated for the construction of a CCPP with the capacity of 1600 MW. The decision was published on the official website of the regional administration (surkhandaryo.uz).

Baseline Studies

The ESIA has been prepared by a review of relevant desktop information as well as a series of physical site surveys which have been summarized in the relevant environmental and social impact assessment Sections of this report. The environmental and social baseline surveys carried out as part of the ESIA included is given in Table 1.

Table 1: Environmental and Social Baseline Surveys

Site Surveys	Period
Terrestrial Ecology Surveys	17th July 2021
Irrigation Reservoir(lake)	15th July 2021
Soil Survey	15th July 2021
Groundwater and surface water sampling	9-16th July 2021
Sediment and lake sampling	13th July 2021
Zooplankton and phytoplankton sampling	13th July 2021
Noise Monitoring Survey	10th to 14th July 2021
Air Quality Monitoring Survey	10th to 16th July 2021
Socio Economic Data Collection	28th July 2021
Stakeholder Consultations	This has been completed with different stakeholders on July 2021 through official letters, calls and public consultation meetings conducted.
Livelihood Restoration Surveys	15th October 2021
Terrestrial Flora and Fauna Survey	April 2022
Additional Site Surveys	
Air Quality Monitoring Survey	20th July 2022-20th August 2022
Noise Monitoring Survey	20th to 23rd August 2022 -
Socio Economic Data Collection	July 2022-August 2022
Terrestrial Flora and Fauna Survey	September 2022
Aquatic Survey	September 2022

Project Location

The Project site is located in the Angor district of the Surkhandarya region of the Republic of Uzbekistan, on the northeastern coast of the Uchkizil Reservoir, which is an off-stream reservoir type used for irrigation.

Distance of the Project area to the regional center of Uchkizil village is approximately 2.0 km, and 14 km to Termez city centre.

Figure 1: Project Location (Regional Context)

The Site is at an average elevation of 337 m above sea level whereas the level of the Uchkizil Reservoir reserve is 318 m above sea level.

The project area can be considered as a flat terrain and there is no agricultural and/or economic activity within the project area. Project area consists mainly typical representatives

of the flora of sandy and saline deserts of the southern part of Central Asia. Photos showing the project site are presented below.

Figure 2: Project Area – General View (July, 2022)

The nearest residential buildings are located in the south (Uchkizil Village, ~1.4 km) and the west (Kattakum Village, ~1.0 km) (see Figure 3).

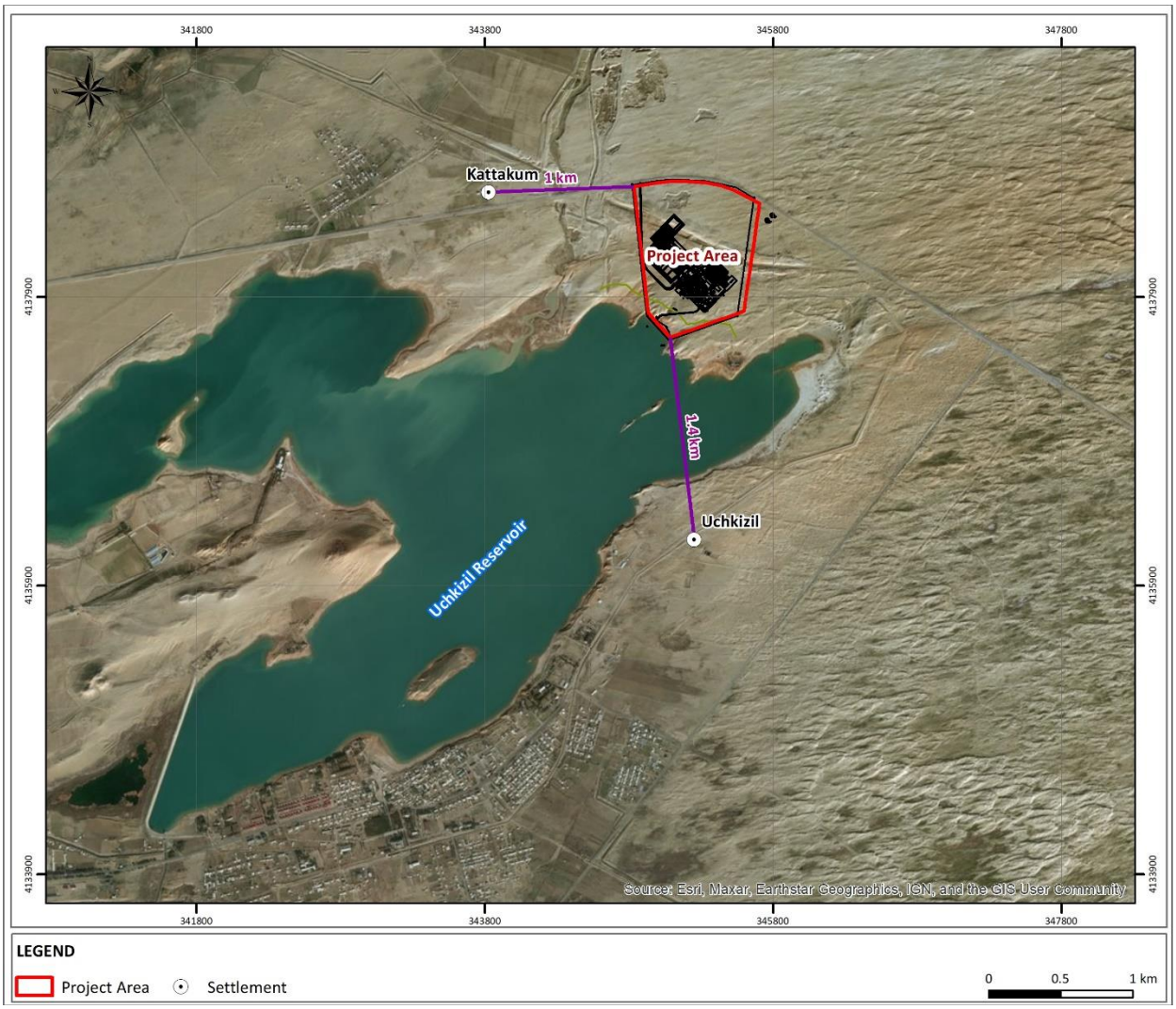


Figure 3: Project Location

Project Characteristics

The proposed Project is a Combined Cycle Power Plant (CCPP) project. The CCP consists of two combine cycle gas turbines and a steam turbine (one unit). The main features of the power plant are presented in Table 6.

Table 2: Main Characteristics of The Designed Combined Cycle Power Plant

Feature	Description
Type of technology	Combined Cycle Power Plant
The total area of the allocated land for construction	73.4 hectares.

Feature	Description
Number of units of combined cycle plants	2
Power Generation	1600 MW
Capacity of each unit	Gas Turbine – 551 MW Gas Turbine – 551 MW Steam Turbine – 538 MW
Configuration	2 Gas Turbines + 2 Heat Recovery Steam Generators + 1 Steam turbine
CCGT type	Siemens
CCGT efficiency	60%
Working hours per year	8000 h
Fuel	Natural gas
Natural gas consumption per hour	283.000 m³/h
Annual consumption of natural gas	283.000 m³/h x 8.000 h per year = 2.264.000.000 m³/year
Condenser cooling type	Water cooled
Cooling tower type	Dry cooler system
Source water - cooling water	Uchkizil Reservoir
Initial water	Uchkizil Reservoir
Source of Raw Water	Uchkizil Reservoir
Process water - for boilers	Process demineralized water will be supplied from our own demineralization plant through a connection to the demineralized water system
Stack height	65 m
Stack diameter	8,24 m
Auxiliary equipment	- Feed Water and Steam System - Fuel Gas System Incl. Gas Compressor Station - Dry Cooler System - Closed Condenser System - Water Treatment System - Waste Water System - Sampling System - Dosing System - Firefighting System - Lifting System - Electrical System - Standby Diesel Generator - C&I System

Feature	Description
	- Civil Works System
Number and type of transformers	2 transformers 600 MVA, 2 auxiliaries 27/44 MVA, various auxiliary transformers

The following elements of the plant will also be part of the Project:

- Site entrance and security building;
- Administration building, offices and amenities;
- Central Control Room;
- HVAC system;
- Electrical Systems;
- Laboratory;
- Workshops;
- Warehouse and stores;
- Emergency Diesel Generator;
- Fire-fighting system; and
- Other mobile plant and vehicles.

A dedicated firefighting team will be based on-site during operations. A simplified version of the project layout is presented in Figure 9.

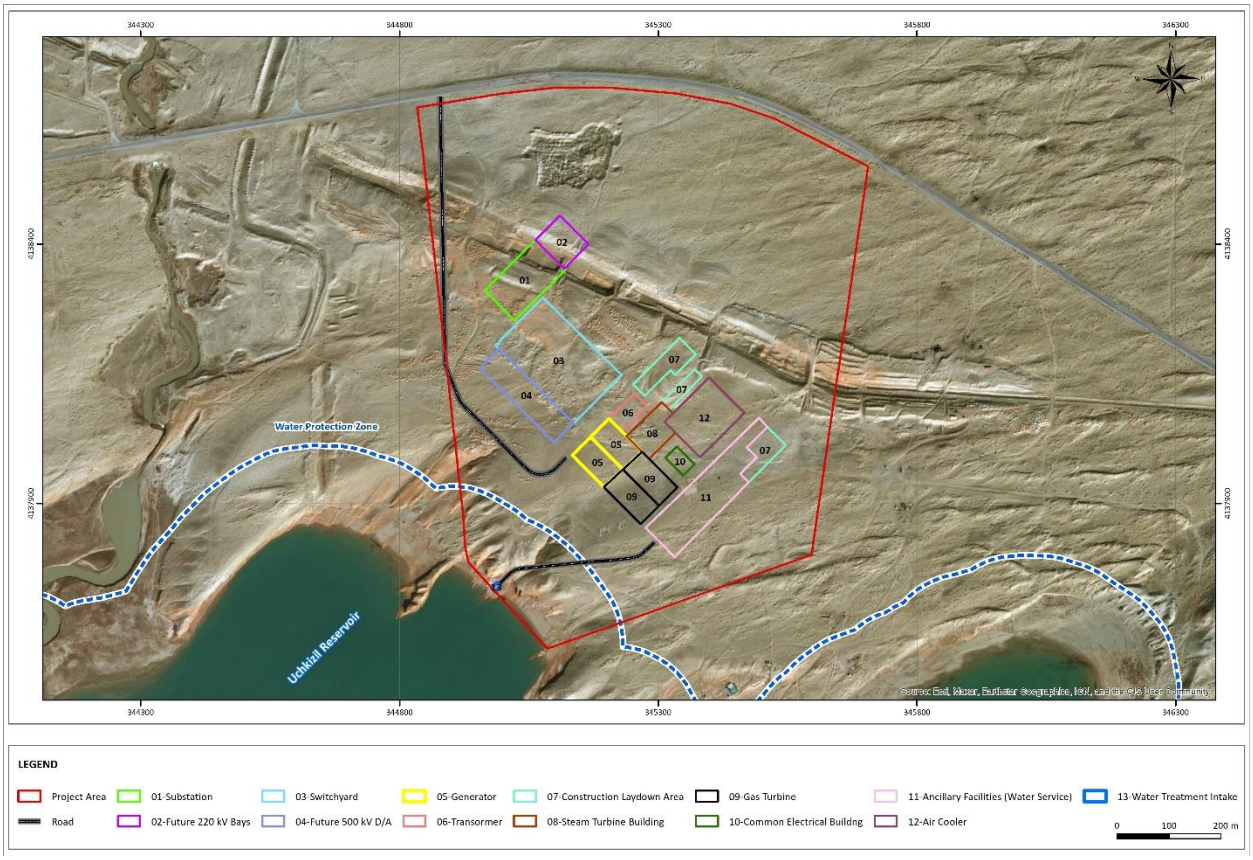


Figure 4: Simplified Version of the Project Layout

Workforce Requirements

It is expected the number of construction workers will be around 2050 during the peak period of the construction. It is expected that approximately 30 % of the workforce could be available to unskilled staff whereas the rest will require technical qualifications. It is foreseen that the ratio of foreign workers will be close to the number of local people to be employed. It is anticipated that the EPC Contractor will have approximately 130 people and the Project Company will have 10-15 permanent staff at the site during the construction stage.

During the operation phase of the proposed project, it is anticipated that the number of the workforce will be around 300 staff.

It should be noted that the given number of the workforce may change depending on Project needs during the construction and operation activities.

Accommodation and Logistics

It is planned that there will not be any accommodation facilities within the construction area. Based on the previous experiences in similar projects, it is expected the EPC contractor will arrange accommodation off-site and will use the existing housing compounds located in Uchkizil. Since the EPC contractor has not been awarded yet, the location of such

accommodation is not readily determined. However, it will be ensured that the Project Company will specify the standards of facilities for worker accommodation in line with the IFC/EBRD Worker Accommodation Guidelines.

The EPC contractor will provide the transfer of the workers to the construction site and will perform a Traffic and Logistics Study to assess roads and determine access requirements via other modes of transport. It is foreseen that the existing M-39 main road will be adequate during the construction activities and no additional access road will be opened to reach the project site

Project Schedule

The key milestones of project timeline are given below.

Table 3: Key Milestones

Milestones	Date
Notice to Proceed	June 2023
Site Preparation and Mobilization	July 2023
GT 1 Erection and Commissioning	February 2025
GT 2 Erection and Commissioning	September 2025
Scheduled Project Commercial Operation Date	December 2026

Project Alternatives

The project forms part of the Strategy of Action for the Five Priority Development Areas of Uzbekistan (2017 -2021) to introduce new technologies for generating thermal energy as the Project is being implemented as heat recovery in order to generate electricity.

In 2018, Uzbekistan ratified the Paris Agreement and adopted a national commitment to reduce GHG emissions per unit of GDP by 10% of the 2010 level by 2030. In addition, In 2020, the Ministry of Energy published its plans for the Power capacity development in Uzbekistan for the 2020-2030 period in a document called "Concept note for ensuring electricity supply in Uzbekistan in 2020-2030". The document talks in length about Uzbekistan's plans to rebuild its existing power plants, invite private power developers to take part in the power sector development to increase the power production capacity, lays out the plans for reforms, etc. The Concept Note states that "*Construction of a 1300MW TPP utilizing CCGT technology is planned in Kashkadarya or* ***Surkhandarya*** *regions to be commissioned in 2025-2026*."

Taking into consideration of Uzbekistan's national electricity strategy, "Do-Nothing scenario" is considered as not applicable alternative, since it does not align with objectives of the Ministry of Energy. Besides, the project will lead decommissioning of inefficient existing thermal power plants and will contribute to the effective use of natural gas resources that will result in decreasing CO_2/kWh intensity.

The Project Company will meet the requirements described in the EU Best Available Techniques Reference Document prepared for Large Combustion Plants, 2017. The project will use most advanced technologies that are currently available to reduce environmental impacts.

Associated Facilities

The ESIA study evaluated the scope of the associated facilities in line with the AIIB Environmental and Social Policy. There are three facilitities that are considered in the analysis of associated facilities.

- Air insulated substation, wherein the electric power will be evacuated from the Project.
- 9 km overhead transmission lines (OHL) connecting between the substation and the existing grid facilities.
- Gas pipelines and the gas distribution station that feeds the gas to the Project.

According to the analysis, the substation will be built within the project area, hence impacts and mitigations measures associated with the substation are included in the ESIA study. The 9-km OHL is considered Associated Facility in accordance with lenders' standards while the gas pipelines are not. Thus, the gas pipelines are not considered in the scope of this ESIA study. However, the Project Company will not have any control or influence on the overhead transmission line. Therefore, a brief explanation on likely impacts and risks of the overhead electricity transmission lines are summarized in the ESIA study. Requirements in accordance with the national environmental legislation should be followed during the construction and operation of these facilities and relevant impact assessment studies are conducted.

Assessment and Management of E&S Impacts

Air Quality

During construction phase, local ambient air quality may potentially be affected by increased dust, particularly during the site preparation stage (site clearance and earthworks etc.) and by the exhaust gas of construction vehicles, equipment and temporary power generators. The typical air emissions resulting from these activities include nitrogen oxides (NO_X), sulphur dioxides (SO_2), carbon monoxide (CO), carbon dioxide (CO_2), volatile organic compounds (VOC), particulates and benzene, toluene, ethylbenzene and xylene (BTEX).

Excavations and earthworks and vehicle movements cause dust which typically comprises large diameter particles, settle rapidly and close to the source. The operation of construction vehicles and fuel consuming construction equipment will be the only sources of gaseous emissions during construction phase

Activities associated with the operational phase of the Project will result in the emissions of gaseous pollutants from the operation of the CCGT power blocks. These emissions will occur under combined cycle operating modes using natural gas fuel only. Impacts from the CCGT are likely to be associated with emissions from the two main stacks associated with the HRSG.

The key pollutants arising from natural gas combustion and emitted via the stacks will be oxides of nitrogen (NO and NO_2) and carbon monoxide (CO). A detailed air quality dispersion modelling assessment has been undertaken to determine impacts associated with the proposed Project. The key pollutants considered in this assessment are: oxides of nitrogen (NO2 and NO) and carbon monoxide (CO) are the key pollutants emitted from combustion of natural gas that may potentially lead to exceedances of any relevant standards. Predicted concentrations are compared with the most stringent applicable standards and guidelines incorporated into Uzbekistan law and also the European Union (EU) standards, the

International Finance Corporation (IFC) guidelines and the World Health Organisation (WHO) Guidelines.

According to modelling results for NO2, NO, and CO , for all periods highest level concentration values are under both National Ambient Air Quality Standards, IFC/WB EHS Guideline Fundamental Principles and EU Environmental Standards.

During commissioning, the stack emissions will be tested for NO, NO_2, CO to ensure that the control systems are operating correctly and that emission values comply with applicable standards and guidelines.

During operation there will be continuous emission monitoring system (CEMS) of stack emissions of NO, NO_2 and CO to ensure compliant conditions are maintained through appropriate process controls.

GHG Emissions and Climate Change

During the construction and operation phases, significant amount of direct and indirect GHG gases (namely CH_4, CO_2, N_2O, SF6, HFCs, PFCs and NF_3) are released due to earthworks, cement and steel use, maintenance activities, stationary combustion of natural gas, vehicles and equipment that works with diesel fuel. Greenhouse gases of the project through its life cycle calculated by establishing a system boundary with cradle to gate approach. Having considered only on-site emissions, all GHG emission estimations are calculated in CO2 equivalent with conversion factors of EPA by using existing data.

Table 4: Summary of GHG Emissions Estimated for Construction Phase

Item	Estimated GHG in tons of CO2 equivalent (for 1-year activity)
Scope 1 – combustion of fuel	244.5
Scope 2 – purchased electricity	1573
Scope 3 – water supply	4.3
Annual Total	**1822 tons of CO2 equivalent**

The total estimated GHG emission for operation phase is summarized in the table below.

Table 5: Summary of GHG Emissions Estimated for Operation Phase

Item	Estimated GHG in tons of CO2 equivalent (for 1-year activity)
Scope 1 – combustion of fuel	**4.63 x10^6**
Scope 2 – purchased electricity	**230.6**
Scope 3 – natural gas supply	**826,182**
Scope 3 – water supply	**89.4**
Annual Total	**5.46 x 10^6 tons of CO2/year**
Total Emission during operation phase (25 years)*	**5.46 x 106 x 25 = 136.5 x 106 tons = 0.136 Gigatons**

Noise and Vibration

The main noise sources during construction phase are the heavy machineries to be used in construction activities. Four receptors were selected in regards to assessment of noise generated during the construction and operation of the projects. Three of these receptors are residential areas in te vicinity of the project area whereas the remaining one is the waste processing facility approximately 250 m away from the project area.

Based on the calculations, noise levels during construction phase of the project is under the limit values specified for the day and night time in both national and international limits. In addition to this, it is stated in IFC's EHS Guidelines that noise levels should not result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site. and the calculations revealed that there is no any increase in background levels of 3 dB(A).

In regards to operation, the design of the project includes selection of state-of-art technologies to have low noise level equipment to prioritize the reduction of noise at the source. Where noise levels exceed 80dB(A), additional mitigation measures will be taken to reduce noise at source. Additionally, noise protection devices will be provided to personnel on-site and the area marked as a high-noise zone where ear protection is mandatory.

Water Resources and Wastewater Management

During construction, the main activities that could negatively impact the aquatic life and water quality can be listed as follows:

- Laying of the outfall and water intake pipelines to the reservoir;
- Water usage for construction and domestic purposes
- Groundwater dewatering discharge on the reservoir banks from the construction activities on site;
- Habitat fragmentation as a result of construction of the intake and outfall.
- Discharge of dust into air and water due to heavy duty vehicles and working machines activities.

- Erosion due to soil movement in case unappropriated management of top soil, surplus soil, dumpsites and borrow pits.

At the construction stage of the Plant, water is mainly needed to prepare mortars, as well as to irrigate the territory in order to reduce dusting on the construction site. In addition, household and drinking water needs will consist of drinking needs, showers, and cooking. The water needs during construction phase will be supplied from the nearby districts via trucks. The drinking water will be supplied by bottled water from the market.

Therefore, no water is planned to be supplied from both Uchkizil reservoir and groundwater during the construction phase of the Project. On the other hand, the water will be supplied from the Uchkizil Reservoir during the commissioning phase.

The water intake structure will be at a sufficient depth below minimum water level to avoid collisions with boats and intake of warm surface water and at sufficient distance from the bed of the reservoir to avoid the intake of sediments and sludge. The water intake velocity will be limited with 0.15 m/s and a bubble curtain shall be applied to prevent fish and fauna to enter the intake.

The discharge point will be at a sufficient distance from the shore to promote mixing with the main water body. Following the detailed design together with performing performing a bathymetry, hydraulic and nearshore topography survey, the exact locations will be detrmined and necessary relevant permits will be obtained frm the national authorities.

Soil, Geology, and Groundwater

Soil contamination during construction work is possible with the spill of oil products used as fuel for mobile vehicles and construction equipment. However, the pollution will be minor and localized. Due to poor solubility, oil products will have a low migration capacity and will not pose a hazard to groundwater. The likelihood of a fire occurring due to fuel spills is also low. In general, during the construction period, soils and groundwater contaminated with oil products will have a minor risk to the environment and personnel safety.

The presence and use of such dangerous and hazardous chemicals increase the probability of accidental spills or releases of minor quantities of these materials into the receiving hydrological environments. Further, site preparation activities and associated construction of infrastructure can result in increased sediment loads in reservoir. Any leaks/damage to the soil and groundwater will be prevented through appropriately designed storage options.c Any leaks/damage to the soil and groundwater will be prevented through appropriately designed storage options.

Waste Management

During construction, waste will be generated during earthworks, construction of the fences, paths and buildings. Typical construction wastes include concrete, asphalt, scrap steel, glass, plastic, wood, packaging materials and domestic waste from construction workers (i.e. relating to food consumption). Household wastewater generated during construction is planned to be directed to a temporarily installed storage tank (a waterproof cesspool) with subsequent removal to the nearest treatment facilities in the city of Termez. The EPC Contractor will also seek other options such as establishment of package (small-scale)

wastewater treatment plant in accordance with the requirements set in the national legislation.

The operation of the proposed Project will generate small amounts of non-hazardous domestic waste from the operation of the administration facilities and from activities of the employees.

This waste can be classified as both recyclable and non-recyclable. Recyclable waste includes paper, tin cans, plastics, cartons, rubber, and glass, while non-recyclables will consist mainly of food residues and other organic waste. Other solid non-hazardous waste generated during operation will be landscaping waste and uncontaminated replacement parts and packaging.

Hazardous waste to be generated during the operation stage will be stored in allocated impervious hard standing areas in sealed containers stored with impermeable bases, sufficient containment and separation capacity, sun/rain shelter, separate drainage system, good ventilation and equipped with spill kits & spill response procedures. This area must be placed away from any sources of ignition. Waste containers will be marked with appropriate warning labels to accurately describe their contents and detailed safety precautions. Labels will be waterproof, securely attached, and written in English and other languages as required such as Uzbek and Russian. Wherever possible, chemicals will be kept in their original container.

Ecology

The area is adjacent to the western end of the Kattakum sandy massif, which is home to rare and endemic plant and animal species. The landscape of the peripheral part of the Kattakum sands is a wavy or slightly hilly sandy plain, the central part is occupied by a rather extensive massif of semi-fixed hilly sands (the height of the hillocks is 3–7 m), among which there are small saline settlings. The Uchkizil Reservoir has an area of about 10 km^2 and a depth of maksimum 37 m, a sandy bottom, and mostly low and gentle sandy and sandy loam shores, but its northern coast, adjacent to the Project area, has relatively steep, eroded slopes, composed of outcrops of gypsum and saline depressions.

The preliminary list of the flora of the Kattakum sands, compiled on the basis of reports, literature, herbarium data and photographs taken by field team during the field survey includes 131 species, mainly typical representatives of the flora of sandy and saline deserts of the southern part of Central Asia. The vast majority of species are native; the number of alien plant species is extremely insignificant.

Only 3 species included in the Red Book of Uzbekistan (*Allium rhodanthum, Dipcadi turkestanicum, Oligochaeta vvedenskyi*) are noted based on literature and herbarium data for the sandy massifs of Kattakum and Khaudaktau in the central part of the Surkhan-Sherabad valley, the first two of them are known only from Khaudaktau and have not been noted for the past several decades, despite special searches. Nevertheless, there is a possibility of finding these species in the Kattakum sands (not excluding the project area).

In total, 61 plant species of 17 families were recorded within the project area during the field survey in September, 2022 5 of them are alien weeds.

Within the area of planned thermal power plant and along power transmission line, species listed as CR, EN or VU on the IUCN Red List, as well as plants included in the Red Data Book of Uzbekistan were not found. One species (*Salsola rosmarinus*) is assessed as endangered (EN) in the neighboring country, Tajikistan. *Salsola rosmarinus* is not endemic, it has a wide

geographical range covering Middle East and southern part of Central Asia (Egypt, Arabian Peninsula, Iran, Afghanistan, Uzbekistan, Turkmenistan, and Tajikistan).

Most of species recorded for the project area are typical for southern deserts of Central Asia and more or less common and widely spread. Most of plants are native, the number of alien species is small (5), and their role in vegetation cover is unsignificant.

There are 27 species of reptiles belonging to 12 families on a relatively small and rather highly urbanized project area.

In total, during three field visits to the project area, 2 species of amphibians (100% of those indicated in the literature sources and 40% of the species composition of amphibians in Uzbekistan) and 20 species of retiles (74.1% of those indicated in the literature and 32 .2% of the species composition of amphibians in Uzbekistan) were found. Of reptiles, 6 species (30% of the encountered species) are rare and listed in the Red Book of the Republic of Uzbekistan, 1 species is listed in the IUCN Red List (5% of the encountered species), 3 species (15% of the encountered species) is included in CITES and 4 narrow-range, endemic taxa (20% of the encountered species).

A total of 149 bird species can be identified for the region around the project area, which are rare or listed. The only endemic bird of Uzbekistan, Podoces panderi does not live here. Among them, 21 species have IUCN statuses (NT-10 species, VU - 7 species and EN - 4 species). 33 species are included in the Red Book of Uzbekistan (2019) 4 species with the EN status, 23 - VU and 6 NT species. During the field surveys, 49 bird species were recorded, 26 of them directly in the planned area.

A total of 57 species of birds were noted during 3 field trips. Of these, 6 species are listed in the National Red Book (2019) and 3 species are listed in the IUCN Red List.

Approximately 22 species of mammals belonging to 6 families have been recorded in project area and its surrounding area based on available literature sources.

The territory is potentially inhabited by 6 species of mammals included in the Red Book of the Republic of Uzbekistan; *Otonycteris hemprichi, Vulpes corsak turkmenicus, Vormela peregusna, Lutra lutra seistanica, Hyaena hyaena, Felis margarita, Caracal caracal michaelis, Vormela peregusna*. and the 5 species are included CITES (*Lutra lutra, felis chaus, Felis lybica, Felis margarita, Caracal caracal michaelis*). Two species are Central Asian endemics that *Rhinolophus bocharicus* and *Allactaga severtzovi*. *Gazella subgutturosa* that used to inhabit the area has been completely exterminated.

In general, the species composition of mammals in the project area and the projected transmission line correspond to the species composition of mammals in the deserts of the temperate zone.

Particularly rare and endemic species of mammals are not found here. Two species of mammals listed in the Red Book of Uzbekistan are widely distributed species with a low threat status category in the national Red Book and no threat status in the IUCN Red List.

A Preliminary Critical Habitat Assessment was performed based on the outcomes of the surveys conducted in July 2021 April 2022 and September 2022. None of plant and animal species observed during the field survey in the project area meet the criteria for CHA.

Socio-economy

The ESIA study identified several positive and negative impacts likely to arise during the construction of the Project. These impacts are;

- Employment generation,
- Local economic development,
- Labour influx,
- Impacts on social services

The primary economic impact during construction is likely to result from employment creation during this phase. This Project is expected to create employment opportunities during the construction phase for unskilled and applicably skilled workers. To prevent social conflicts between local employee and expats, should be paid attention to the balance between in the employment shares.

In addition to the direct monetary increase to the families of the employed, the money paid to the workers will also stimulate the local economy with a multiplier effect, so that the money earned from the locally spent Project will recirculate within the local economy.

The Project construction will require involvement of significant workforce (direct and contracted) Approximately 30% of the workforce is estimated to be non-qualified and 70% of will be qualified. The Contractor prioritise localisation of workforce (including subcontractors through contractual requirements) and it is anticipated that 50 % of the workforce will be national people. This policy will maximise the use of local workers and reduce the influx of non-local workers to the area.

Livelihood Restoration

During the social site surveys conducted in 2021 and 2022, no legal and/or informal landusers are observed within the project area. Although the project does not have any impact on livelihood, a framework Livelihood Restoration Plan is presented within this ESIA Report to ensure that the Project company will follow the minimum requirements set in this plan, in case required.

Community Health and Safety

Potential impacts of the project on community health and safety arise from the necessity of accomodation of the workforce, ilnesses and diseases, and sexualy transmitted diseases due to increase in local population.

The provision of accommodation for self-sufficient workers accommodation will be the responsibility of the contractor. It is expected that the workforce required for the construction activities will accommodate in nearby cities and there will no accommodation in the project area. All worker accommodation facilities will be designed and operated in accordance with IFC Workers Accommodation Guidance. The workforce will be transferred to the project area by shuttle buses.

Material transport vehicles, shuttle buses, and vehicles transporting the waste generated at construction sites may result in increased traffic on off-site roads during the construction period.

The project area will require site-based security at the gates and on patrol around the site and access road during construction in order to prevent the public from trespassing to the construction areas. This is so as to minimize the potential for construction site incidents or damage of construction machinery. It is anticipated that the security personnel will be unarmed.

The ESIA Report presents a detailed mitigation measures and mitigation plan in each dedicated chapter in order to avoid, minimize and offset above listed potential impacts that can arise during the project life. The ESIA Report concluded that with the implementation of proposed mitigation measures, the project will have minor to medium residual impacts on the receptors.

Environmental and Social Management System

The Project will establish Environmental and Social Management Systems (ESMS) in order to effectively manage the environmental and social impacts of the project from the land preparation and construction phase to the closing phase. During the creation of the ESMS, the following subject / documents will be taken into consideration.

- Compliance with relevant national laws and regulations and EU directives
- IFC PSs
- AIIB Environmental and Social Policy
- IFC EHS General Guidelines
- Environmental and Social Action Plan (ESAP) prepared within the scope of the ESIA study

The defined measures to eliminate impacts and risks identified at various stages of the project should be adopted not only by the Project Company, but also by the EPC Contractor and, if any, Sub-Contractors. The Company Owner will be responsible for the implementation of the issues in the ESIA by all parties.

The Project Company will appoint an ESMS Manager who will be responsible for the establishment, implementation and maintenance of the ESMS. The ESMS Manager and his team will work closely with the employees of the project owner and contractors to ensure the most effective implementation of the ESMS.

The Project Company. will prepare the necessary procedures to establish and maintain an effective internal and external communication mechanism. Efficient communication will be provided through the website of the project owner and mechanisms such as meetings.

Stakeholder Engagement

Project Stakeholders

The details of the stakeholders defined for the project are presented in the SEP.

Stakeholder Engagement Activities to Date

According to the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 541 dated 07.09.2020 "On further improvement of the mechanism for assessing environmental impact", objects of I and II categories of environmental impact are subject to the procedure for passing public hearings about environmental impact. In accordance with, the Public Hearing Meeting was conducted in Angor District 17 of August 2021.

Besides, during the ESIA study, qualitative and quantitative techniques were applied for public disclosure as Household Survey, Local Authority Disclosure and Focus Group Discussion. Household survey covered 410 household, which of 295 were in Angor and 115 of them were in Termez.

Local Authority Disclosure were conducted among 16 mahalla representatives in Angor and Termez districts from July-August, 2022.

Six Focus Group Discussion (FGD) were held in July-August 2022, who were the representative of women, youth/unemployed and farmers.

The main concerns raised during the social site survey were related to the full-time job opportunities during the construction and operation stages of the project. The majority of the respondents highlighted that their school needs well-equipped sports center so that youth could have an opportunity to develop their skills in sports.

The disclosure meetings were also conducted to inform the public who are likely to be affected by the planned Project and other interested stakeholders in December 2022. First meeting was held with 27 attendances in Angor District on 20th December 2022. Second meeting was held with 23 people in Termez District on 22rd December 2022. Furthermore, there were also meetings held with the women (52 participants) and youth (23 participants) groups on 23rd December 2022 in Termez and Angor Districts, respectively. No concern regarding the Project's potential E&S impacts and risks was received during the meetings. The questions raised mostly related to local employment, expected wages, potential E&S-related impacts, the baseline studies conducted, electricity distribution, the Project schedule and capacity development activites to be conducted for the technical personnel to be employed. All the questions were answered by Uzassytem kindly.

Stakeholder Engagement Plan

The ESIA Report includes a stand-alone SEP which is prepared based on the social site surveys. The SEP aims to establish and maintain constructive dialogue between the Project and the local communities, other stakeholders and interested groups.

The Project Company will assist and collaborate with the EPC Contractor to implement the SEP throughout the construction phase of the Project. The implementation of the SEP throughout the operation phase of the Project will be under the responsibility of the Project Company.

All stakeholders (individuals, groups, or entities) directly and/or indirectly affected by the Project or have a direct or indirect influence/impact on the Project are identified in the SEP. Besides, to establish and maintain a constructive relationship through public consultation and

information disclosure, relevant mechanisms and tools are defined in the SEP. In addition, the SEP establishes external and internal mechanisms that will ensure timely and appropriate implementation of actions for the management of grievances and feedback received.

Grievance Mechanism

Grievance Redress Mechanism (GRM) will be developed enable stakeholders to raise grievances to the project and seek redress when stakeholders perceive an adverse impact arising from the project activities. The mechanism sets out clear systematic steps for affected individuals and communities to submit complaints and feedback and simultaneously for the Project in responding to queries, feedbacks and complaints received. This mechanism will be applied to guarantee the project is responsive to any concerns and grievances particularly from affected stakeholders and communities.

GRM will be available to personnel, workers, project staff and people living or working in the areas impacted by the project activities. Any impacted or concerned person or group of people about the project activities have the right to participate in the GRM and be encouraged to use it. Moreover, the developed GRM does not replace the public mechanisms for filing complaints and resolving conflicts in the legal system of Uzbekistan, but, on the contrary, seeks to minimize its use as much as possible.

The external and internal grievance collection channels to be used during the construction and operation phase are described in the ESIA Report. The Project Company will review and adapt these channels, as appropriate and consistent with their internal/institutional procedures and mechanisms, within the SEP to be updated prior to start of operation phase and implemented throughout the operation phase.

1. INTRODUCTION

The government of the Republic of Uzbekistan aims to modernize and increase electricity production in the country to foster economic growth.

Uzbekistan is an energy-intensive country. The investment in CCGT technology will assist Uzbekistan in moving toward a low-carbon economy. Power generation from burning gas in a CCGT is the cleanest method of generation using fossil fuels. The CCGT turbines burning natural gas produce significantly fewer greenhouse gases than traditional coal or oil-fired thermal power stations, as a result of both the less greenhouse-intensive nature of natural gas and the greater inherent energy conversion efficiency of CCGT technology. The introduction of CCGT technology will therefore begin the process in Uzbekistan of reducing the average greenhouse intensity of power generation. This process will accelerate as older less efficient plants burning coal or oil are retired and more CCGT plants are added to the total asset mix.

In addition, Uzbekistan is actively involved in energy trading with neighboring countries and is an active participant in the Central Asia Regional Economic Cooperation (CAREC). In 2008, the CAREC countries defined their long-term strategy for developing the region's energy sector as" to ensure energy security through the balanced development of the region's energy infrastructure and economic growth through energy trade." Uzbekistan would like to increase the amount of gas exported to the region, and so any reduction in domestic gas consumption means that there is more gas available for export.

In line with national energy strategy, Ministry of Energy has signed an agreement with Stone City Energy for designing, financing, building, commissioning, operating, and managing the 1,600MW power plant for a period of 25 years.

This report is prepared in pursuance of the agreement mutually signed between FC "SCE-QUVVAT" LLC and JV "UzAssystem "LLC. UzAssystem is appointed to undertake an Environmental and Social Impact Assessment Report (ESIA) in compliance with the Asian Infrastructure Investment Bank (AIIB) Environmental and Social Policy (ESP) and International Finance Corporation (IFC) Standards for the project of the CCPP.

It should be noted the proposed project is considered as Category I of environmental impact with a high risk according to the Law "On Environmental Expertise" and the Decree of the Cabinet of Ministers of 07.09.2020 № 541On further improvement of the mechanism of environmental impact assessment"). Hence, first stage of the Environmental Impact Assessment report (national acronym - PZVOS) was developed for this facility and a positive Conclusion of the State Environmental Expertise of the Republic of Uzbekistan No.04-01/10-08-1655 dated September 29, 2021 was obtained. As the Stage III of national EIA process The 'Statement on Environmental Consequences' ('ZEP' is the national acronym) represents the final stage of national EIA process and it will be conducted before the project is commissioned.

The Surkhandarya 1600 MW Combined Cycle Power Plant will be referred to as "The Project" entire of the report.

2. PROJECT INFORMATION

2.1 Project Description

The proposed Project is a CCPP project. The combined cycle power plant consists of two CCGTs and a steam turbine (one unit). The baseload capacity of the Project is 1,600 MWe. The fuel to be used at the plant is natural gas and it will be supplied from a pipeline to be constructed by the Government. The electrical high voltage system of the plant will have a 500 kV grid connection with an air-insulated switchyard to be constructed in the Project area. The plant will have two transformers (600 MVA), two auxiliary transformers (27/44 MVA), and various auxiliary transformers.

In the CCPPs, compressed air and natural gas enter the combustion section of the gas turbine plant. Combustion products in a gas turbine with a temperature of approximately 1500°C enter the gas turbine converting kinetic energy into mechanical energy. After the gas turbine, the exhaust gases at a temperature of 670°C enter into the heat recovery steam generator in which steam is generated by transferring thermal energy from the feed water. Exhaust gases from the heat recovery steam generator are discharged into the atmosphere through the stack at a temperature of 85° to 140°C, depending on the content of sulfur. The exhaust gas that loses its heat leaves the power plant via the stack and is emitted to the atmosphere via two stacks 65 m in height and 8.24 m in diameter.

The generated steam in the two heat recovery steam generators enters into the steam turbine, where the kinetic energy of the steam drives the turbine, generating mechanical energy. The exhaust steam is sent to the condenser and, due to heat exchange with the cooling air, is converted into condensate, which is then sent back to the boiler. To replenish the technological losses of steam and water, the power unit is continuously fed with demineralized water. In this process, additional electricity is generated without the use of additional fuel. The Schematic Illustration of a Combined-Cycle Gas Power Plant is presented in Figure 5.

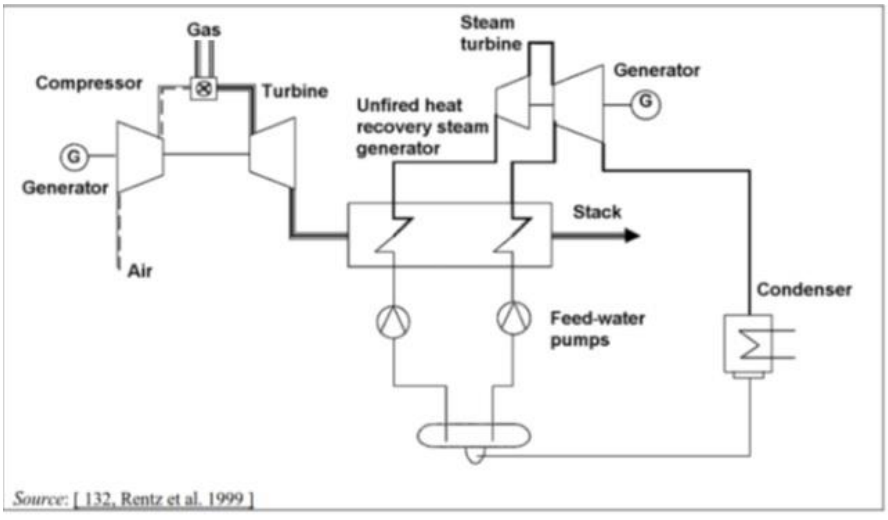


Figure 5: Sample of the Schematic Illustration of a Combined-Cycle Gas Power Plant [1]

2.1.1 Project Facilities

The main features of the power plant is presented Table 6. The overall project layout with legend is provided in Attachment B.

2.1.1.1 Design and Principle of Operation of a CCPP

The air compressed in the CCGT compressor continuously enters the combustion chamber, where it promotes the combustion of gaseous fuel at constant pressure. The combustion products enter the gas turbine, where the kinetic energy of the gas flow is converted into mechanical work of the turbine rotor rotation, where electrical energy is obtained. The gas temperature in front of the gas turbine, depending on the turbine series, is in the range of 1100-1500 ° C.

After the CCGT unit, the exhaust gases at a temperature of 670 ° C are fed into a waste-heat generator (waste-heat boiler), in which steam is generated by transferring thermal energy from gases from the gas turbine to feed water and steam. The gases from the waste heat boiler are discharged into the atmosphere through the chimney/stack at a temperature of about 85-140 ° C.

The generated steam in two waste heat generators enters a steam turbine, where the kinetic energy of the steam drives the turbine, generating secondary mechanical energy and, accordingly, obtaining additional electrical energy.

The combined cycle plant consists of two separate units: a steam power unit and a gas turbine unit. In combined cycle plants, the first generator is located on the same shaft as the gas turbine, which generates an electric current due to the rotation of the rotor. Passing through the gas turbine, the combustion products give it only part of their energy and still have a high temperature at the outlet of the turbine. Further, the combustion products enter the steam power plant, into the waste heat boiler, where water vapor is heated. The flue gas temperature is sufficient to bring the steam to the state required for the rotation steam turbine and additional electrical energy (temperature 500 degrees Celsius and pressure 80 atmospheres) (see Figure 6).

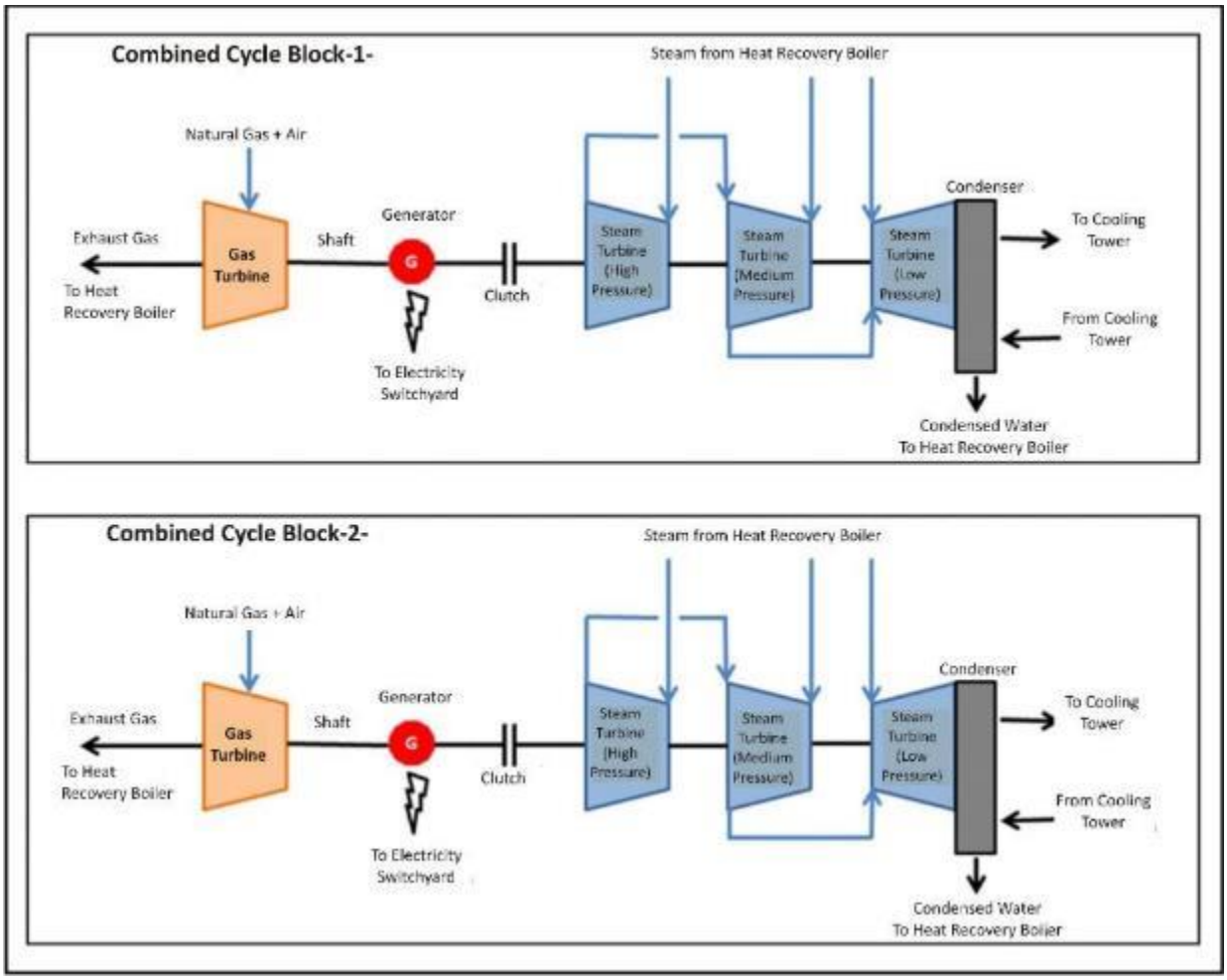


Figure 6: Process Flow Chart for Electricity Generation

The exhaust steam is sent to the condenser and, due to heat exchange with the cooling air, is converted into condensate, which is then sent back to the boiler. To replenish the technological losses of steam and water, the power unit is constantly fed with chemically demineralized water.

Gas will be supplied to the territory of the section of the combined-cycle power plant with a total capacity of 1600 MW through newly constructed pipelines. Fuel gas enters the gas treatment station, equipped with coarse filters and a commercial gas flow meter, and then to the gas control station (GRP), where it is cleaned for subsequent throttling before afterburning (if necessary), then to the gas booster compressor station and then to the enters the main body for combustion in the combustion chamber of the gas turbine.

It is expected that the efficiency of each of the two CCGT units will be 60%, which is 1.6-1.7 times higher than the efficiency of the existing power plants in the energy system of Uzbekistan (34-37% on average).

The maximum consumption of natural gas at each CCGT unit is 141,500 m^3/h (i.e. 283,000 m^3/h for two CCGT units). The consumption of natural gas at the new combined cycle power plant as a whole will amount to 283,000 m^3/h x 8,000 h = 2,264 billion m^3/year (working hours per year will be 8,000h).

A gas booster compressor station (GDCS) is used to supply natural gas to the CCGT combustion chambers.

The gas booster station is designed to compress a mixture of hydrocarbon gases, which serves as a fuel for a gas turbine, during continuous operation of a combined cycle power plant with necessary breaks for preventive maintenance (topping up oil, cleaning filters, etc.). The booster compressor station is designed to operate the CCGT unit with maximum gas consumption. Gas is supplied to the compressor station with a pressure of at least 9 kg / cm^2 and is supplied from the gas compressor station to the CCGT unit to the input block for operational regulation and measurement of the gas flow rate.

Flue gases from the installed CCGT units, containing nitrogen oxides (NO, NO_2), carbon monoxide (CO), and sulfur dioxide (SO_2 negligible), will be discharged through two individual chimney/stacks 65 m high and 8.24 m in diameter.

The main advantage of the proposed design solution from the standpoint of ecology is the reduction of nitrogen oxide emissions in comparison with the currently operated power units, which is achieved due to the use of combustion chambers with dry low-toxic burners when burning natural gas.

At each source of emissions from CCGT units, an automated system for tracking emissions is provided, which provides for continuous instrumental measurements of the concentrations of pollutants (NOx, SO_2, CO). In addition, the following parameters of flue gases will be monitored: volumetric flow rate of flue gases, temperature, pressure, total carbon, and water vapor.

The new installation will be controlled using an automated control system, which, along with operational control, will create high operational reliability and reduce emergency risks.

Table 6: Main Characteristics of The Designed Combined Cycle Power Plant

Feature	Description
Type of technology	Combined Cycle Power Plant
The total area of the allocated land for construction	73.4 hectares.
Number of units of combined cycle plants	2
Power Generation	1600 MW
Capacity of each unit	Gas Turbine – 551 MW Gas Turbine – 551 MW Steam Turbine – 538 MW
Configuration	2 Gas Turbines + 2 Heat Recovery Steam Generators + 1 Steam turbine

Feature	Description
CCGT type	Siemens
CCGT efficiency	60%
Working hours per year	8000 h
Fuel	Natural gas
Natural gas consumption per hour for one unit	283.000 m³/h
Annual consumption of natural gas	283.000 m³/h x 8.000 h = 2.264.000.000 m³/year
Condenser cooling type	Water cooled
Cooling tower type	Dry cooler system
Source water - cooling water	Source water comes from the lake "Uchkizil"
Initial water	Uchkizil Reservoir
Source of Raw Water	Uchkizil Reservoir
Process water - for boilers	Process demineralized water will be supplied from our own demineralization plant through a connection to the demineralized water system
Stack height	65 m
Stack diameter	8,24 m
Auxiliary equipment	- Feed Water and Steam System - Fuel Gas System Incl. Gas Compressor Station - Dry Cooler System - Closed Condenser System - Water Treatment System - Waste Water System - Sampling System - Dosing System - Firefighting System - Lifting System - Electrical System - Standby Diesel Generator - C&I System - Civil Works System
Number and type of transformers	2 transformers 600 MVA, 2 auxiliaries 27/44 MVA, various auxiliary transformers

A purification system will be used for water purification, which includes:

- Pre-processing systems;

- Demineralization systems; demineralization system (reverse osmosis or anion axion filters) volume
- Drinking water treatment systems.

The operating mode of the new combined cycle power plant is basic, year-round, round-the-clock with the maximum possible number of hours of electric power use.

The main power generation equipment consists of:

- New generation combined cycle plants of the type - 2 units. (manufacturer "Siemens", Germany) (see Figure 7);
- Steam turbine - 1 unit. ("Siemens" manufacturer Germany) (see Figure 8).

Figure 7: Sample of the Combined Cycle Gas Turbines with a capacity of 1600 MW

Figure 8: Sample of the Steam turbine "Siemens"

The overall electrical efficiency of the proposed CCGT unit is ~ 60%. The proposed CCGT unit belongs to a relatively new type of power plant operating on natural gas. Combined-cycle power plants are designed to obtain the maximum (primary and secondary from hot exhaust gases) amount of electricity. The main characteristics of the steam turbine are presented in Table 7.

Table 7: The Main Characteristics of The Steam Turbine

Characteristic	Description / meaning
Rotational speed	15,000 rpm
Steam pressure	30 bar
Steam temperature	400 °C
Rated frequency	50-60 Hz

The composition of natural gas to be used as fuel for CCGT unit, according to JSC "Uztransgaz" (gas supply and gas transportation company in Uzbekistan) is given below in Table 8.

Table 8: Natural Gas Composition

Components	Calculated gas composition in% molar
Methane	98.72
Ethane	0.48
Nitrogen	0.74
Carbon dioxide	0.056
Oxygen	absent
Hydrogen sulfide, g/m^3	0.0044
Mercaptan sulfur, g/m^3	<0.001
The lowest heat of combustion in terms of 20 °C and 101.32 kPa, MJ/m^3	33.23
Mechanical impurities weight, g/m^3	absent
Gas density at standard conditions, kg/m^3	0.675
Molecular weight of gas, g/mol	16.2

2.1.2 Ancillary/Support Facilities

The following elements of the plant will also be part of the Project:

- Site entrance and security building;
- Administration building, offices and amenities;
- Central Control Room;
- HVAC system;
- Electrical Systems;

- Laboratory;
- Workshops;
- Warehouse and stores;
- Emergency Diesel Generator;
- Fire-fighting system; and
- Other mobile plant and vehicles.

A dedicated firefighting team will be based on-site during operations. A simplified version of the project layout is presented in Figure 9 and the project layout is provided in Figure 10.

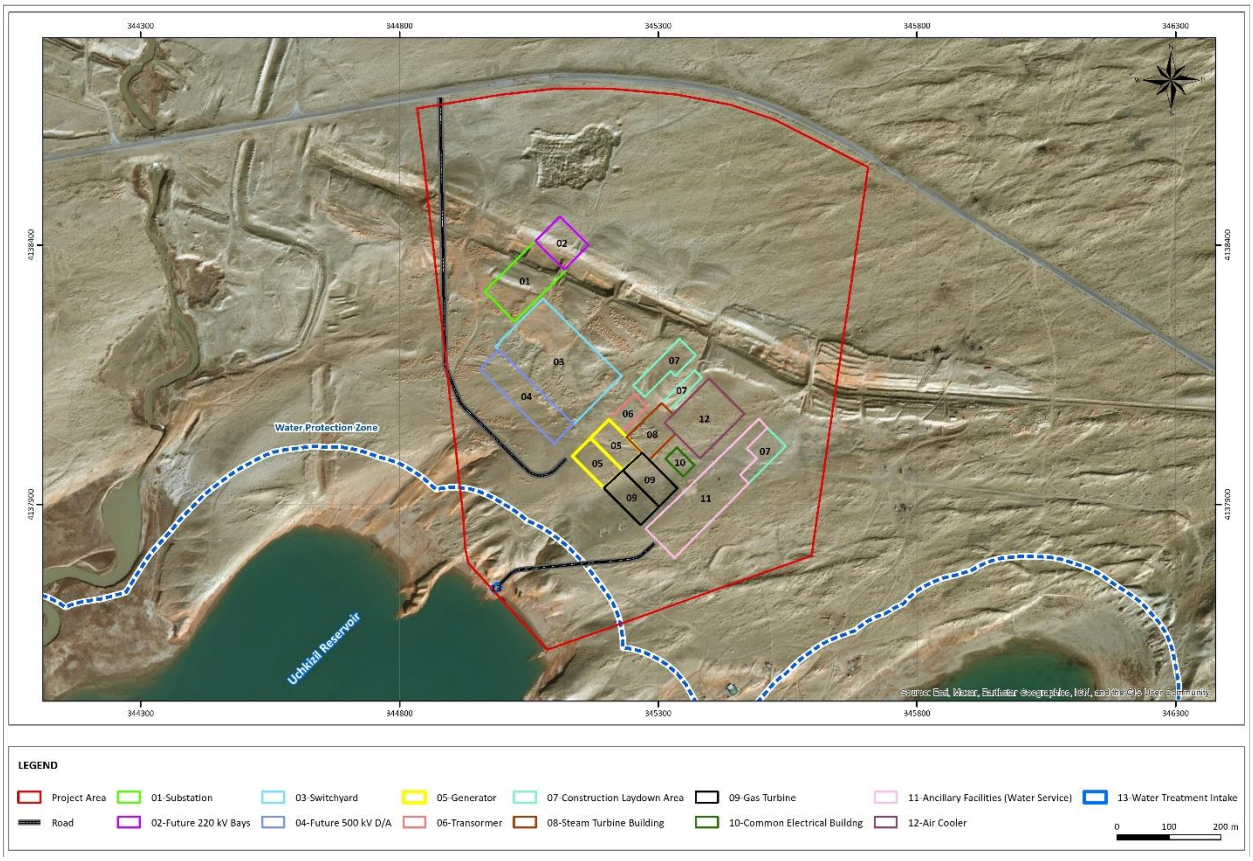


Figure 9: Simplified Version of the Project Layout

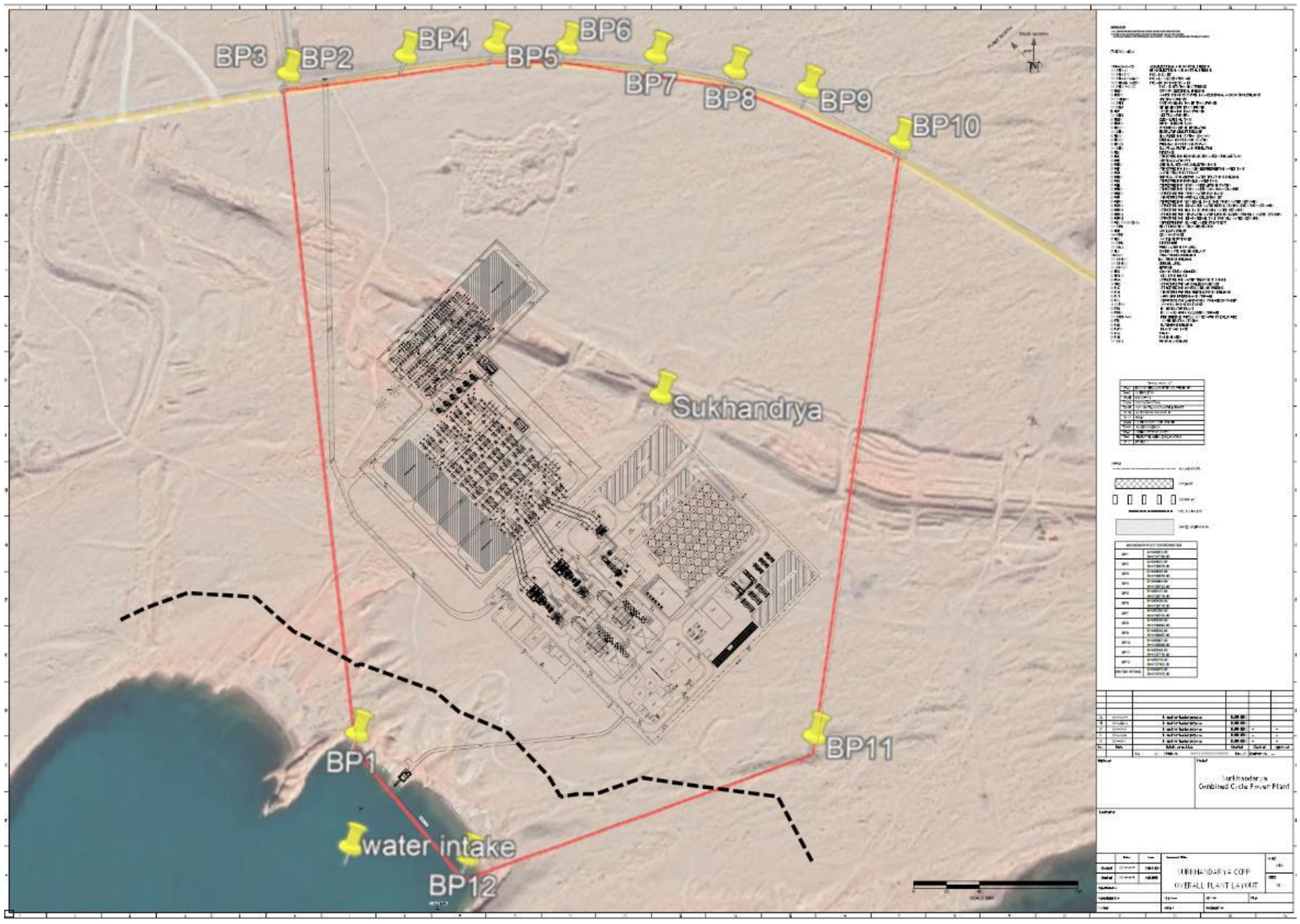


Figure 10: Project Layout

2.1.3 Associated Facilities

As per AIIB ESP, Associated facilities are activities that are not included in the description of the Project set out in the Legal Agreements governing the Project, but which, following consultation with the Client, the Bank determines are:

- directly and materially related to the Project;
- carried out, or planned to be carried out, contemporaneously with the Project; and
- necessary for the Project to be viable and would not be carried out if the Project did not exist.

The AIIB requires the Client, as part of its environmental and social assessment, to identify and assess the potential environmental and social risks and impacts of Associated Facilities, and implement measures as follows.

- To the extent the Client controls or has influence over the Associated Facilities:
  - the Client is required to comply with the requirements of the ESP and applicable ESSs with respect to such facilities, to the extent of its control or influence; and
  - if the Associated Facilities are financed by another MDB, bilateral development organization or development finance institution, the Bank may rely on the requirements of such other development partner in place of all or some of the requirements set out in the ESP and ESSs, provided that, in the Bank's judgment, such requirements do not materially deviate from what would otherwise be required under the ESP and ESSs.
- If the Client does not control or have influence over the Associated Activities, it identifies in the environmental and social assessment the environmental and social risks and impacts the Associated Facilities may present to the Project, as well as potential mitigation measures that are within the Client's control. The Client is required to demonstrate, to the Bank's satisfaction, the extent to which it does not exercise control or have influence over the Associated Facilities by providing details of the relevant considerations, which may include legal, regulatory and institutional factors.

This section aims to provide the details of the associated infrastructures in order to identify the ESIA study requirement for those facilities. Hereafter the list of potential associated facilities considered:

- Air insulated substation, wherein the electric power will be evacuated from the Project.
- 9 km overhead transmission lines (OHL) connecting between the substation and the existing grid facilities.
- Gas pipelines and the gas distribution station that feeds the gas to the Project.

2.1.3.1 Air Insulated Substation

The Project Company and National Electric Grid of Uzbekistan (NEGU) has signed a Power Purchase Agreement (PPA) regarding the construction of 1600 MW CCPP. The official letter received from NEGU dated 10 June 2022 indicates that in accordance with the PPA, the Project Company is responsible for the construction of the power plant itself and 500/220 kV AIS.

It is mentioned that, the AIS facility has been planned separately and before the acceptance of the Project due to the forecasted demand in the project area. Since the planned project will secure the uninterrupted supply of electricity, the AIS project has been integrated to the plant area to decrease CAPEX of the required grid construction and to secure its completion in shorter time. Upon completion

of the construction activities, AIS will be transferred to NEGU. Therefore, AIS is considered as project component and impacts related with the AIS are part of this ESIA study. The AIS is located within the project area and the ESIA study therefore covered the impact area of the AIS.

2.1.3.2 Overhead Electricity Transmission Line

The grid infrastructure present in the relevant region is part of the national backbone extension towards the southern border of Uzbekistan.

The southern segment of the national backbone is expected to handle the cross-border power flow requirements with Tajikistan and Afghanistan, in addition to enabling reliable power evacuation from the southern operational region, Surkhandarya, towards the central and south-west operational regions which are expected to have an increasing demand over the coming years based on population growth, economic growth and industrialization trends in the country.

Moreover, the region is among the most convenient areas in Uzbekistan for the construction of new solar PV plants, which is a big part of the country's energy transformation and decarbonization strategy for the coming years. In this respect, there is already a 450 MW solar PV plant project in Sherabad, which is also going to connect to the substation SS Surkhon. Shortly, the region is expected to host an increasing capacity of solar PV plants and contribute to the renewable power generation capacity increase.

The Grid Impact Assessment study conducted by UzAssystem has revealed that the best grid connection strategy for full power evacuation from the Project is through grid integration at both 220 kV and 500 kV voltage levels. Figure 11 provides a visual description of the proposed OHL connection.

- One generation substation at 220/500kV to have 2 sets of autotransformers 3x167 MVA.
- Two double circuits (4 lines) of new 9km 220 kV OHLs from the generation substation to be connected as 'Line-in/Line-out' (LILO) connection to the existing 220 kV OHLs: 'L-Naibabad 1', 'L-Naibabad 2', 'L-Amu 1', 'L-Amu 2'.
- One single circuit (2 lines) of new 9km 500 kV OHL from the generation substation to be connected as LILO connection to existing 500 kV OHL called 'L-Surkhon – Puli-Khumri' (Afghanistan)

Since the generation substation is part of the project component as mentioned in Section 2.4.3.1, the OHL listed above is considered associated facility of this Project, for the reasons:

- The 9 km 220/500kV OHL is directly and materially related to the substation which is part of the Project;
- The 9 km 220/500kV OHL will be carried out contemporaneously with the substation, which is part of the Project; and
- The 9 km 220/500kV OHL is necessary for the Project to evaculate the electricity; and would not be carried out if the substation which is part of the project did not exist.

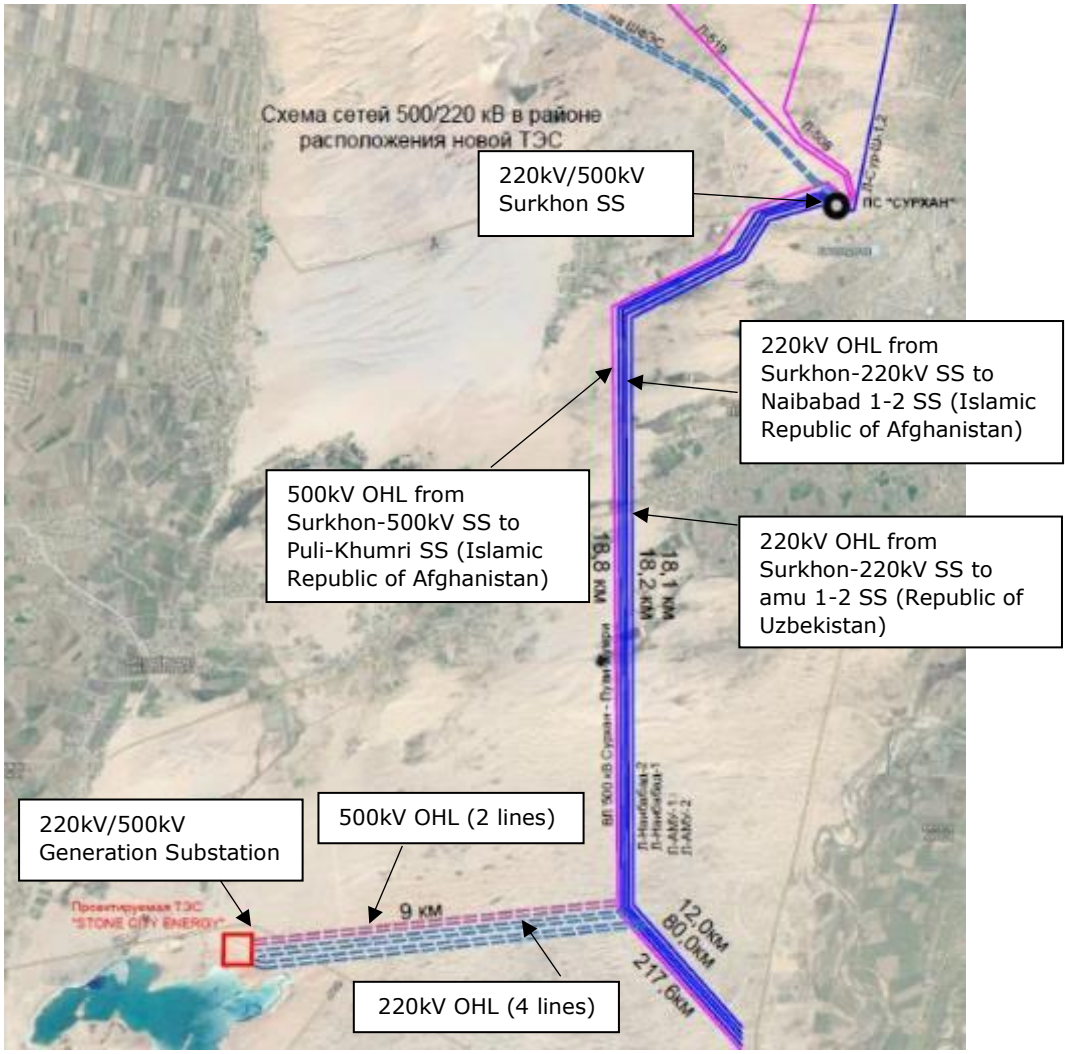


Figure 11: Proposed Grid Connection Strategy for SCE CCPP

The 9 km 220/500kV OHL as associated facility will be designed, built and operated by National Electric Grid of Uzbekistan (NEGU, the Purchaser) according to the PPA. The selection of the OHL corridor has been optimized to minimize the E&S impacts.

An important point is that the proposed grid connection strategy enables the transmission system operator, NEGU, to mitigate technical and environmental impacts for the power supply schemes to the city of Termez, which is located towards the south of the Project site. Thus, required investments for power evacuation arise directly from the operational requirements of NEGU to manage the power grid in its southern operational region, Surkhandarya, and also the Project investment will cancel new additional NEGU substation investment for Termez city (mentioned in the previous subsection). Additionally, the generation substation at the Project site will also be transferred to NEGU after its construction. Since as a private investor the Project has more flexibility to be able to conduct the project faster and shorten the period, construction-related environmental and social impacts are also mitigated as well as accelerating the reliable electricity in the region. All grid investments are going to be built as per NEGU's operational requirements for the region, separate from the Project, and grid assets will be transferred to NEGU following the commissioning phase.

This would also mean that the OHL routes (without cancelation of the planned substation) would be significantly longer than the currently proposed 9 km. LILO solution due to the distance of the load center from the 500 kV transmission line between SS Surkhon and SS Puli-Khumri in Afghanistan.

It has also been calculated that integration of the Project in this configuration will not cause any overload in the grid even if the cross-border connection between Uzbekistan and Afghanistan is disconnected and the generated power can be evacuated towards other parts of the national transmission grid without causing any overloading on any of the existing grid equipment.

2.1.3.3 Gas Pipeline Connection

As it can be seen from Figure 12, the Construction of both gas distribution pipeline and gas distribution station is planned, by the government, to be located at the border of the Project area.

These constructions of both gas distribution pipeline and station will be conducted independently from the Project realization.

Therefore, only the gas pipeline connection between the plant from the gas distribution station will be built specifically for the Project.

Based on the location of the planned gas distribution station (at the border of the CCPP areas), this gas pipeline connection, between the distribution station and the CCPP will be routed only to the area of the plant.

Under Article 6 of Presidential Decree No. 5193 dated 24th July 2021 ("Presidential Decree"), JSC Uztransgas has been instructed to construct a new gas pipeline connecting the gas fields to the Project. Ministry of Finance has been made responsible for arranging the financing for the gas pipeline by September 2023 and JSC Uztransgas is responsible for completing the construction within the timelines.

Pursuant to the Presidential Decree, JSC Uztransgas has commenced the route surveys and studies for the construction of the pipeline. The proposed route is sparsely populated and does not require the resettlement of any population. The overall length of the pipeline till the site is expected to be ~110 kms and will be constructed on an EPC basis. The overall construction is expected to be completed before Q4 2024.

Once completed, the gas pipeline will allow the integration of the gas from the global national gas field with the overall gas network in Uzbekistan. The gas pipeline is a strategic asset for the Government of the Republic of Uzbekistan and all aspects of the design, construction, and operation of the pipeline will be under the control of Uztransgas. The construction and operations of the pipeline will be in accordance with the applicable environmental and social regulations in Uzbekistan.

The Project Company, as per the project agreements, will only be responsible for the interface with the gas pipeline in accordance with the design agreed upon and approved by Uztransgas.

Thus, the gas pipeline and the distribution station are not associated facilities to this Project.

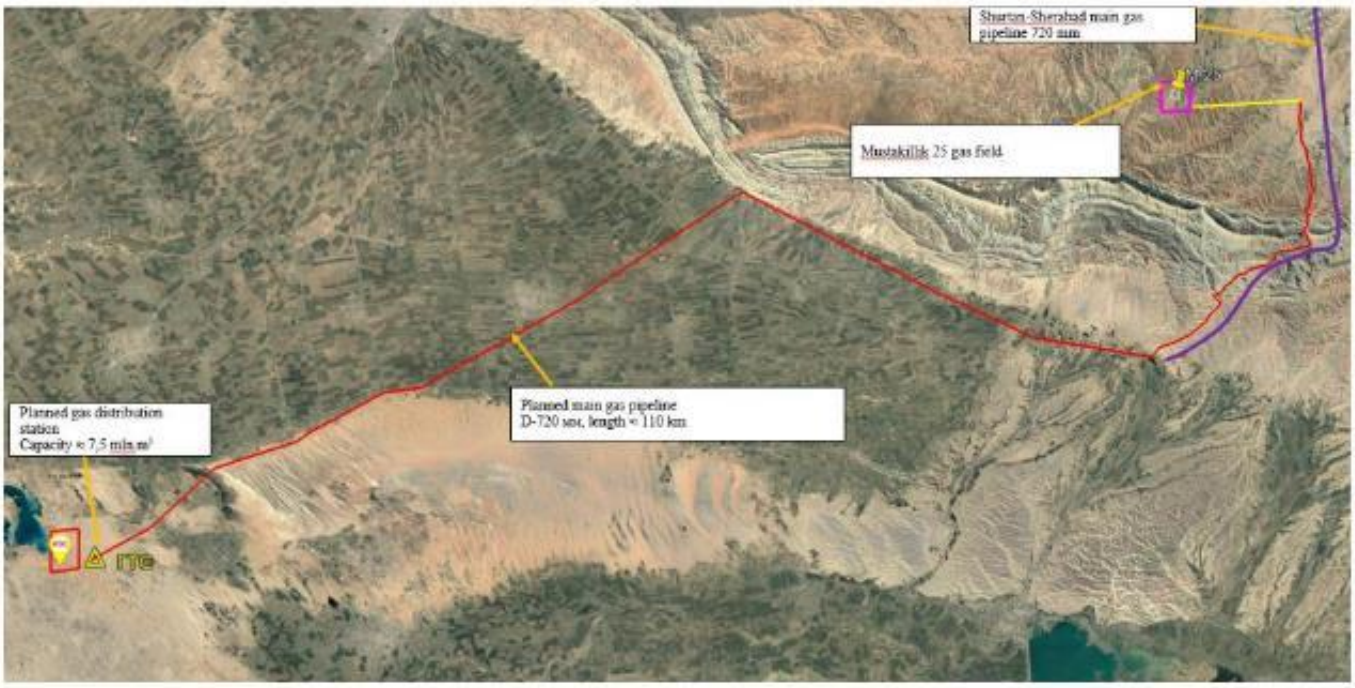


Figure 12: Proposed Gas Pipeline Network Connection Strategy for SCE CCPP

2.1.3.4 Analysis of Associated Facilities

As mentioned above, Government enhancing and enlarging both the electric grid network and gas pipeline network in the Surkhandarya region. The Project is located near the current planning of enlargement projects. Uzbekistan Government will realize these enlargement projects independently from the Project. These facilities are planned for the benefit of the region.

In conclusion, the 9km 220/500kV OHL is associated facility of the Project. However, the Project Company will not have any control or influence on the overhead transmission line. Therefore, a brief explanation on likely impacts of the overhead electricity transmission lines and natural gas pipeline are summarized in the following subsections. Requirements in accordance with the national environmental legislation should be followed during the construction and operation of the OHL and relevant impact assessment studies should be conducted. Requirements according to the national legislation for the associated facilities are summarized below.

2.1.4 National EIA Requirements regarding OTLs and Natural Gas Pipelines

According to the Decree of the Cabinet of Ministers of RUz No. 541 dated 07.09.2020, following power transmission and gas transmission lines are subjected to the state environmental expertise:

- power transmission lines and gas pipelines of republican and interstate significance are subjected to Category I of environmental impact (high risk).
- Power transmission lines and gas pipelines of the Republic of Karakalpakstan, regions and Tashkent city are subjected to Category II of environmental impact (medium risk).
- Power transmission lines and gas pipelines of regional and urban application (except Tashkent) are subjected to Category III of environmental impact (low risk).

The natural gas pipeline that is planned to be built to supply the Surkhandarya CCCP is listed under the Category II, whereas the overhead transmission line is listed under the Category III. For Category II and III projects all stages of EIA (see Table 22) are required.

Environmental protection during construction and operation of high-voltage power lines shall be ensured by making design decisions in strict compliance with the by-laws and regulatory documents effective in the Republic of Uzbekistan.

a) The distance to the nearest constructions when designing power lines shall be regulated in accordance with the requirements of SanPiN No 0350-17 "Sanitary norms and rules for protection of atmospheric air in populated places in the Republic of Uzbekistan".

b) The boundaries of the sanitary protection zone are determined in accordance with the SanPiN No. 2971-84 "Sanitary norms and rules for protection of population from impact of electric field created by overhead power lines".

c) Construction of electrical networks in protected areas shall be determined on the basis of the Decree of the Cabinet of Ministers of the Republic of Uzbekistan No. 93. "On approval of the rules for the protection of electrical networks and structures" dated May 17, 2010.

d) Determination of persons carrying out felling of trees or pruning of trees, when electric networks pass through forest areas growing in close proximity to wires, is determined on the basis of the Decree of the Cabinet of Ministers of the Republic of Uzbekistan No. 93 "On Approval of the Rules for Protection of Electrical Networks and Structures" dated May 17, 2010.

2.1.5 Likely Impacts of Overhead Transmission Lines and Mitigation Measures

The following environmental and social impacts shall be considered during construction activities of the overhead electricity transmission lines. The measures to mitigate the impacts shall be described in the environmental documents to be prepared by relevant parties. Among others, some generic mitigations are recommended for NEGU's consideration under each subsections.

Soil and Geology

Possible Impacts

- Temporary land use change (construction site, temporary access and transportation roads, storage of the vegetable soil layer and the excavated and extracted rocks that will be used afterwards for landscaping and filling, etc.) that has impacts such as degradation of the soil profile,
- Soil degradation in the excavation site:
- Topsoil stripping
- Earth compaction
- Soil erosion and landslide
- Dust accumulation in contaminated soil with other air pollutants due to soil excavation, transportation traffic, loading and unloading raw materials etc.
- Accumulation of contaminants (SO2, NOx and heavy metals) in the soil due to wet deposition (due to snow and rain)

- Infiltration to the wastewater collection network in the construction site, dispersion to the soil of the water filled with material such as cement
- Penetration of leachate arising from the uncontrolled storage of the wastes and construction materials into the soil

Measures to be Taken

- Limitation of temporarily and permanently occupied lands;
- Using appropriate transportation and construction equipment with low-pollutant engines
- Compliance of the transportation and construction equipment operators with the temporary service routes specified,
- Measures to prevent and control pollution: Regular maintenance of the transportation and construction equipment; temporary storage of the stripped topsoil and extracted rocks in the specially designated areas and under suitable conditions; management of other wastes; and management of asphalt and concrete preparation facilities
- Prevention of the soil erosion during the use of the road by means of the rehabilitation of the road surface where necessary
- Proper collection and treatment of the wastewater that will be generated during the road maintenance works; disposal of the treated effluent in accordance with the legal provisions

Noise and vibration

Possible Impacts

- The vehicles and equipment to be used in the construction works causing noise that might affect the workers, locals and animals around the operation points
- The vibration generated by the construction works such as blasting, stone and rock extraction, establishment of building foundations, piling and the truck traffic especially on the uneven surface leading to the following:

Measures to be Taken

- Timely and regular maintenance of machinery and equipment to be used
- Creating a schedule for the construction activities on the route in a way that will reduce impacts (in hours during the day);
- Preparing a plan for the arrangement of the vehicle traffic with the purpose of limiting the frequency of passage from the residential areas during the construction phase
- Checking and ensuring the compliance with the speed limit and tonnage for the trucks passing from the residential areas during the construction phase
- Performing background noise level measurements in order to take the corrective measures for the excessive noise pollution during the construction phase
- Regular maintenance of the vehicles and equipment by authorized service providers

Air Pollution

Possible Impacts

- Generation of dust from the soil removal, excavation works, transportation traffic, loading and discharging of the materials etc.

- The emissions of the air pollutants caused by the equipment used for transportation and construction (particulate matter emissions from diesel motors, NOx, volatile organic compounds, carbon monoxide, benzene and other various hazardous air pollutants).

Measures to be Taken

- Checking the roadworthiness of the vehicles and construction equipment,
- Ensuring the service roads and the construction sites where construction equipment operates remain damp by using a street sprinkler
- Periodically washing the tires of the vehicles in order to prevent dust emissions during the transportation of the excavation materials
- Checking and cleaning the loose materials on the vehicles and at the sites used for the storage of the excavation materials
- Covering the tops of the trucks used to transport the excess excavation materials with a tarpaulin

General socioeconomic impacts including the impacts on public health

Possible Impacts

- Disturbance caused by noise, vibration and air pollution, and airborne diseases (asthma, allergy etc.)
- Economic impacts arising from changes in land use
- Health and safety impacts arising from the use of explosives, use of heavy construction equipment etc,
- Adverse impacts such as noise, etc. on the residential areas in the vicinity of construction sites and transportation routes in the event that night works are performed

Measures to be Taken

- Reducing the Workplace Health Risks
- Using personal protective equipment and providing seasonal work clothes
- Using high-quality fuel and proper equipment
- Regular performance of emission control
- Building underpasses and overpasses in the residential areas where the route passes in order to ensure safe passage
- Reducing the health risks for the local community
- Using brand new, highly efficient and safe road construction machinery and equipment
- Determining a precise route for the construction vehicles and equipment, and observing the working hours
- Working in coordination with the local health units

Impacts on the Surface and Ground Waters

Possible Impacts

- Damage in seasonally or continuously flowing stream beds during the construction works; change in the waterbeds; temporary disruption of other morphologic factors and/or flow profile (speed, level), and possible temporary impacts on the level of groundwater

- The physical, chemical and biological qualities of the waters changing due to the aforementioned factors; observing pollution on surface and ground waters.

Measures to be Taken

- Suitable designs and construction techniques that aim to limit/restrict the activities that cause the waterbed to change/get disrupted
- Impact-mitigating measures that aim to prevent and control the pollution (very similar to those described for Soil and Geology)

Impacts on flora and fauna, eco-systems, landscape and protected areas

Possible Impacts

- Loss of vegetation cover in the areas where construction corridor and filling-splitting works are performed
- , The loss of rare or endangered nesting sites and/or biodiverse habitats is not expected to be high.
- , Since waterfowl and mammals do not prefer this reservoir, deterioration of waterways is not expected.
- setting barriers against wildlife movement,
- visual and auditory disturbance due to the presence of machinery, construction workers and related equipment,
- sedimentation and erosion caused by construction activities and rainwater flow; increased turbidity of surface waters,
- destruction of the landscape areas.

Measures to be Taken

- Positioning so as to avoid critical land and water habitats (e.g, old-growth forests, wetlands and spawning habitats),
- Preventing or changing the construction activities in breeding seasons and other sensitive seasons or at particular times of the day;
- Preventing the short and long term impacts on the quality of the water habitats minimizing the clearing and deterioration of the river bank vegetation cover, providing sufficient protection against landslide and erosion, and considering the beginning of the rainy season according to the construction schedule;

Wastes

Possible Impacts

- The following activities will be carried out during the preparation and construction stage: operations such as stripping vegetable soil, levelling, preparation of the construction site, construction and installation of the office and auxiliary facilities.
- The wastes from such activities include the following:
- Domestic wastes (municipal wastes),
- packaging and packing wastes of the equipment (wood, cardboard, plastic, etc.),

- hazardous wastes (chemical substances such as paints and solvents and their containers, oily packages and fabrics, etc.)
- special wastes (waste oils, accumulators and batteries, filters, etc.)
- excavation and construction wastes (i.e. scrap deal, wood, concrete waste, etc.)

Measures to be Taken

- domestic wastes, including the organic wastes such as biodegradable food wastes must temporarily be collected inside containers with closed tops separated from other wastes, and it must be ensured that they are regularly collected by the related municipalities and disposed of at landfills.
- non-hazardous packaging wastes arising from the materials, parts and equipment should be collected separately from the other wastes at a temporary storage area reserved within the site, and should be collected by the licensed institutions/firms authorized by the Ministry of Environment and Urbanization of Turkey as per the provisions of the Regulation on Packaging Wastes Control.
- limited amount of wastes that are considered as hazardous according to the annexes of the Regulations on Waste Management must be collected in temporary storage areas segregated onsite separate from the non-hazardous wastes, and it must be ensured that they are collected by authorized vehicles, and recovered or disposed of in authorized plants in compliance with the provisions of the Regulation on Waste Management.

The impacts regarding the operation of overhead electricity transmission lines, but not limited to, are summarized below:

Soil and Geology

Possible Impacts

- Permanent change in land use in the construction area of tower feet as well as in transformer center and switchyard areas,
- Dispersion and leaking of pollutants into soil as a result of the accidents and breakdowns in the vehicles and equipment to be used in the maintenance works,
- The erosion of soil due to the removal of the plants along the working corridor and the deterioration of the basin structures.

Measures to be Taken

- Limitation of temporarily and permanently occupied lands;
- Compensation of the losses for the loss of land users
- Prevention of soil erosion by re-planting.

Noise and vibration

Possible Impacts

- Noise generated by the vehicles and equipment to be used during maintenance work,
- The corona noise, which may occur in the conductors used in transmission lines.

Measures to be Taken

- Regular maintenance of the vehicles and equipment to be used for the maintenance works, and non-performance of the maintenance work during the night hours in the vicinity of the residence,
- During the design work, the route should be selected at an adequate distance from the vulnerable residential areas in order to reduce the impact of corona.

Air Pollution

Possible Impacts

- Dust emissions resulting from the stripping of vegetation and similar activities during the maintenance work,
- Exhaust generated by the vehicle and equipment to be used in maintenance work.

Measures to be Taken

- Settling the dust by spraying water with sprinklers during the stripping of the vegetation or other activities that generate dust emission
- Regular maintenance of vehicles and equipment at authorized service centers

General health and safety related impacts on community and workers

Possible Impacts

- Unauthorized persons might climb up the towers and receive electric shock and/or fall,
- Electromagnetic field effect caused by the electric current,
- If glass insulators are used, these insulators might fall down, get broken and cause a fire due to lens effect under the sun.
- Landscape aesthetics impacts
- Radio interference from the transmission lines.
- Occupational health and safety risks to construction workers during maintenance activities (working at height etc.,),

Measures to be Taken

- Mounting of mechanical components that will prevent climbing during the service of the transmission line,
- Announcement of the commissioning date of the line and high voltage of the line to the locals; and placement of the necessary warning signs,
- Prevention of fires originating from ETL by use of silicon insulators.

General socio-economic impacts on community

Possible Impacts

- Economic impacts arising from changes in land use (forest, agriculture etc.),

Measures to be Taken

- Ensuring provision of necessary compensation for affected agricultural assets in consultation with the relevant authority of RUz,
- Ensuring implementation of measures for livelihood restoration in consultation with the relevant authority of RUz such as providing grants for land enhancement and security, maintaining access to the project site to continue feed collection, technical assistance for improvement of leaseholders' remaining lands, etc.,
- Implementing measures defined in Land Resettlement Framwork (LRF) included in Chapter 18 of this report.

Impacts on the Surface and Groundwater

Possible Impacts

- Contamination of the surface and groundwaters with the leakages of oil that is used for the maintenance of vehicles and equipment,
- Domestic wastewater generated by the facilities such as transformer center.

Measures to be Taken

- Preventing the performance of vehicle and equipment maintenance in areas close to the stream beds; prevention of leakage with petroleum / fuel leak intervention kits in the event that dangerous substances are poured into the soil,
- Disposal of the domestic waste within the scope of the relevant legislation.

Impacts on flora and fauna, eco-systems, landscape and protected areas

Possible Impacts

- In the event that the ETL route passes through the shrub areas, chopping down of the trees might affect the wild life in the region and might cause the loss of forest habitats,
- Adverse impacts on fauna due to corona noise,
- Deaths caused by birds nesting on transmission towers,
- Risk of fire in the event that the ETL is broken due to natural disasters or accidents.
- The loss of rare or endangered nesting sites and/or biodiverse habitats is not expected to be high.
- Since waterfowl and mammals do not prefer this reservoir, deterioration of waterways is not expected.
- Collision of avifauna (e.g. Lesser Whitethroat - Sylvia curruca, Egyptian Vulture- Neophon percnopterus, Masked Wagtail - Motacilla personata, Chiffchaff - Phylloscopus collebitbird species) on the OHL;
- Electrocution of avifuana (w.g. Lesser Whitethroat - Sylvia curruca, Egyptian Vulture- Neophon percnopterus, Masked Wagtail - Motacilla personata, Chiffchaff - Phylloscopus collebitbird species) on the OHL.

Measures to be Taken

- Selection of a route that will minimize the impacts on flora and fauna as much as possible during design works,
- Placement of anti-bird devices to deter birds from nesting and perching,
- Installment of bird divertors on the OHL and the bird marker balls on the earth wire near the bird habitats, forest areas and water bodies in the light of detailed avifauna surveys,
- Erection of line protection relays to ensure the electricity will be cut off in the event of a rupture in the ETL due to a natural disaster or accident.

Wastes

Possible Impacts

- Wastes generated by the personnel and by the maintenance of vehicle and equipment

Measures to be Taken

- Disposal of the hazardous and non-hazardous wastes according to the relevant legislation
- Disposal of the domestic waste generated within the scope of the relevant legislation

2.2 Project Location

The Project site is located in the Angor district of the Surkhandarya region of the Republic of Uzbekistan, on the northeastern coast of the Uchkizil Reservoir, which is an off-stream reservoir type used for irrigation. The earth dam type Uchkizil reservoir is in operation since 1957.

Distance of the Project area to the regional center of Uchkizil village is approximately 2.0 km, and 14 km to Termez city centre. The location of the Project area in Uzbekistan is presented in Figure 13 and the Project location (regional) is presented in Figure 14.

Figure 13: General Project Site Location

Figure 14: Project Location (Regional Context)

The EIA positive consent decision dated September 29, 2021 and numbered 04-01/10-08-16-55 indicates that a total area of 73.4 hectares was allocated for the implementation of the Surkhandarya Project by referring the decision of the Khokim (Governor of Region) of Angor district No. 131–8–0–Q dated August 26,2021, a land plot in Kattakum village community assembly, (see Attachment A).

The Site is at an average elevation of 337 m above sea level whereas the level of the Uchkizil Reservoir reserve is 318 m above sea level. The coordinates of the Project area are presented in Table 9. This ESIA Report was mainly developed according to the Project location information received from the Sponsor on July 2021, however the geographic coordination of Project location altered on April 2023. Accordingly, necessary revisions were made throughout the ESIA Report in a manner to present updated Project location.

Table 9: Geographic Coordinates of the Project Area

Geographic Coordinate System Universal Transverse Mercator (UTM) Zone 42, World Geodetic System (WGS) 84				
No	**Point No**	**X**	**Y**	**Z**
1	R1	4138299	345061.4	341.487
2	R2	4138256	345143	342.536
3	R3	4138134	345340.7	342.262
4	R4	4138545	345371.5	342.163
5	R5	4138195	344822.4	342.868
6	1	4138663	344834.1	
7	2	4138571	344845.7	
8	3	4138467	344857.2	
9	4	4138380	344866.9	
10	5	4138283	344877.7	
11	6	4138182	344889	
12	7	4138110	344897	
13	8	4138042	344904.5	
14	9	4138001	344909.1	
15	10	4137957	344914	
16	11	4137878	344922.8	
17	12	4137812	344930.2	
18	13	4137787	344932.9	
19	14	4137730	344985.7	
20	15	4137676	345034.9	
21	16	4137620	345085.9	
22	17	4137639	345138.9	
23	18	4137656	345188.6	
24	19	4137673	345235.5	
25	20	4137692	345288.6	
26	21	4137712	345343.7	
27	22	4137733	345403.4	
28	23	4137762	345485.2	
29	24	4137788	345558.7	
30	25	4137801	345596.1	
31	26	4137858	345604.4	
32	27	4137916	345612.9	
33	28	4137980	345622.3	
34	29	4138015	345627.4	
35	30	4138108	345641	
36	31	4138161	345648.7	
37	32	4138179	345651.4	
38	33	4138206	345655.4	

Geographic Coordinate System Universal Transverse Mercator (UTM) Zone 42, World Geodetic System (WGS) 84				
No	**Point No**	**X**	**Y**	**Z**
39	34	4138267	345664.2	
40	35	4138332	345673.8	
41	36	4138428	345687.8	
42	37	4138496	345697.7	
43	38	4138550	345705.6	
44	39	4138599	345607.7	
45	40	4138642	345524.4	
46	41	4138670	345440.1	
47	42	4138690	345335.7	
48	43	4138701	345208.8	
49	44	4138702	345104.3	
50	45	4138690	344998.6	
51	46	4138678	344922.3	

The project area can be considered as a flat terrain and there is no agricultural and/or economic activity within the project area. Project area consists mainly typical representatives of the flora of sandy and saline deserts of the southern part of Central Asia. Photos showing the project site are presented below.

Figure 15: Project Area – General View (July, 2022)

2.3 Land Use and Site Condition

The three largest land use categories in Uzbekistan are listed as:

- agricultural land (46.1% or 20,473 thousand ha),
- lands of the forest fund (21.7% or 9 635 thousand ha),
- lands of the reserve (27.6% or 12,262 thousand ha).

In total, these land categories cover more than 42 million hectares (95% of the country).

For the construction of the combined cycle power plant, unused land of the Kattakum with an area of 73.4 hectares was allocated (please see Attachment A).

Key aspects of the vicinity of the project boundary:

- uncultivated and unused lands in the north, west, and east,
- Uchkizil Reservoir in the south,
- one of the tributes of the Zang Canal that discharges into Uchkizil Reservoir in the west at a distance of 450-550 meters,
- M-39 main road in the north, northeast and,
- the main railway line Kagan-Termez-Dushanbe in the south at a distance of 7 km.

The nearest residential buildings are located in the south (Uchkizil Village, ~1.4 km) and the west (Kattakum Village, ~1.0 km) (see Figure 16).

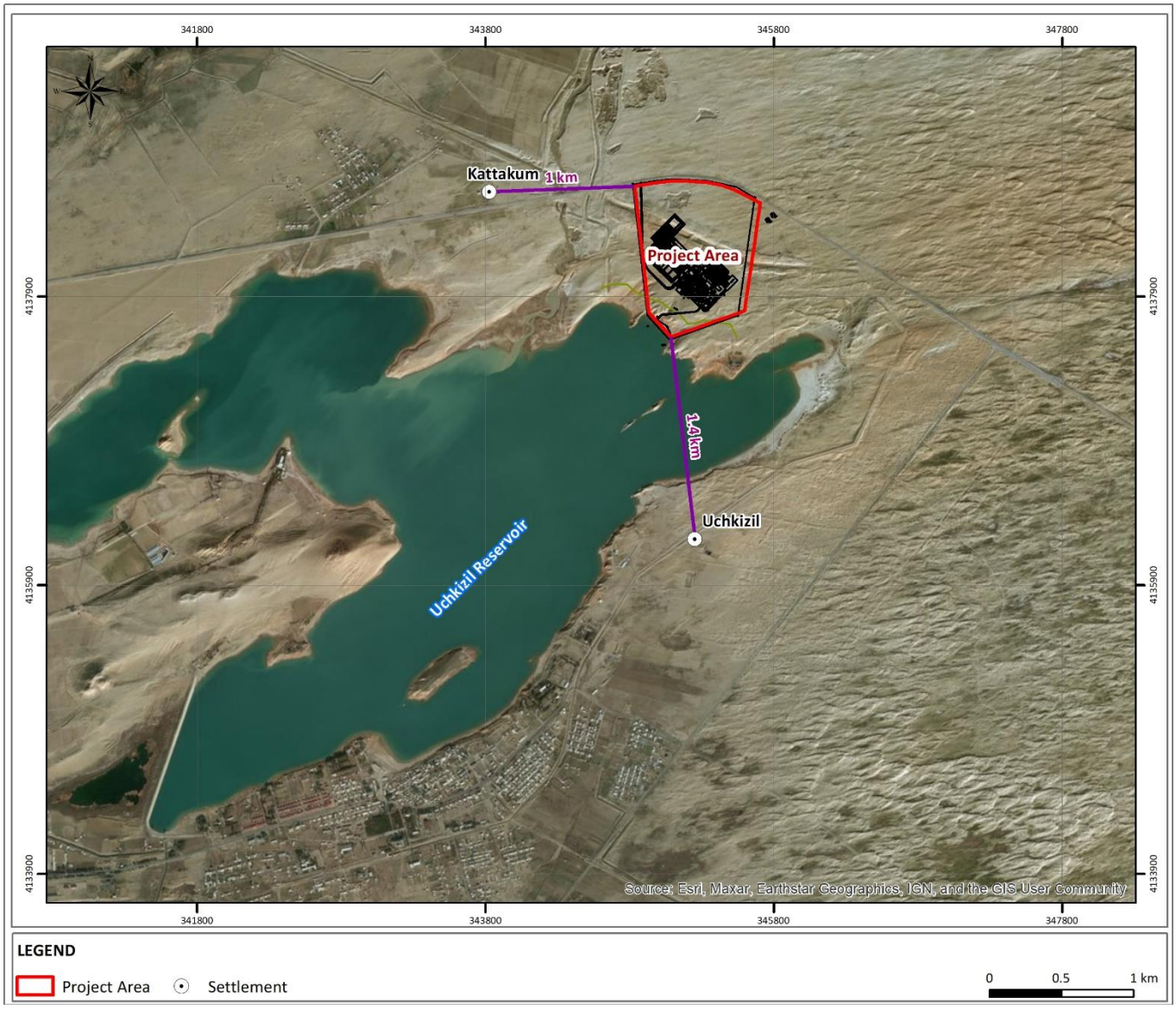


Figure 16: Project Location

2.3.1 Land Ownership

According to the 1998 Land Code of the Republic of Uzbekistan, all land in Uzbekistan is state property and permits for use of land are granted and monitored by the State through the rayon and oblast administrations. The official letter of the Surkhandarya Region Khokin, dated 30 August 2021, the Project area is allocated for the construction of a CCPP with the capacity 1600 MW. The decision was published on the official website of the regional administration (surkhandaryo.uz).

2.4 Project Spatial Scope and Areas of Influence

Area of Influence (AoI) or the spatial scope is the physical area, which is the minimum study area of the ESIA studies. AoI is always larger than the project area to assess the potential impacts and the

spatial scope varies depending on the topic being studied. The total spatial scope of the ESIA is the result of the sum of all the areas of influence from each assessed topic. The AoI is the geographic area that may directly or indirectly experience impacts to the biological and, physical or socio-economic environments from resettlement, earthworks, construction, and operation of the Project components. The proposed Project AoI includes the receptors that may be permanently and temporarily affected by the Proposed Project features.

Based on desktop studies and field surveys, potential environmental and social receptors that are likely to be affected by the proposed Project are determined as per the type of the Project related activities. Accordingly;

- Air Quality: The AoI for the likely impacts on air quality is determined as 7 km by considering wind direction and nearby settlements (see Figure 17).
- Noise Level: The AoI for the likely impacts on noise levels is determined as 4 km by considering noise emissions and nearby receptors (see Figure 18).
- Ecology: The AoI for the likely impacts on ecological features is determined as per the Uchkizil Reservoir and its surrounding including the Project area (see Figure 19).
- Surface Water: The AoI for the likely impacts on surface water is determined as per the Uchkizil Reservoir (see Figure 20).
- Socioeconomy: The AoI for the likely impacts on social features is determined as per the settlements around the Project area and utilization purposes of the Uchkizil Reservoir (see Figure 21).

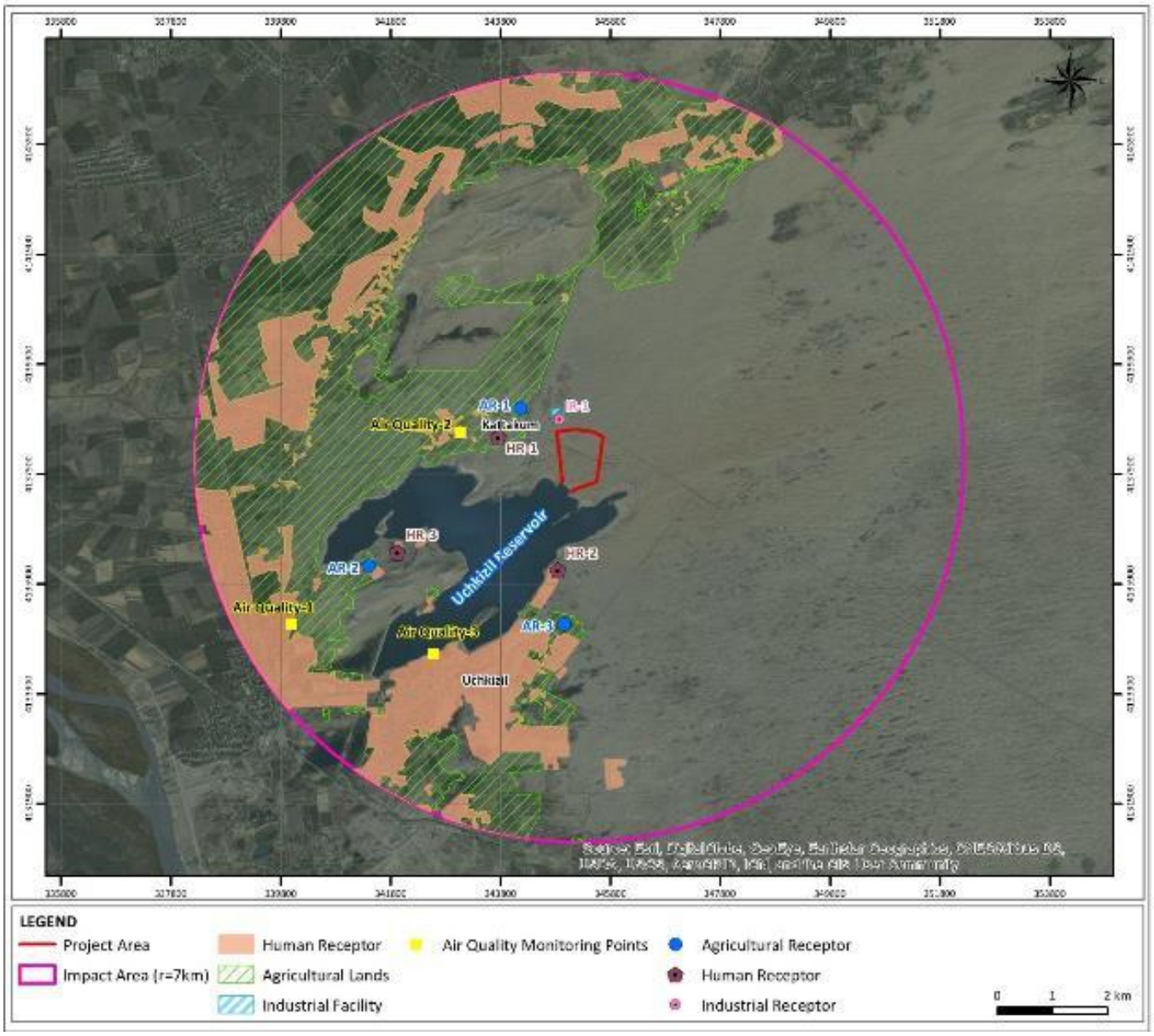


Figure 17: AoI for Air Qualiy

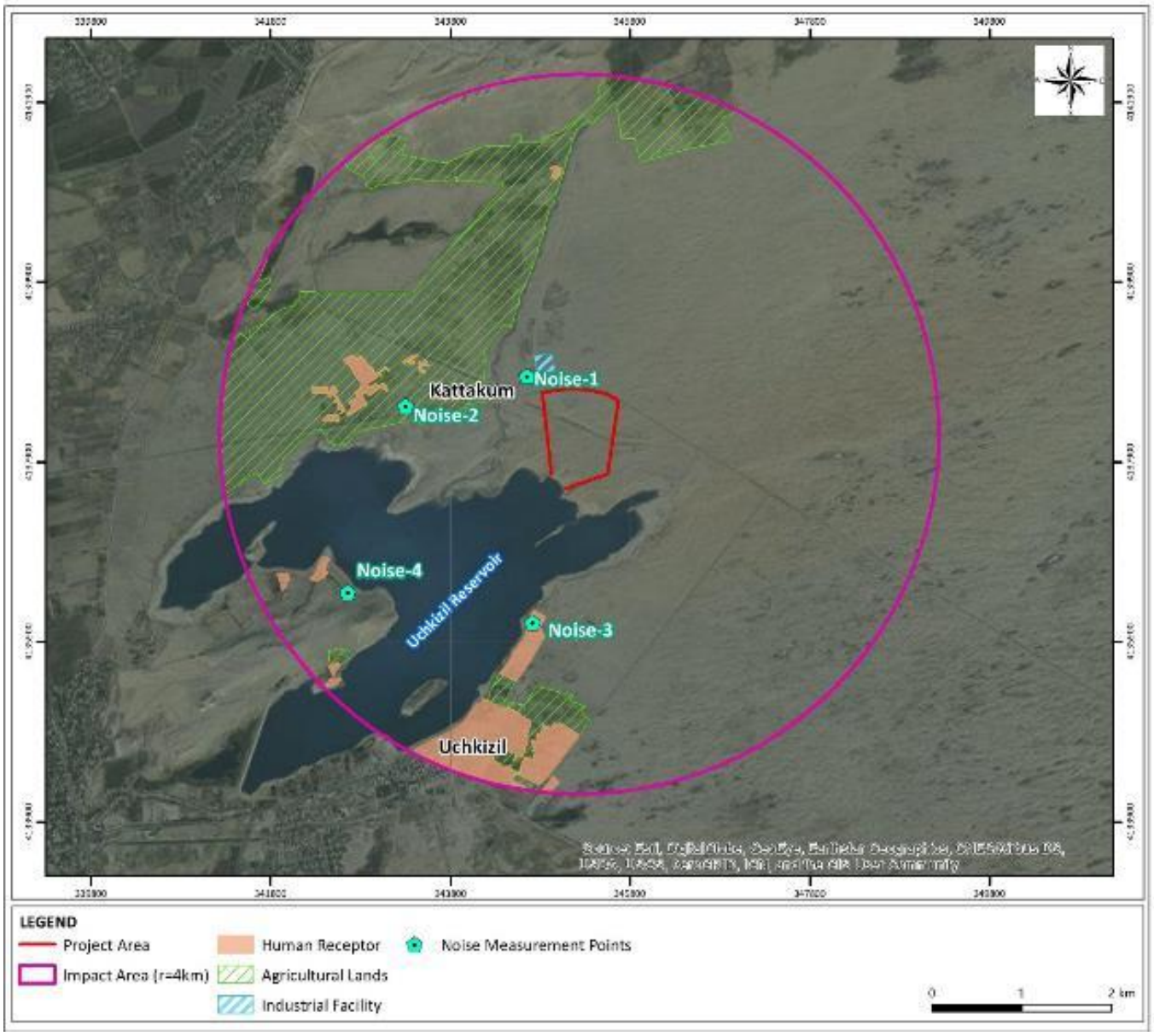


Figure 18: AoI for Noise Levels

Figure 19: AoI for Ecology

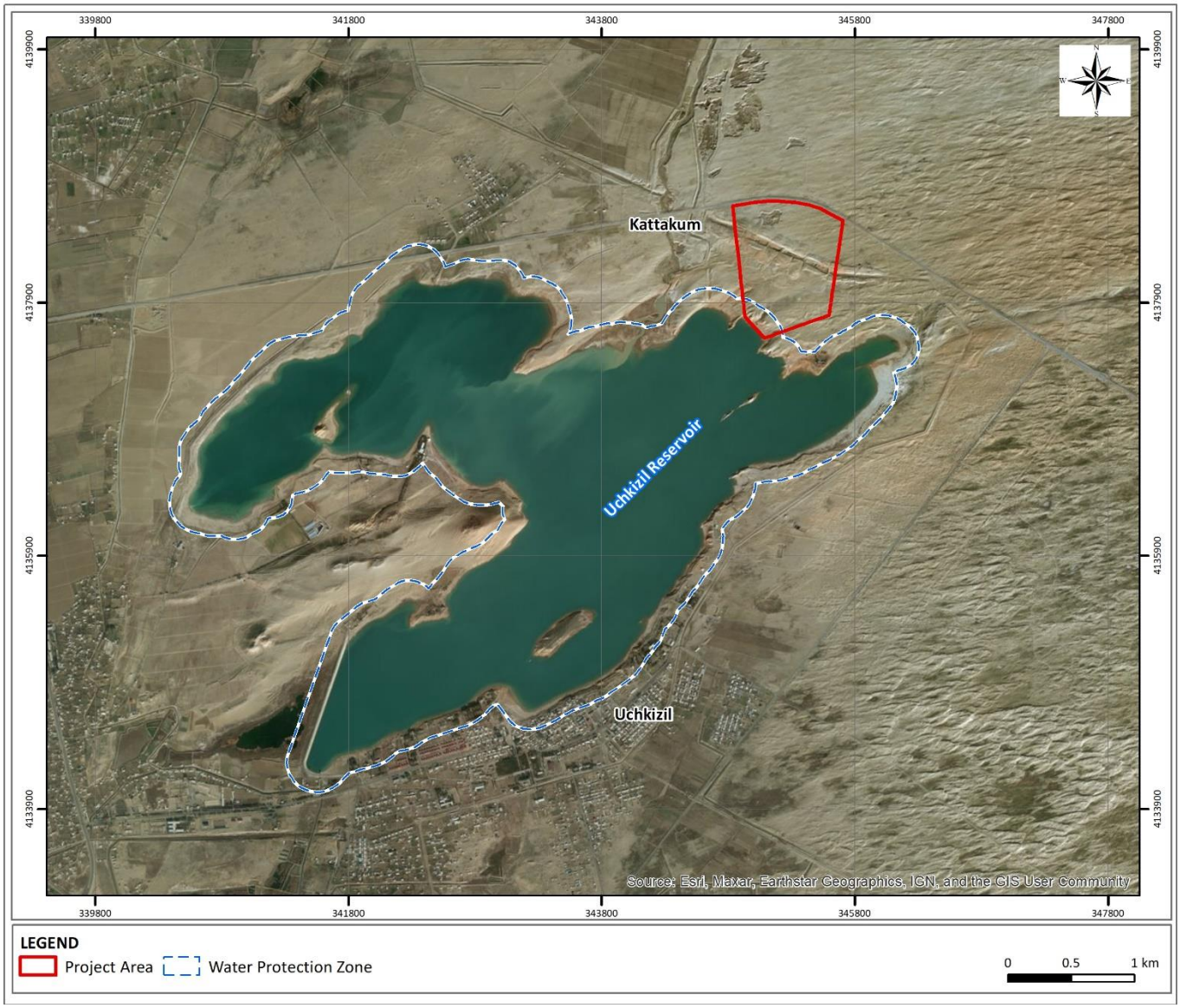


Figure 20: AoI for Surface Water

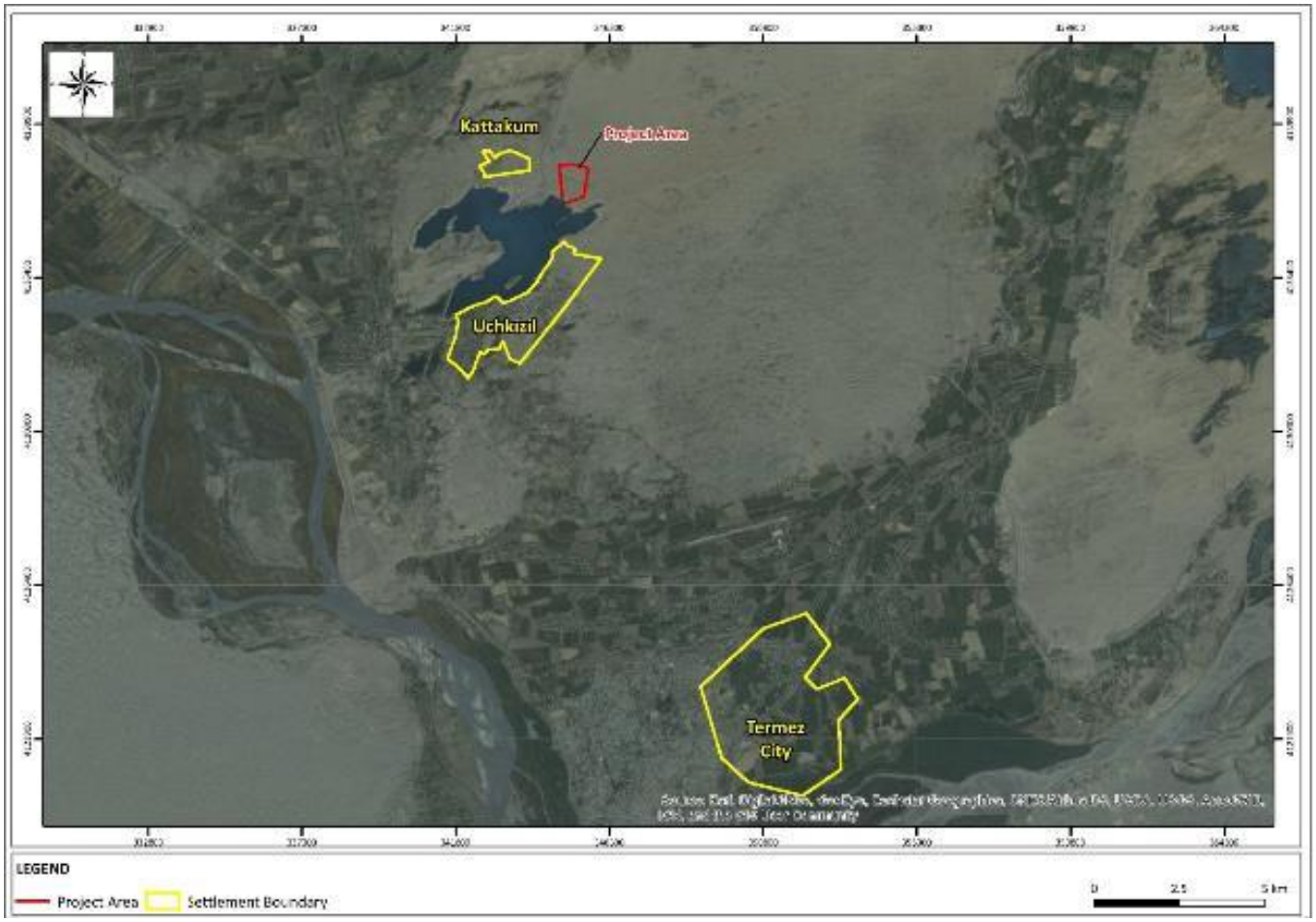


Figure 21: AoI for Social

2.5 Construction Phase

The awarded Engineering Procurement and Construction (EPC) Contractor will be responsible to prepare the Construction Execution Plan, which will be progressively updated through the construction's different stages. The Construction Execution Plan will commence with the preparation of a preliminary construction plan and schedule for each work package; this includes all of the key dates throughout the construction phase. Critical aspects such as road access, construction seasons, construction labor availability, and camp requirements are assessed and integrated into the plan. This information is also to be incorporated into the Health, Safety, Security, and Environment (HSSE) Plan for the area, which will also address aspects such as traffic management, access, and egress, etc.

The construction activities will consist of site grading, the opening of the access roads, the construction of administrative, control, and maintenance buildings, and the installation of the power plant facilities. It is expected that site grading will be minimal due to the current level nature of the site. The general earthwork activities will consist of cut and fill activities for degrading the site, construction of dikes, foundation, and pavement sub-grade preparation, and excavation and backfill for utilities. It is anticipated that the construction activities will commence in November 2022 and commissioning will take place in August 2024 (see Table 11).

2.5.1 Water Consumption

The daily water consumption including domestic needs, irrigation purposes, and concrete production during the construction stage will be approximately 170 m^3/day and it is expected that the water will be brought in containers from nearby containers.

2.5.2 Sanitary Services

Domestic wastewater generated during construction is planned to be collected in septic tanks with subsequent removal to the nearest treatment facilities in the city of Termez.

2.5.3 Temporary Construction Area

During the construction stage it is anticipated that temporary site offices, workshops and warehouses, batching plant and outdoor laydown area will be located within the project area (see Figure 9).

2.5.4 Accommodation and Logistics

It is planned that there will not be any accommodation facilities within the construction area. Based on the previous experiences in similar projects, it is expected the EPC contractor will arrange accommodation off-site and will use the existing housing compounds located in Termez city. Since the EPC contractor has not been awarded yet, the location of such accommodation is not readily determined. However, it will be ensured that the Project Company will specify the standards of facilities for worker accommodation in line with the IFC/EBRD Worker Accommodation Guidelines.

The EPC contractor will provide the transfer of the workers to the construction site and will perform a Traffic and Logistics Study to assess roads and determine access requirements via other modes of transport. It is foreseen that the existing M-39 main road will be adequate during the construction activities and no additional access road will be opened to reach the project site [3].

2.5.5 Workforce Requirement

It is expected the number of construction workers will be around 2050 during the peak period of the construction. It is expected that approximately 30% of the workforce could be available as unskilled staff whereas the rest will require technical qualifications. It is foreseen that the ratio of foreign workers will be close to the number of local people to be employed, approximately 50%. It is anticipated that the EPC Contractor will have approximately 130 people and the Project Company will have 10-15 permanent staff at the site during the construction stage.

It should be noted that the given number of the workforce may change depending on Project needs during the construction activities.

2.5.6 Vehicles, Equipment, and Machinery Requirement

The EPC contractor will be in charge for construction activities and will make use of different vehicles, equipment, and machinery during the construction stage. The expected number of vehicles according to their fuel types are presented below.

Table 10: List of Vehicles and Construction Equipment During Construction Phase

Vehicles & Equipment Name	Quantity	Fuel
750t Crawling Crane	1	Diesel
150t Crawling Crane	1	Diesel
Hydraulic Lifting Device and Lifting Frame	1	Electrical
250t Crawling Crane	1	Diesel
50t Crawling Crane	1	Diesel
50t Truck Crane	1	Diesel
Gantry Crane	2	Electrical
Truck	3	Diesel
Forklift	2	Diesel
Electric Welding Machine	301	Electrical
Diesel Generator	1	Diesel
Tower Crane	2	Electrical
Vehicle Crane	2	Diesel
Wheel Loader	1	Diesel
Backhoe Excavator	7	Diesel
Crawler Bulldozer	1	Diesel
Road Roller	2	Diesel
Dump Truck	10	Diesel
Platform Lorry	1	Diesel
Batch Plant	2	Electrical
Concrete Pump Truck	3	Electrical
Concrete Delivery Truck	6	Electrical
Piling Machine	4	Diesel

2.6 Commissioning Phase

Commissioning and testing sequence of the project is given below.

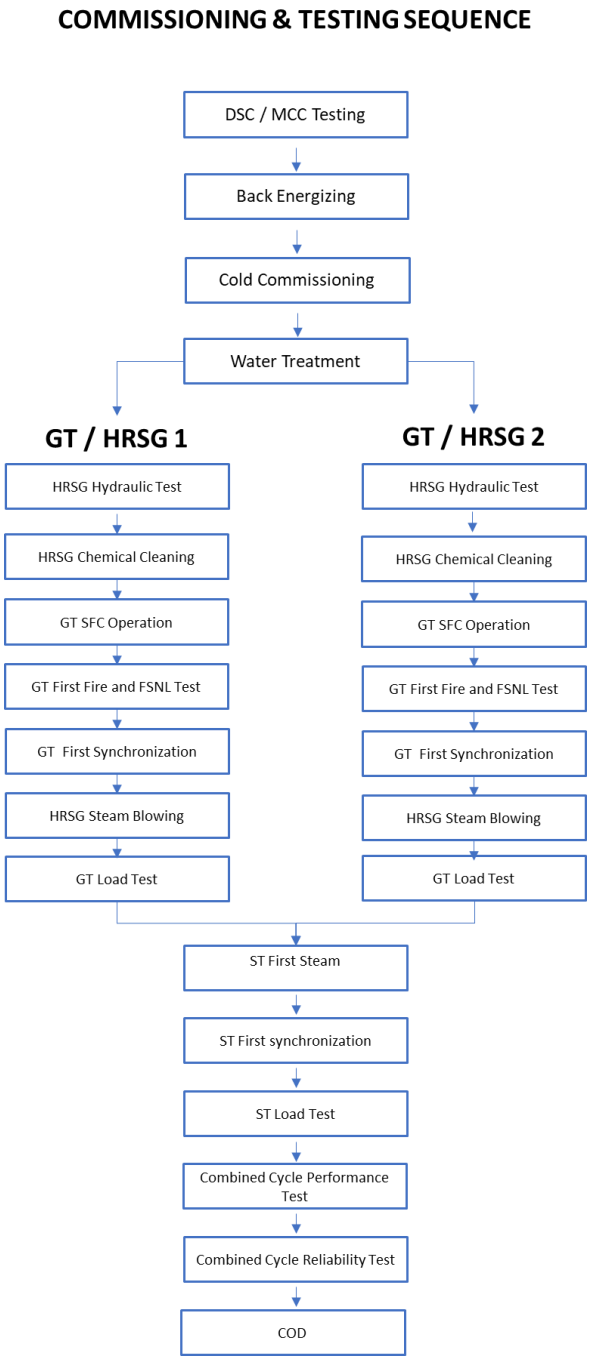


Figure 22: Commissioning and Testing Sequence of The Project

2.7 Operation Phase

During the operation phase of the proposed project, it is anticipated that the number of the workforce will be around 300 staff. During the operational phase, it is foreseen that project personnel will be responsible to arrange their own accommodation facilities, which will be most likely located in Termez.

The annual natural gas consumption will be around 2.3 million m³ for the generation of electricity.

2.8 Closure and Decommissioning Phase

The proposed plant will have a minimum lifespan of 25 years and after this period operation of the plant will be handed over to Uzbekistan Government. The closure and decommissioning activities will consist of dismantling and demolition of all structures and removal of above-ground structures. The potential impacts likely to occur during decommissioning will be similar to the ones defined for construction activities. Therefore, it has been considered that mitigation measures that are described for construction activities are valid for the decommissioning stage and shall be applied accordingly.

The decommissioning programme is uncertain and will be developed towards the end of project life. Environmental and social conditions of the receptors may be different than the current state and there might be changes in relevant legislation and technologies to be applied. Therefore, it is recommended that the Project owner shall develop the Decommissioning Plan 24 months prior to the decommissioning activities. In conclusion, the assessment of impacts during closure and decommissioning has not been considered in detail in this ESIA.

2.9 Project Schedule and Milestones

The project schedule is presented in Attachment B and key milestones are given below.

Table 11: Key Milestones

Milestones	Date
Notice to Proceed	June 2023
Site Preparation and Mobilization	July 2023
GT 1 Erection and Commissioning	February 2025
GT 2 Erection and Commissioning	September 2025
Scheduled Project Commercial Operation Date	December 2026

3. APPROACH TO ESIA

3.1 Objectives of the ESIA

The main objectives of this ESIA in relation to the Project are as follows:

- Provide an overview of the Project design, identification of sensitive receptors in the Project's area of influence, and assessment of Project alternatives including Best Alternative Technique (BAT);
- Assessment of baseline conditions (existing conditions) prior to the development of the Project through review of available data and conducting surveys;
- Assessment of the Project's environmental and social impacts during the construction, operation, and decommissioning phases;
- Review of compliance obligations, including applicable Uzbekistan regulations and international regulations and standards as well as international lender requirements;
- To engage with key stakeholders and Project affected people to disclose Project information, study outcomes, gain lay knowledge about the local environmental and social context, and seek feedback on Project;
- Determination of applicable mitigation and management measures including monitoring requirements to be implemented in order to avoid or minimize potential impacts and maximize potential environmental and social gains;
- Prepare a framework from which the construction, commissioning and operational phases respective environmental and social management systems and plans can be developed and implemented.

3.2 Structure of the ESIA

To comply with the requirements for environmental and social assessment established by international good practices, this report is presented in the following format developed by UzAssystem:

- **Volume 1:** Non-technical Summary (Non-techinical Summary of the ESIA, including the main outcomes, and conclusions).
- **Volume 2:** Main Text, Abbreviation, List of Tables, and List of Figures and Environmental and Social Management Plan
- **Volume 3:** Attachments
- **Volume 4:** Stakeholder Engagement Plan

Volume 2 consists of the main text of the ESIA, which identifies and elaborates the impact assessment with mitigation, management, and monitoring measures.

Table 12: ESIA Report Structure

Section	Contents
Volume 1: Non-Technical Summary	
Non-Technical Summary	A brief summary of the ESIA report and summary of key findings/results
Volume 2: Main Report	
Table of Contents	Provides an overview of each section including the main level headings
List of Tables	Provides a list of all tables provided in the report
List of Figures	Provides a list of all figures provided in the report
Abbreviations and Definition	Provides an explanation of the units and the key terms used within the report
Executive Summary	Summary of the main outcomes of the ESIA study
1. Introduction	Presents a general information on the project
2. Project Information	Sets out an overall description of the project activities including the activity objectives and rationale, project location, activities during the activity phases, required space for the project, activity resources and their types and sources, and the project schedule
3. Approach to ESIA	Describes the service provider who prepared the study, assessment of significant impacts, which will include methodology used for impact identification, analysis and assessment, analysis and assessment of potential impacts (for each applicable environmental component) expected to take place during the different phases of the project including cumulative and residual impacts, summary of assessment of anticipated impacts before mitigation, summary of the baseline studies and the scoping report
4. Project Alternatives	Describes the assessment methodology, "Do-nothing scenario" alternative, location determination alternatives, design alternatives, and comparison of alternatives, when applicable
5. Regulatory Framework	Outlines the relevant legal framework and guidance applicable to the Project which are considered in the study
6. Air Emissions and Ambient Air Quality	Presents Standards and Regulation, baseline condition, sensitive receptors, potential impacts, cumulative impacts and monitoring table related with air quality
7. Noise Level	Presents Standards and Regulation, baseline condition, sensitive receptors, potential impacts, cumulative impacts and monitoring table related with noise
8. Water Resources and Water Environment	Presents Standards and Regulation, baseline condition, sensitive receptors, potential impacts, cumulative impacts and monitoring table related with water resources
9. Ecology	Presents Standards and Regulation, baseline condition, sensitive receptors, potential impacts, cumulative impacts and monitoring table related with ecological conditions
10. Soil, Geology and Groundwater	Presents Standards and Regulation, baseline condition, potential impacts, cumulative impacts and monitoring table related with geology

Section	Contents
11. Solid Waste and Wastewater Management	Presents Standards and Regulation, potential impacts, cumulative impacts and monitoring table related with waste management practices
12. Traffic and Transportation	Presents Standards and Regulation, baseline condition, potential impacts, cumulative impacts and monitoring table related with traffic and transportation
13. Archaeology and Cultural Heritage	Presents Standards and Regulation, baseline condition, potential impacts, cumulative impacts and monitoring table related with archaeology
14. Landscape and Visual Amenity	Presents Standards and Regulation, baseline condition, sensitive receptors, potential impacts, cumulative impacts and monitoring table related with visual aspects
15. GHG Emissions and Climate Change	Presents impacts related with climate change and GHG generation
16. Socio-Economics	Outlines the baseline social and economical condition of the project affected area, potential impacts
17. Public Consultations	Describes the public consultations that are already performed and planned consultation activities
18. Livelihood Restoration	Sets out the legislation and the framework regarding livelihood restoration
19. Labor and Working Conditions	Presents Standards and Regulation, baseline condition, sensitive receptors, potential impacts, cumulative impacts and monitoring table related with working conditions
20. Community Health, Safety & Security	Presents Standards and Regulation, baseline condition, sensitive receptors, potential impacts, cumulative impacts and monitoring table related with community health and safety
21. Human Rights Impact Assessment	Presents Standards and Regulation, baseline condition, sensitive receptors, potential impacts, cumulative impacts and monitoring table related with human rights
Volume 3: Attachments	
Attachment A	Letter & Conclusions from State Committee on Ecology & Environmental Protection
Attachment B	Overall Project Layout, Water Balance Diagram and Project Schedule
Attachment C	List of Archaeological & Cultural Sites within the Surkhandarya Region
Attachment D	Laboratory Analyzes Results
Attachment E	Hydrological Analysis Report

Section	Contents
Attachment F	Environmental Social Management Plan (ESMP)
Attachment G	Chance Find Procedure
Attachment H	Minutes of Institutional Meetings
Volume 4	**Stakeholder Engagement Plan (SEP)**

3.3 ESIA Team

UzAssystem has engaged in preparing Local EIA and ESIA Report for this project. This includes supporting the Project consortium up to Financial Close with their prospective lenders.

In order to ensure that the Project meets the requirements of the State Committee on Ecology and Environmental Protection, UzAssystem has been subcontracted and will be responsible for some elements of the ESIA process, including baseline studies, stakeholder identification and engagement/consultation, and liaison with relevant government authorities in Uzbekistan. The team of the ESIA Project is presented Table 13.

Table 13: Project ESIA Team

Name	Position	Profession	Contribution to Relevant Chapter of ESIA	Company
Merve ACIRLI	Project Director	Environmental Engineer	Entire ESIA	UzAssystem
Ulas GUNGOR	Project Manager	Environmental Engineer	Entire ESIA	UzAssystem
Hakan Bekar	Senior ESIA Specialist	Environmental Engineer	Entire ESIA	UzAssystem
H. Bülent Kadıoğlu	Senior ESIA Specialist	Environmental Engineer	Entire ESIA	UzAssystem
Ugur AKCAY	ESIA Specialist	Environmental Engineer	Chapter 6 Air Emissions and Ambient Air Quality (Air Quality Modelling)	UzAssystem
Ayse AKKURT	ESIA Specialist	Chemist	Chapter 11 Solid Waste and Wastewater Management	UzAssystem
Eylul KIRBAC	ESIA Specialist	Environmental Engineer	Chapter 11 Solid Waste and Wastewater Management	UzAssystem

Name	Position	Profession	Contribution to Relevant Chapter of ESIA	Company
Elif ALTUNTAS	ESIA Specialist	Environmental Engineer	Chapter 4 Regulatory Framework	UzAssystem
Farrukh SATTAROV	Local EIA Specialist	Environmental Expert	Chapter 4 Regulatory Framework	UzAssystem
Ozden AFACAN	GIS Manager	Hydrogeological Engineer	Preparation of maps	UzAssystem
Burcu SAHIN	GIS Specialist	Geological Engineer	Preparation of maps	UzAssystem
Damla SARACMAVIS	GIS Specialist	Geological Engineer	Preparation of maps	UzAssystem
Mert EKER	Geology Manager	Geological Engineer	Chapter 10 Soil, Geology and Groundwater	UzAssystem
Bijan DIZECI	Project Engineer	Geological/Geophysical Engineer	Chapter 10 Soil, Geology and Groundwater	UzAssystem
Huseyin EKICI	Project Engineer	Civil Engineer	Chapter 10 Soil, Geology and Groundwater	UzAssystem
Gizem ARIKAN	Biodiversity Specialist	Biologist	Chapter 9 Ecology	UzAssystem
Ozge CELIK	Social Specialist	Sociologist	Chapter 16 Socio-economics, Chapter 17 Public Consultations, Chapter 18 Livelihood Restoration, Chapter 20 Community Health, Safety and Security	UzAssystem
Buse Nur Hayta	GHG Expert	Environmental Engineer	Chapter 15 GHG Emissions and Climate Change	UzAssystem
Ercan Özbulut	Social Specialist	Sociologist	Chapter 16 Socio-economics, Chapter 17 Public Consultations, Chapter 18 Livelihood Restoration, Chapter 20 Community Health, Safety and Security	Freelance Expert
Timur Abduraupov	Herpetologist	Ecological Expert	Chapter 9 Ecology	Freelance Expert

Name	Position	Profession	Contribution to Relevant Chapter of ESIA	Company
Anna Ten	Ornithologist	Ecological Expert	Chapter 9 Ecology	Freelance Expert
Maria Gritsyna	Theriologist	Ecological Expert	Chapter 9 Ecology	Freelance Expert
Zuri Mustafayeva	Hydrobiologist	Ecological Expert	Chapter 9 Ecology	Freelance Expert
Ulugbek Mirzaev, PhD	Ichthyologists	Ecological Expert	Chapter 9 Ecology	Freelance Expert
Askar Kuvatov	Ichthyologists	Ecological Expert	Chapter 9 Ecology	Freelance Expert

3.4 ESIA Methodology

This section provides information about the data collection and consultation process undertaken to inform the ESIA and the methodology that has been used to describe the sensitivity of environmental and social receptors; predict the magnitude of environmental and social impacts and assess the significance of impacts upon applicable environmental parameters.

The purpose of an ESIA is to identify the positive and negative impacts caused by project implementation. This is assessed through an analysis of the effects resulting from the interaction between environmental and social components and the various activities of a project and its development, including temporary (for example, during construction) and associated facilities.

The international ESIA flowchart is presented in Figure 23.

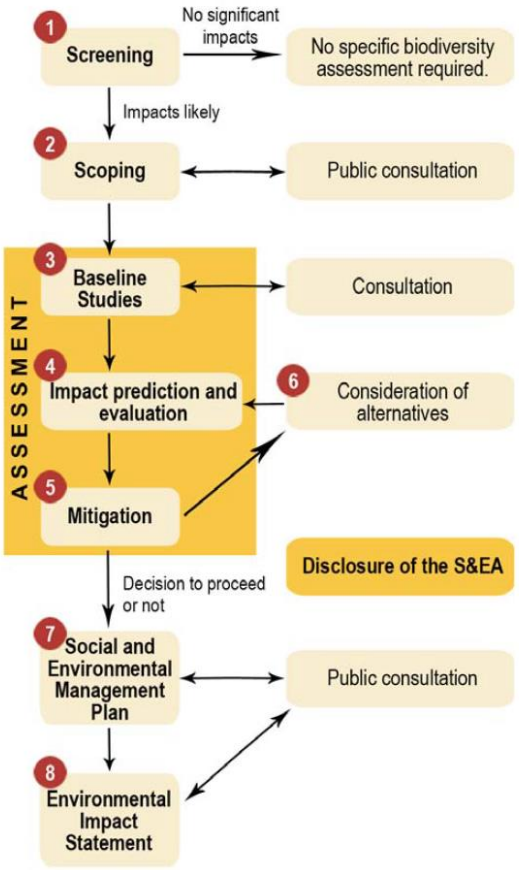


Figure 23: International ESIA Process Flowchart (extracted from IFC, A Guide to Biodiversity for Private Sector)

3.5 Significance Determination Methodology

Environmental and Social impacts can be characterized as interactions between some of the project's features and some of the surrounding environment's features. The assessment of significant effects or impacts is an essential concept, which limits the consideration of the effects or impacts a project may have on the environment to those, which are significant enough to merit the costs of assessment, review, and decision-making.

The assessment of significance relies on experts' judgments about what is important, desirable, or acceptable with regard to changes triggered by the project in question.

At present, there is no international consensus among practitioners on a single or common approach for assessing the significance of impacts. This makes sense considering that the concept of significance differs across the varying political, social, and cultural contexts that Projects face.

Nevertheless, the determination of impacts' significance can vary considerably, depending on the approach and methods selected for the assessment. The choice of appropriate procedures and methods for each judgment varies depending on the Project's characteristics. Several methods, be they quantitative or qualitative, can be used to identify, predict, and evaluate the significance of an impact.

The significance of the impact will be determined in three steps as described below.

Environmental Receptors can be described as below:

- Elements of the environment that are of value to the functioning of natural or human systems (i.e. areas or elements of ecological, landscape or heritage value, soil and sediment, air and water bodies); and
- Human receptors, such as people (i.e. users of dwellings, places of recreation, places of employment, and community facilities), and human systems (e.g. employment market).

It should be noted that the sensitivity of the social receptors has been identified according to the field survey observations, which has taken into consideration the stakeholder feedback received through the ESIA study. The overall magnitude of the impacts has been determined by using professional judgement in consideration of the geographical extent, reversibility, duration and frequency of the impact.

The receptors are described in terms of their spatial importance and/or the sensitivity of that receptor to change due to potential impacts. The environmental value (or sensitivity) of the receptors identified will be defined using the criteria in Step 1.

Step 1: The value and sensitivity of the receiving environment/receptor will be rated according to the following scales.

Value and Sensitivity	Physical Receptor	Human Receptor	Biodiversity Receptor
High	Little or no capacity to absorb proposed changes and has national or international value e.g. receptors where people or operations are particularly susceptible to noise or air quality changes)	Receptors with high vulnerability and permanent presence within the direct or indirect AOI (e.g. school, poor or vulnerable household, hospital). No capacity to absorb project changes or no opportunity for mitigation.	Substantial loss of ecological functionality
Medium	Moderate capacity to absorb proposed changes e.g where it may cause some uncomfort or distraction or disturbance	Receptors with moderate to high vulnerability and or somewhat affected by project impacts. Limited capacity to absorb changes. Potential opportunities for mitigation	Moderate but sustainable change which stabilises under constant presence of impact source, with ecological functionality maintained
Low	Good capacity to absorb proposed changes and not protected or has low value	Receptors with low to moderate vulnerability, or are located in the AOI infrequently. Good capacity to absorb changes with no	Species or community unaffected or marginally affected

Value and Sensitivity	Physical Receptor	Human Receptor	Biodiversity Receptor
	e.g. receptors where the disturbance is minimal.	lasting effects, or good access to mitigation measures.	
Negligible	No or negligible importance and rarity, site scale. The receiving physical environment is tolerant of the proposed change	No or negligible importance and rarity, site scale. The receiving human environment is tolerant of the proposed change	No or negligible importance and rarity, site scale. The receiving biological environment is tolerant of the proposed change

The impact is the change of state of the environment which is caused by project activity. In general, this change can be measured or estimated in some manner. The magnitude of the impacts is classified as mentioned in Step 2.

Step 2: The magnitude of impacts will be rated according to the following scales.

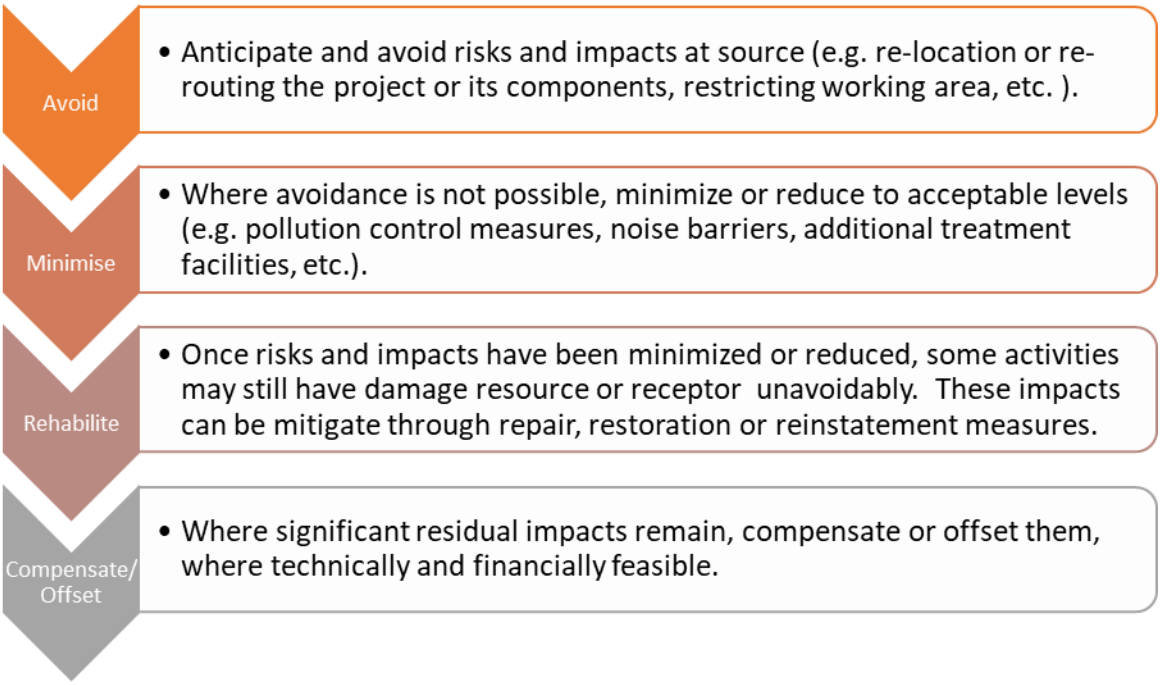
Impact Magnitude	The Magnitude of The Impact Scale
High	Loss of resources and/or quality and integrity over a significant area; severe change/damage to key characteristics, features or elements, for more than 2 years
Medium	Loss of resources, but not adversely affecting the integrity over a significant area; partial loss of/damage to key characteristics, features or elements, for more than 6 months but less than 2 years
Low	Some measurable change in attributes, quality or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
Negligible	Little or no measurable change in attributes, quality or vulnerability

Once the value and sensitivity of the receptor and magnitude of the impacts are assessed, the significance of the impact will be derived as mentioned in Step 3.

Step 3: The significance of impacts will be assessed as below.

		Receptor Sensitivity			
		High	**Medium**	**Low**	**Negligible**
Impact Magnitude	**High**	**Major**	**Major**	**Moderate**	**Minor**
	Medium	**Major**	**Moderate**	**Minor**	**Negligible**
	Low	**Moderate**	**Minor**	**Minor**	**Negligible**
	Negligible	**Minor**	**Negligible**	**Negligible**	**Negligible**

After completion of the significance of the impact determination, mitigation and enhancement measures is evaluated. The mitigation hierarchy is used to limit the negative impacts and manage risks. Mitigation hierarchy is a step-by-step process as given below. In this hierarchy, avoid at source is more preferable and compensate is undesirable.



Residual impacts are those impacts that are predicted to remain after the application of all the proposed mitigation measures. Residual significant impacts need to be carefully monitored and managed during the implementation phase of the project. The adverse impacts that cannot be avoided or removed completely should be minimized, and finally, those which remain significant and cannot be reduced further have to be accepted. For significant residual effects, it may be necessary to provide compensation or offsetting. This is where some other aspect of the environment is developed or managed in a manner that offsets unavoidable significant effects.

3.6 Scope and Objectives of the ESIA

The project investor plans to apply to international finance institutions (IFIs) for the financing of the Project. Therefore, the Project owner requested this ESIA to meet the IFIs' requirements in accordance with AIIB and IFC.

The purpose of this ESIA is, like local EIA, to identify potential environmental and social impacts to be originated from the project activities during construction, operation, and decommissioning phases, and to propose concrete measures to avoid, reduce or mitigate such potential impacts and risks to the extent possible.

The most significant disparity between the local EIA and international ESIA processes is baseline environmental surveys. However, there are similar approaches for illuminating the public about the project and presenting EIA to the public. In accordance with World Bank processes, at the ESIA procedure period at the beginning phase of the work, acknowledgment of the public process is conducted. During this process, it may be easily presented that the public becomes sensitive and has valued issues and expectations about decreasing the environmental impacts to the lowest level.

ESIA processes are being conducted in compliance with European Union EIA instructions (97/11/EC numbered instruction and varied 85/337/EEC numbered instruction). On the other hand, the projects

financed jointly with the World Bank's common finance supply are accepted by other finance institutions. To determine the environmental and social expectations from the projects, the standard assessment and examination procedure has been applied that is called "IFC-PS's" which is accepted by most of the finance corporations.

The national EIA procedure usually does not bring out the need for conduction of a socio-economic survey, usually existing literature data is satisfactory to make a social impact assessment of a project for both projects. Therefore, further studies were carried out for understanding the existing socio-economic conditions and the perception of the affected communities about the project with the intention to get the real impacts of the project on the communities in compliance with the IFIs' requirements. The social study was initiated with the determination of the objectives of the study and the desktop studies to gather secondary data. During the following data collection process, determination of the study area covering the potentially affected settlements, design, and selection of the sampling, training of the personnel to be assigned for the site survey and the data collection were the steps. This phase of the social study is followed by the analysis of the data collected, evaluation of identified impacts and mitigation, and reporting. The primary data was collected through literature data.

During the following data collection process, determination of the study area covering the potentially affected settlements, design, and selection of the sampling, training of the personnel to be assigned for the site survey and the data collection were the steps. This phase of the social study is followed by the analysis of the data collected, evaluation of identified impacts and mitigation, and reporting. The primary data was collected by using questionnaires, interviews with the authorities, and stakeholders.

Another difference between the national EIA Report coverage and internationally accepted ESIA Report coverage is the need for the development of appropriate environmental and social monitoring program. For this purpose, the Environmental and Social Management System (ESMS) will be developed.

Other additional studies conducted within the context of the international ESIA Report coverage are as follows:

- Detailed social and environmental impact assessment was conducted.
- Applicable national and international social and environmental standards are presented.
- Environmental Management System is explained for application during the implementation of the project.
- A grievance procedure is developed to forward any complaints, which the public may be faced, to a competent person/authority, promptly and transparently.

Furthermore, the agreements including all the commitments mentioned in the Report should be prepared and signed mutually with construction and operation contractors (if any). During the period of construction and operation, all activities and results thereof should be inspected and reported by an independent environmental consultant or by an environment monitoring firm. All progress and events should be reported to the institutions that provide financial support during all phases of the project, regularly.

3.7 Environmental and Social Categorization and its Rationale

The project is considered as Category I of environmental impact with a high risk according to the national Law "On Environmental Expertise" and the Decree of the Cabinet of Ministers of 07.09.2020

No.541 "On further improvement of the mechanism of environmental impact assessment". Hence, first stage of the Environmental Impact Assessment report (national acronym - PZVOS) was developed for this facility and a positive Conclusion of the State Environmental Expertise of the Republic of Uzbekistan No.04-01/10-08-1655 dated September 29, 2021 was obtained. As the Stage III of national EIA process the 'Statement on Environmental Consequences' ('ZEP' is the national acronym) represents the final stage of national EIA process and it will be conducted before the project is commissioned.

The project investor plans to apply to international finance institutions ("IFIs") for the financing of the Project. Therefore, the project owner requested this ESIA to meet the IFIs' requirements in accordance with AIIB and IFC.

Although AIIB and IFC standards are used in the report, equator principles are also taken into consideration to determine project categorization and used in some relevant parts of the project report.

As per AIIB ESP, the AIIB screens and categorizes each Project as early as feasible at the outset of its due diligence assessment of the Project in order to determine the nature and level of the required environmental and social assessment, information disclosure and stakeholder engagement required of the Client for the Project. In its categorization, the AIIB takes into consideration the type, nature, location, sensitivity and scale of the Project, so that the Client's assessment is proportional to the significance of the Project's potential environmental and social risks and impacts.

The AIIB determines the Project's category on the basis of the Project's component presenting the highest environmental or social risk and potential impacts (including direct, indirect, cumulative and induced impacts, as relevant, in the Project area). The Bank reviews these environmental and social risks and impacts, regardless of the categorization being considered.

As per categorization of AIIB ESP, the Project is considered as Category A, which is s likely to have significant adverse environmental and social impacts that are irreversible, cumulative, diverse or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works and may be temporary or permanent in nature. For Category A projects it is required to prepare:

- an environmental and social impact assessment (ESIA) or equivalent environmental and social assessment, for each Category A Project, and
- an environmental and social management plan (ESMP) which is included in the ESIA report for the Project.

The ESIA for a Category A Project examines the Project's potential environmental and social risks and impacts, both positive and adverse, compares them with those of feasible alternatives (including the "without Project" alternative), and recommends any measures needed to avoid, minimize, mitigate, offset or compensate for adverse impacts and improve environmental and social performance of the Project.

Pursuant to Equator Principle 1, the project(s) is categorized as per the magnitude of potential impacts. As part of their review of a project's expected social and environmental impacts, EPFIs uses a system of social and environmental categorization, based on the IFC's environmental and social screening criteria, to reflect the magnitude of impacts understood because of assessment.

In that regard, the Project is a Category A project in accordance with Equator and IFC's Environmental and Social Sustainability Policy.

Key environmental and social items considered applicable to this appraisal include:

- The company's capacity;
  - Identify, assess and manage Environmental and Health&Safety risks and impacts associated with its construction and operation of the Project,
  - Identify and manage Occupational Health and Safety ("OHS") risks and impacts associated with;
  - The primary supply chain of operations;
  - Labor and working conditions;
  - Management of wastewater, air emissions, wastes and hazardous materials; and
  - Land acquisition.

In conclusion, since the project is assessed as High Risk project both under the national legislation and international standards, which require a full ESIA study.

3.8 Baseline Studies and Research

Forming an integral part of the ESIA, the baseline surveys provide a benchmark of the existing conditions by which the potential impacts of the proposed project can be assessed for the construction and operational phase. This ESIA has been informed by a review of relevant desktop information as well as a series of physical site surveys which have been summarized in the relevant environmental and social impact assessment Sections of this report. The environmental and social baseline surveys carried out as part of the ESIA included is given in Table 14.

Table 14: Environmental and Social Baseline Surveys

Site Surveys	Period
Terrestrial Ecology Surveys	17th July 2021
Irrigation Reservoir(lake)	15th July 2021
Soil Survey	15th July 2021
Groundwater and surface water sampling	9-16th July 2021
Sediment and lake sampling	13th July 2021
Zooplankton and phytoplankton sampling	13th July 2021
Noise Monitoring Survey	10th to 14th July 2021
Air Quality Monitoring Survey	10th to 16th July 2021
Socio Economic Data Collection	28th July 2021
Stakeholder Consultations	This has been completed with different stakeholders on July 2021 through official letters, calls and public consultation meetings conducted.
Livelihood Restoration Surveys	15th October 2021
Terrestrial Flora and Fauna Survey	April 2022
Air Quality Monitoring Survey	20th 2022-20th August 2022
Noise Monitoring Survey	20th to 23rd August 2022 -
Socio Economic Data Collection	July 2022-August 2022
Terrestrial Flora and Fauna Survey	September 2022

Site Surveys	Period
Aquatic Survey	September 2022

It should be noted that air quality measurements were performed in line with GOST Standards via a local accredited laboratory (see Chapter 6) by taking into consideration of the following issues;

- During the operation stage, the same measurement method will be followed, to assess the current air quality and the results will be submitted to the competent authority to ensure that the proposed mitigation measures are effective.
- There are no existing major sources of emission in the vicinity of the project area, although, not wholly representative of long-term conditions, short-term measurements were deemed as acceptable to check if there exist any extreme unexpected conditions in the ambient air quality.

However, in order to assess medium term air quality, additional air quality measurements are being performed via passive diffusion tubes sampling and concentrations of SO_2, NO_2, and NO_x are monitored. The total duration of sampling period with diffusion tubes will be 4 weeks between 20 July 2022 and 20 August 2022. For each pollutant, duplicate diffusion tubes are deployed at all monitoring locations for increased accuracy. The results of the additional air quality samplings are provided in the Chapter 6 together with the updated air quality modelling study. Since there are no major industrial sources in the vicinity of the project area, there are no significant changes in the results of the air quality modelling study with the new measurement results. The impacts on sensitive receptors described in this ESIA Report were not changed.

Figure 24: Passive Diffusion Tube Sampling Campaign in July-August 2022

Similarly, noise measurements were performed according to the GOST standards by the local accredited laboratory (see Chapter 7). It should be noted that the time interval for each noise measurement was 15 minutes and the accredited laboratory has performed noise measurement every hour for two days at each sampling point, which represents a clear picture of the sampling locations. However, additional noise level measurements were performed according to the ISO 1996-2 standard at the same locations to increase the accuracy of the previous measurements. Chapter 7 of this ESIA Report was updated to include additional survey results. However, impacts on sensitive receptors described in this ESIA Report were not changed.

Regarding the social baseline survey performed in July 2021, although the number of the sampling and household surveys was calculated by using the internationally accepted statistical formula, due to Covid-19 restrictions, the planned sampling size could not be achieved and vulnerable groups couldn't be addressed well. Therefore, an additional campaign is being performed in July 2022 and August 2022 to have thorough assessment on impacts on livelihood (especially on fishers) in the vicinity of the Project area. Additional Focus Group Discussion meetings were also be performed with identified groups such as fishers, women, etc. The social baseline sections and related impacts were updated following the social survey which were performed in July-August 2022. The household questionnaire survey is presented in Chapter 16 and the Final ESIA Report presents the outcomes of the additional social site survey. It should be noted that during the stakeholder consultations performed as of July 2022, there are no concerns raised by the local people against the Project. A stand-alone Stakeholder Engagement Plan is already developed together with the Grievance Mechanism in Volume 4.

As for the ecological baseline conditions, this ESIA Report covers the terrestrial flora and fauna surveys performed in July 2021 (summer season) and April 2022 (spring season). The first two surveys revealed that there are no critical and endangered species are observed in and around of the project area. However, in order to cover multiple seasons as recommended in the IFC Guidelines, an additional terrestrial flora and fauna survey is planned to be conducted in September 2022 (autumn season) especially to observe the birds (if any) that are classified as Endangered in literature studies.

This ESIA Report includes a Critical Habitat Assessment that is prepared in line with the summer and spring season surveys. This CHA was revised according to outcomes of autumn survey. A Biodiversity Management Plan is also addressed in the Final ESIA Report, in case required.

Besides, this ESIA Report also includes the results of the aquatic survey performed in July 2021 (summer season). As similar to the terrestrial surveys, an additional aquatic survey was performed in September 2022 (autumn season). The results of this survey were also included in the Final ESIA Report.

3.9 Scoping Report

Although not legally required according to the national legislation, a Scoping Report had been prepared in July 2021 since the Project Company foresees that an environmental and social impact assessment will be in discussion to have finance from the International Finance Institutions.

The Scoping Report was prepared to determine the content and extent of information on the biophysical and social environment subject to an ESIA. The Scoping Report highlighted the key environmental issues related to the project at an early stage so that they are appropriately addressed during the successive stages of the studies. The Scoping Report also provided methodologies for the environmental baseline surveys.

3.10 Project Stakeholder Analysis and Consultations

Consultation with stakeholders is an essential part of the environmental & social assessment process. The main objective of the consultation is to establish a dialogue with those stakeholders who may be affected by aspects of the Project or who may have an interest in the outcome of the ESIA process.

3.10.1 Uzbekistan Requirements

The EIA procedure is regulated by Law on Environmental Expertise and the Regulation on State Environmental Expertise (SEE), approved by Decree No.491 of the Cabinet of Ministers on 31 December 2001 and amended in 2005 and 2009. There are two non-mandatory mechanisms for public participation in the EIA assessment procedure which include the public environmental review (PER) and public hearings. The law allows independent expert groups to organize PER but the findings are non-mandatory. However, there are no provisions for public hearings. The EIA assessment procedure Manual provides some procedural guidance by recommending organization of public hearings in the course of the draft EIA preparation. Review of past development Projects in Uzbekistan shows that public consultations in Uzbekistan do not generally involve public consultations and is limited to local, regional, and national authorities as applicable. Such recommendations (which do recommend public hearings during EIA) are described in the Resolution of the Cabinet of Ministries of the Republic of Uzbekistan No. 949.

3.10.2 Lender Requirements

As per AIIB ESP, The AIIB believes that transparency and meaningful consultation are essential for the design and implementation of a Project and works closely with its Clients to achieve these objectives. Meaningful consultation is a process that begins early and is ongoing throughout the Project. It is inclusive, accessible, and timely, and is undertaken in an open manner. It conveys adequate information that is understandable and readily accessible to stakeholders in a culturally appropriate manner and in turn, enables the consideration of stakeholders' views as part of decision-making. Stakeholder engagement is conducted in a manner commensurate with the risks to, and impacts on, those affected by the Project. In the context of a Project in which the Bank determines that there are risks of retaliation against the Project's stakeholders, or of other threats to their safety, it seeks to work with the Client so that the Client avoids or minimizes such risks.

All of the IFC Performance Standards include requirements for an amount of stakeholder consultation/engagement (either in the EIA, or as part of the future ESMS) and therefore the project will require a level of engagement. In particular, IFC Performance Standard 1 on "Social and Environmental Assessment and Management Systems" describes the stakeholder engagement requirements in more depth. It states the following:

"Stakeholder engagement is the basis for building strong, constructive, and responsive relationships that are essential for the successful management of a project's environmental and social impacts. Stakeholder engagement is an on-going process that may involve, in varying degrees, the following elements:

- Stakeholder analysis and planning;
- Disclosure and dissemination of information;
- Consultation and participation;
- Grievance mechanism; and

- On-going reporting to Affected Communities. The nature, frequency, and level of effort of stakeholder engagement may vary considerably and will be commensurate with the project's risks and adverse impacts, and the project's phase of development."

3.10.3 Project Stakeholders

Approach to Stakeholder Identification

During the ESIA studies, a systematic approach has been implemented to identify affected stakeholders. The stakeholders are identified in three different categories; project affected people, other interested parties and disadvantaged/vulnerable groups.

Project affected people are the ones who can be directly affected by the potential impacts whereas interested parties are national and international non-governmental organizations and the interested part of the civil society.

The details of the stakeholders defined for the project are presented in the SEP and the list of the stakeholders is as below:

Table 15: The List of Stakeholders

Stakeholder Group	Definitive Stakeholders	Specific Interest /Relevance/Influence
Project Affected People	• Residents of Uchkizil Mahalla (within 5 km radius of the project area) • Residents of Kattakum Mahalla (within 5 km radius of the project area) • Residents of Bahor Mahalla (within 10 km radius of the project area) • Residents of Dehqonbirlashuv Mahalla (within 10 km radius of the project area) • Residents of Ilgor Mahalla (within 10 km radius of the project area) • Residents of Karvon Mahalla (within 10 km radius of the project area) • Residents of Kayran Mahalla (within 10 km radius of the project area) • Residents of Khalqobod Mahalla (within 10 km radius of the project area) • Residents of Ilgor Mahalla (within 10 km radius of the project area) • Residents of Madaniyat Mahalla (within 10 km radius of the project area) • Residents of Markaz Mahalla (within 10 km radius of the project area)	- Affected/potentially affected from Project-related E&S risks and impacts that will be managed through the Project's future ESMS - Management of E&S impacts - Cooperation to maximise benefits and planning for local employment and the supply of goods and services

Stakeholder Group	Definitive Stakeholders	Specific Interest /Relevance/Influence
Other interested parties	• Termiz Khokimiyat • Angor Khokimiyat • District Health Department • Department of Cultural Heritage of Surkhandarya Region • Department of Cultural Heritage of Surkhandarya Region • Termiz Archaeological Museum • Termiz District Education Department • Termiz District Health Department • Angor District Health Department • Angor District Agriculture Department • Angor District Educational Department • Angor District Cadastre Department • Amu Surkhan Regional Inspection Department • Angor District Labour Department • Angor District Road Construction and Transportation • Angor MonoCentre Official Training Centre (Ministry of Labour) • Angor District Youth Department • Termiz District Agriculture Department • Termiz District Labour Department • Termiz District Municipal Department • Termiz District Cadastre Department • Academic/educational institutions	- Influence on Project-related permitting processes - Coordination of Project activities and processes, and stakeholder engagement activities - Management of environmental and social impacts - Emergency preparedness and coordination - Management of cumulative impacts
Disadvantaged and vulnerable	Women Youth Female headed households Fishermen People with disabilities People with irregular income	- Affected/potentially affected from Project-related E&S risks and impacts that will be managed through the Project's futureESMS - Ensuring that sensitive and disadvantaged Persons / Groups have access to sufficient information about the Project, ensuring that these persons / groups

Stakeholder Group	Definitive Stakeholders	Specific Interest /Relevance/Influence
		benefit equally from the benefits of the Project
Local businesses, suppliers, other industrial projects	Local companies	- Positively affected from potential Project benefits/opportunities - Supply of local goods and services related to the project - Coordination of infrastructure services - Management of cumulative impacts
Local media	National and local newspapers, local magazines and TV channels	Project information sharing with stakeholders

According to the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 541 dated 07.09.2020 "On further improvement of the mechanism for assessing environmental impact", objects of I and II categories of environmental impact are subject to the procedure for passing public hearings about environmental impact. In accordance with, the Public Hearing Meeting was conducted in Angor District 17 of August 2021.

Besides, during the ESIA study, qualitative and quantitative techniques were applied for public disclosure as Household Survey, Local Authority Disclosure and Focus Group Discussion. Household survey covered 83 household, which of 57 were in Angor and 26 of them were in Termez.

Local Authority Disclosure were conducted among 8 local authority representatives in Angor and Termez districts from 22 to 29 July, 2021.

First Focus Group Discussion (FGD) was held in Uchqizil with 24 attendances, who were the representative of Khokiyat, district statistic department, district health department, labor and social protection, mahalla on 28 July 2021.

At the same day the 2nd FGD was held in Angor with 37 attendances, who were the representative of Khokiyat, district statistic department, district health department, finance and investment department, labor and social protection, mahalla.

The main concerns raised during the first social site survey were related to the usage of Uchkizil Reservoir which has significant importance to the local people regarding irrigation, and recreational activities. The majority of the respondents highlighted that their school needs well-equipped sports center so that youth could have an opportunity to develop their skills in sports.

Additional stakeholder consultations were performed during second social site survey. The outcomes of these consultations are presented in this Final ESIA Report.

Previous stakeholder engagement activity log is presented in Table 16.

Table 16: Stakeholder Engagement Activity Log

Consultation Activity	Date	Location	Participants
Public Hearing (under national EIA Legislation)	17 August 2021	Angor	Local people and local authorities (7 women and 5 men)
1st Consultation Meeting	28 July 2021	Uchqizil	24 attendances, who were the representative of Khokiyat, district statistic department, district health department, labor and social protection, residents of Uchkizil
2nd Consultation Meeting	28 July 2021	Angor	37 attendances, who were the representative of Khokiyat, district statistic department, district health department, finance and investment department, labor and social protection, residents of Uchkizil
Local Auhority Survey	22 to 29 July, 2021.	Angor and Termez	8 local authority
Household Survey	July 2021	Angor and Termez	83 household, which of 57 were in Angor and 26 of them were in Termez

Consultation Activity	Date	Location	Participants
Additional Local Governmental Authority Survey	27 July -04 August 2022	Angor and Termez	Termiz Khokimiyat, Department of Cultural Heritage of Surkhandarya Region ,Department of Cultural Heritage of Surkhandarya Region,Termiz Archaeological Museum,Uchkizil Mahalla, Termiz District Education Department,Termiz District Health Department,Termiz Khokimiyat,Angor District Health Department,Angor District Agriculture Department,Angor District Educational Department,Angor District Cadastre Department,Amu Surkhan Regional Inspection Department,Angor District Labour Department,Angor District Road Construction and Transportation,Angor MonoCentre Official Training Centre (Ministry of Labour),Angor District Youth Department,Kattakum Mahalla
Meetings with Mahalla Reis	29 July -04 August 2022		Uckızıl, Kattakum, Zartepa, Markaz, Orol, Madaniyat, Kayran, Karvon, Khalqobod, Dehqonbirlashuv, Bahor, Ilgor, Tallashqon, Qoshtegirmon, Zang Gilambop and Namuna Mahallas Reis’
Focus Group Discussion	02 August 2022	Angor District Angor Khokimiyat Meeting Room	Women who live in Angor's mahallas (# of participants:13)
	09 August 2022	Termez District Termez Khokimiyat Meeting Room	People engaged in Agriculture and/or in Husbandry in Angor (# of participants:5)

Consultation Activity	Date	Location	Participants
	10 August 2022	Angor District Angor Khokimiyat Meeting Room	Angor Young /Unemployed people (# of participants:13)
	10 August 2022	Termez District Termez Khokimiyat Meeting Room	People engaged in Agriculture and/or in Husbandry in Termiz (# of participants:7)
	13 August 2022	Uchkizil Mahalla Committee Meeting Room	Women who live in Termiz's mahallas (# of participants:7)
	13 August 2022	Uchkizil Mahalla Committee Meeting Room	Termiz Young /Unemployed people (# of participants:6)
Household Surveys	July-August 2022	Angor and Termez	A total of 412 household survey were conducted, the breakdown is as follow: Uchkizil – 33 Kattakum – 37 Zang Gilambop -15 Namuna-20 Orol -31 Khalqobod-31 Bahor-25 Markaz-20 Zartepa-30 Dehqonbirlashuv-24 Ilgor-25 Karvon-25 Kayran-30 Madaniyat-21 Qoshtegirmon-25 Tallashqon-20

4. PROJECT ALTERNATIVES

4.1 Do-nothing Scenario

The Uzbekistan 2030 Energy Strategy defines the mid-term and long-term objectives and directions for the development in the power sector between 2020 and 2030. The main objectives include:

- Satisfying the country's electrical power demand in full through domestic generation without dependence on energy imports and thus ensuring energy security;
- Improvement of national economy's energy efficiency with parallel reductions in energy intensity achieved through, inter alia, creation of economic mechanisms to stimulate rational use of electrical power to consumers;
- Increase the energy efficiency of generation, transmission, and distribution of electrical power to satisfy the growing demand;
- Reduction of power equipment wear through consistent renewal, increasing reserves in generation and transmission assets;
- Development and expansion of renewables use and their integration into the unified power system; and
- Development of efficient basic electricity market model.

In order to efficiently fulfill the objectives above and achieve the targeted goals, implementation the strategy calls for the implementation of the following measures:

- Improvement of efficiency and rationale use of electricity at all stages of technological processes based on the use of energy saving technologies and optimization of generating assets;
- Ensuring diversification in power and heat energy sectors through increased share of renewable energy sources and creation of renewable energy investment project mechanism utilizing PPP approaches, enhancement of government policies related to development of renewable energy sources, demonstration of renewable energy projects;
- Development of comfortable, rule of law based, administrative environment for investments and wholesale power sales with a view to attract long term investments first of all foreign direct investments;
- Enhancement of corporate governance, increasing transparency of state-own power enterprises' financial and economic operations;
- Expansion of trans-boundary trade and strengthening of regional cooperation through the reinstatement and modernization of transmission lines connected to neighbouring countries' power systems; and
- Development of market relations through step-by-step liberalizing and reduction of government role, creation of a new market model based on clear separation of rights and responsibilities between actors in this sector at each step of market evolution, starting from Single Buyer and all the way to establishment of competitive wholesale and retail markets.

In regard to the Project, its development is in line with the use of energy efficient technologies to ensure the power sector's overall sustainability. The strategy aims to increase efficiency of the plant

during construction of new power plants operating in base-load condition, the use of combined cycle technologies with generator efficiency over 60%.

The government of the Republic of Uzbekistan through the Ministry of Energy aims to modernize and increase the electricity production in the country to foster economic growth and develop public-private partnership in the country's energy sector. The project forms part of the Ministry of Energy's plan to increase and modernize electricity production in the country.

The project also forms part of the Strategy of Action for the Five Priority Development Areas of Uzbekistan (2017 -2021) to introduce new technologies for generating thermal energy as the Project is being implemented as heat recovery in order to generate electricity.

In 2018, Uzbekistan ratified the Paris Agreement and adopted a national commitment to reduce GHG emissions per unit of GDP by 10% of the 2010 level by 2030. In addition, in 2020, the Ministry of Energy published its plans for the Power capacity development in Uzbekistan for the 2020-2030 period in a document called "Concept note for ensuring electricity supply in Uzbekistan in 2020-2030". The document talks in length about Uzbekistan's plans to rebuild its existing power plants, invite private power developers to take part in the power sector development to increase the power production capacity, lays out the plans for reforms, etc. The Concept Note states that "*Construction of a 1300MW TPP utilizing CCGT technology is planned in Kashkadarya or* ***Surkhandarya*** *regions to be commissioned in 2025-2026*."

Taking into consideration of Uzbekistan's national electricity strategy, "Do-Nothing scenario" is considered as not applicable alternative, since it does not align with objectives of the Ministry of Energy. Besides, the project will lead decommissioning of inefficient existing thermal power plants and will contribute to the effective use of natural gas resources that will result in decreasing CO2/kwH intensity.

Also, an alternative to the decisions made can be a "zero" option, i. E. abandonment of the planned activities and preservation of the existing situation in the region. In this case, there will be no:

- Ensured the accelerated development and increase in the competitiveness of the country's energy sector;
- The active attraction of foreign direct investment in the construction of new generating facilities;
- The growing demand for electricity and heat was satisfied;
- Reduction of specific indicators of fuel consumption in comparison with traditionally used power units;
- Increasing production efficiency.

4.2 Site Selection

Three possible sites were suggested by the Ministry of Energy for the project location. The locations of these are provided in Figure 25. All three sites were visited during the concept development stage, and consultation was held with local municipality.

Figure 25: Approximate Location of Three Sites Allocated for Proposed Project

The suitability of the three sites was reviewed and comparatively ranked for the following criteria, and the outputs are summarised in Table 17.

- technical constructability
- environmental risks
- social risks

The outputs of the comparative assessment indicated a preference for Option 3 based on E&S considerations. Beside the below analysis based on E&S, Option 1 is too small for the plant as well.

The lengths of the new access road and OHTL connection required are less in the Option 1. However, E&S impacts and risks of Option 3 (the selected) on the sensitive receptors during access road construction are temporary and can be managed properly with the implementation of appropriate preventive measures. Besides, E&S impacts and risks of OHTL connection on the biodiversity throughout the Project life cycle will be minimized by selecting the route in a manner to minimize the impacts on the biodiverstiy during design stage, placement of anti-bird devices, installment of bird divertors and erection of line protection relays in the case of natural disaster or accident. On the other hand, Option 1 is closer to the industrial receptors. Considering the cumulative impacts due to existing industrial neighbours, Option 1 has E&S risks on the sensitive receptors that are more difficult to be managed throughout the Project life cycle compared with Option 3. Option 2 has the most significant E&S risks. Thus, Option 3 was selected among the three options.

Table 17: Comparative Analysis of Alternative Sites

Aspect	Option 1	Option 2	Option 3 (selected option)
Constructability – Power plant / OHTL and gas pipeline	Constructability (once access is achieved) is consider having the same E&S impact for all three options (1)		
Constructability - road	New access road required (~400m) (1)	New access road required (~400m (1)	No existing access road. New access road required (~800m) (2)
Natural resource use and waste (gas pipeline)	New gas pipeline connection from the north – no difference in length. (1)		
Natural resource use and waste (OHTL)	The New OHTL connection length is (~0km) (1)	The New OHTL connection length is (~2km) (3)	The New OHTL connection length is (~0.5km) (2)
Landscape and visual impact (LVIA)	Industrial receptors as neighbour (2)	Local receptors close to the site (farming field) and nearby on the other site of the main road (3)	No receptors on the site or nearby (1)
Habitat loss /disturbance (compaction)	Assumed to be broadly similar for all options (1)		
Species disturbance	Assumed to be broadly similar for all options (1)		
Cultural heritage	Assumed to be broadly similar for all options (1)		
Local air quality (construction)	Industrial receptors Potential for cumulative AQ impacts. (2)	Local receptors on the site and nearby (3)	The nearest receptors are more than 1.5 km from the site (1)
Environmental noise and other nuisances (e.g., construction works)	Industrial receptors neighbour site. Potential for cumulative AQ impacts. (2)	Local receptors on the site and nearby (3)	The nearest receptors are are more than 1.5 km from the site (1)

Involuntary resettlement (economic and physical resettlement)	No IR anticipated (1)	Local receptors on the site and nearby. Livelihood restoration is required, as also possible physical resettlement (3).	No IR anticipated (1)
Comparative Ranking Total	14	21	13

This ESIA Report was mainly developed according to the Project location information received from the Sponsor on July 2021, however the geographic coordination of Project location altered on April 2023. Accordingly, necessary revisions were made throughout the ESIA Report in a manner to present updated Project location.

4.3 Alternative Design Options

In recent years, significant positive changes have been observed in the legislation of the Republic of Uzbekistan, aimed at both increasing the efficiency of the energy industry enterprises, introducing energy-efficient technologies, and increasing the investment attractiveness of this sector of the economy as a whole.

It should be noted that within the framework of the "Concept for the provision of the Republic of Uzbekistan with electric energy for 2020-2030" it is provided:

- Increase in electricity production from 63.6 billion kWh·up to 120.8 kWh;
- Reducing the consumption of natural gas in the production of electricity from 16.5 billion cubic meters to 12.1 billion cubic meters;
- Reduction of losses during transmission of electricity to 2.35% and losses during distribution - to 6.5% (1.85 times less than in 2019).

The implementation of these plans will ensure the country's energy security, taking into account the forecasts that in 10 years' energy consumption in Uzbekistan will almost double.

At the same time, today the bulk of generating capacities (about 85%) are thermal power plants, in connection with which, by 2030, it is predicted to commission 15.6 GW of new and modernized small generating capacities of thermal power plants. At the same time, decommissioning of 6.4 GW of physically obsolete equipment of generating capacities at large TPPs is forecasted.

It is noted that plans to reform the electric power industry of Uzbekistan until 2030 have already been voice earlier in the summer of 2019. It was assumed that the structure of generating capacities by 2030 will look as follows: power units using natural gas will reach 16.3 GW, or 51% of the total capacity (the year 2020 33%), HPPs - 3.8 GW, or almost 12% (the year 2020 - 16%), power units using coal, 2.6 GW, or 8.2% (the year 2020 - 11%).

Decentralization and construction of low-power TPPs, such as the proposed project for the construction of a combined-cycle power plant with a capacity of 1600 MW in the Angora district of the Surkhandarya region will lead to a significant reduction in electrical energy losses during its transportation, as well as a reduction in fuel consumption and, accordingly, emissions of pollutants into the atmospheric air.

When considering the issue of commissioning additional capacities for the production of electrical energy and the construction of a thermal power plant in the Surkhandarya region, it was also assumed to obtain electrical energy using diesel generators working on diesel fuel.

The proposed diesel generator is designed to generate electricity in conditions of unstable or no power supply. A diesel generator also converts mechanical energy from the combustion of diesel fuel into electrical energy.

Analysis of all parameters, including the type of fuel used, fuel consumption per 1 kW / h of about 150 g, efficiency, and, accordingly, the amount of electricity produced showed that, in comparison with diesel generators, combined-cycle plants operating on gas to generate electricity consume 2.5 times less fuel and efficiency will be 60%.

In this regard, it was decided to build a combined cycle power plant - a new generation, with a capacity of 1600 MW in the Angora region to supply power to the border regions (Muzrabad, Termez) districts of the Surkhandarya region, as well as the city of Termez.

4.3.1 Cooling Technology

The Cooling methods are a particularly key aspect of alternative analysis. Water availability in Uzbekistan (including the Project area) is highly variable, relatively scarce, and a vital resource to the local agriculture. Furthermore, it is possible that regional water scarcity could increase as a result of climate change, although local climate models also predict an increase in river flow (up to 2050 and for the period of the Project's Power Purchase Agreement) due to additional meltwater from glaciers that (in part) feed these rivers. A range of cooling techniques are available and have been considered in the design of the Project. These include 'Wet Cooling Towers'; and 'Air-Cooled Condensers'. Schematic illustrations of these techniques are provided below between Figure 26 and Figure 28.

Table 18: Natural Gas Composition

2-2-1 SGT 9000HL GTCC @ 17°C / 55% RH	Unit	Air-Cooled Condenser	Wet Cooling Tower-1	Wet Cooling Tower-2
Gas Turbine Gross Power	[MW]	1103	1103	1103
Steam Turbine Gross Power	[MW]	533	534	563
Gross Power	[MW]	1636	1637	1666
Aux. Load & Transformer Losses	[MW]	33	34	37
Net Power	[MW]	1603	1603	1629
Net Electrical Efficiency	[%]	62.01	62.02	63.02
Cooling Tower Blowdown & Spray Losses / Drift	[t/h]	-	240.5	241.5
Cooling Tower Water Evaporation	[t/h]	-	962	966
Steam Cycle Makeup				
@ 1% HRSG Blowdown	[t/h]	13.08	13.14	13.76
@ 2% HRSG Blowdown	[t/h]	25.51	25.63	26.22
Cooling System	-	See Figure 26	see Figure 27	see Figure 28

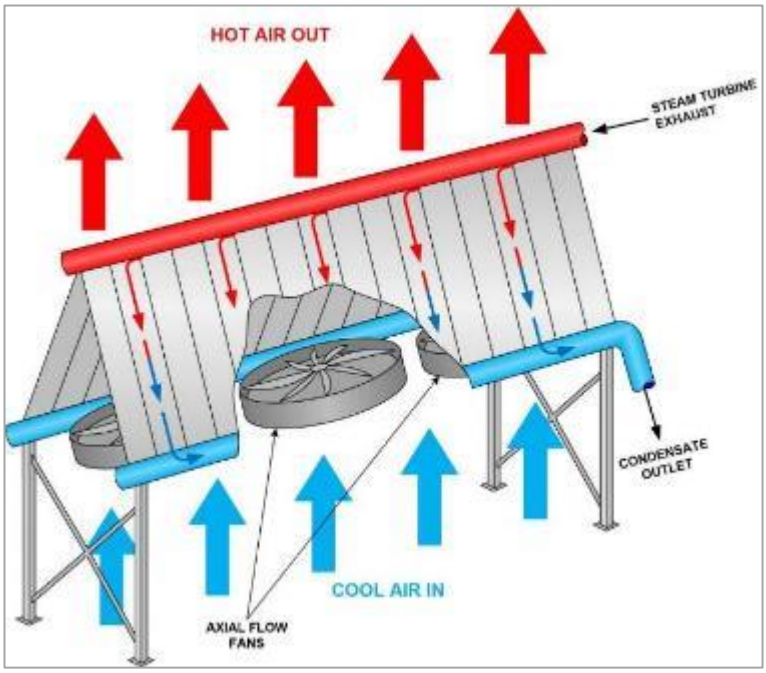


Figure 26: Sample of the Air-Cooled Condenser System [2]

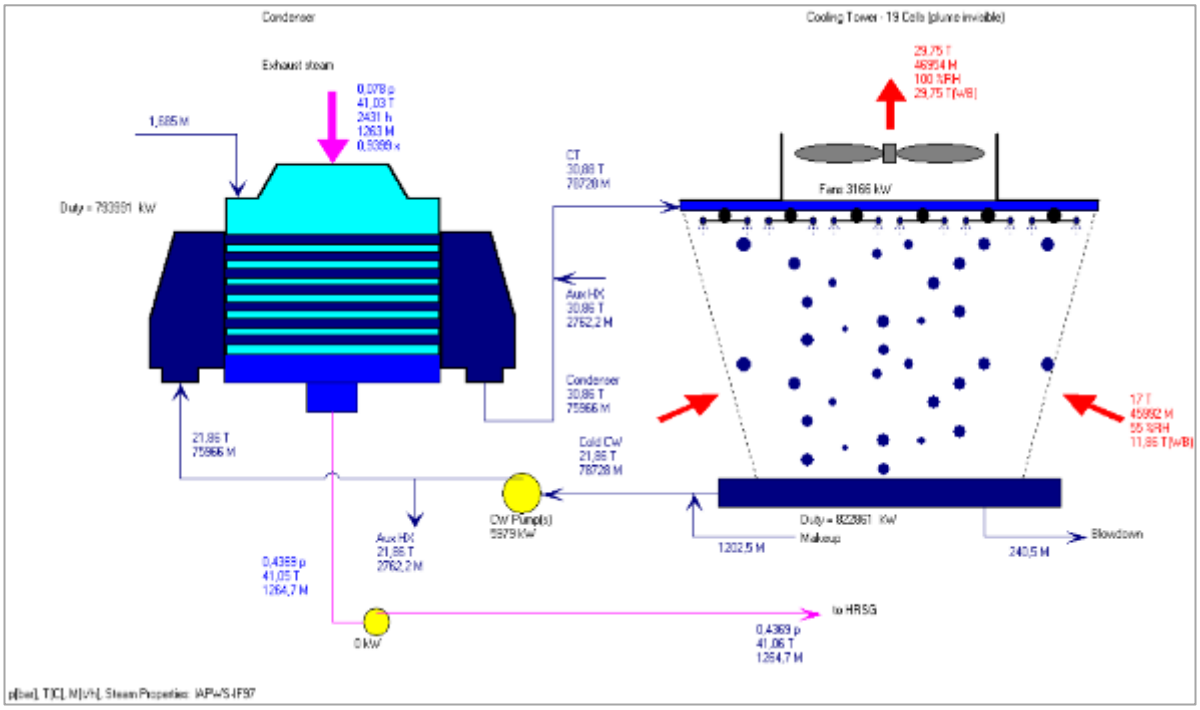


Figure 27: Sample of the Wet Cooling Tower System-1

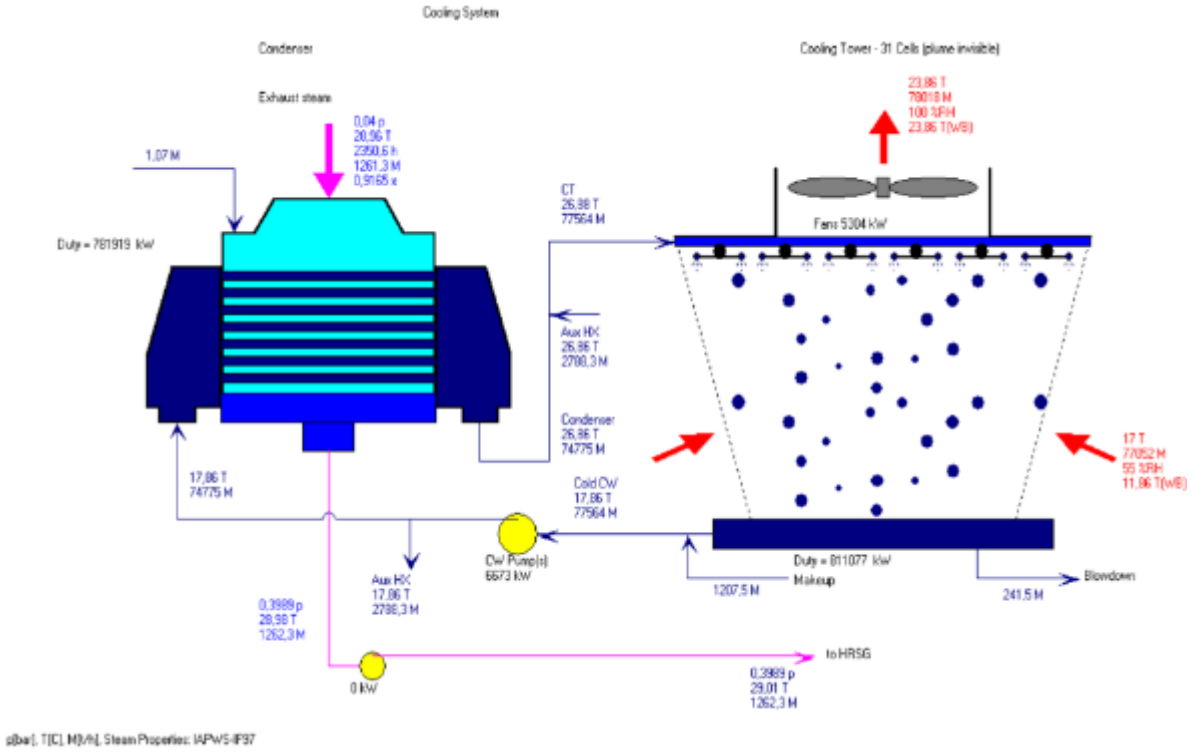


Figure 28: Sample of the Wet Cooling Tower System-2

The selected cooling approach is an air-cooled condenser. Even though it is slightly less efficient than other options, it requires less water than wet cooling tower, considering the fact that water is a scarce natural resource in Uzbekistan. As noted above, the impact on the overall energy efficiency does not affect the ability of the plant to operate within GIIP energy efficiency parameters.

4.3.2 Combustion Technology

The Project has selected to use the most advanced gas turbine technology at present. During the concept design stage, consideration was given to several supplier options. An analysis of these options for maximizing energy efficiency and addressing environmental protection is provided in Table 20. An energy efficiency level associated with GIIP, and best available techniques (BAT-AEEL) refers to the ratio between the combustion unit's net energy output(s) and the combustion unit's fuel/feedstock energy input at actual unit design. The net energy output(s) is determined at the combustion unit boundaries, including auxiliary systems (e.g., flue gas treatment systems), and for the unit operated at full load. BAT-AEELs are expressed as a percentage. The fuel/feedstock energy input is expressed as a lower heating value (LHV). A comparison of the combustion systems considered for this Project is provided in Table 19. The analysis findings indicated that all meet BAT-AEELs or IFC Guidelines for energy efficiency, and the final selection was determined based on the option that was determined to provide the most electrical output (Siemens SGT5-9000HL).

Table 19: Comparative Assessment of Energy Efficiency and Other Environmental Considerations for Process Selection

Technology	Expected net plant heat rate (KJ/kWh	Net electrical efficiency	IFC EHS Guidelines TTP (2017) /BAT-AEELs	Efficiency: % Gross, LHV	IFC EHS Guidelines TTP (2017)	SCR required (NH3 emissions)
Ansaldo GT36-S5	5937	60,63	46-62	62,88	51	No
GE 9HA.02	5804	62,03	46-62	64,33	51	Yes
MHPS 701 JAC	5841	61,63	46-62	64,12	51	Yes
Siemens SGT5-9000HL (selected option)	5867	61,36	46-62	63,51	51	No

Several other features of the combustion system contribute to maximizing energy efficiency and minimizing E&S impacts. Table 20 summarises other characteristics of the combustion system that contribute to maximizing energy efficiency.

Table 20: Summary of Other Energy Efficiency Optimization Approaches

General techniques to increase the energy efficiency of natural-gas-fired boilers, gas turbines and engines	Applicability to Project
Combustion optimization – The power plant is designed to run in line with industry best practices	The Project uses Gas Turbines in Combined Cycle mode for electricity production.
Advanced control system for the gas turbine and subsequent recovery boiler	Advanced control systems are applied, including high-performance monitoring.
Optimization of the working medium conditions	As enabled by GT exhaust temperature of over 650oC and the advanced materials available in the market, the HP and HRH steam temperatures are both at 600 oC and above to increase thermal efficiency. The power station operates at the highest possible flue gas/steam temperature and pressure while maintaining NOx emissions below the permitted ELV.
Optimization of the steam cycle	The steam cycle has been optimized to reduce the condenser cooling water to the lowest temperature possible within design conditions

In addition, the following additional measures will be employed to operate the plant with minimal impact on the environment.

Table 21: General Measures for Reducing Environmental and Social Impacts

Action	Description for mitigating and managing environmental and social impacts
Environmental Management **OHS Management**	The Project will implement and adhere to an environmental (and social) management system (ESMS) that is aligned with the plan, do, check and review requirements of ISO14001 and ISO 45001. The ESMS also includes preparing an air management plan (including dust management) (including GHG emissions), water discharge management plan, noise management plan, waste management plan and OHS plan.
Environmental Monitoring	Monitoring for the following will be performed: Energy efficiency CEMS is included at the flue gas emission point (NOx, CO) Wastewater (from flue gas treatment) monitoring
Measure to reduce NOx emissions to air	Low-NOx burners (LNB) are proposed, which represent GIIP for the control of NOx emissions. Regular testing of fuel quality.
Measures to reduce CO and unburnt substances	Automated flue blending and mixing to ensure stable combustion. Regular planned maintenance according to suppliers' recommendations Advanced control system
Measure to reduce emissions of ammonia	No SCR required. Meet emissions limits for NOx.
Continuous Emissions Monitoring System (CEMS)	To be installed on main stacks.
Measure to reduce discharges to Water	De-mineralizers are regenerated, and the effluent is neutralized before discharge. Condensate polisher is also included. All wastewater streams will be segregated so they may be treated separately, depending on the pollutant content so as to meet discharge limits or taken off site for treatment.

Measures to reduce noise emissions	Prevention maintenance regime for inspection and maintenance of equipment closing of doors and windows of enclosed areas, if possible Equipment operated by experienced staff Avoidance of noisy activities at night, if possible Provisions for noise control during maintenance activities

4.4 Best Available Techniques

The Project Company will meet the requirements described in the EU Best Available Techniques Reference Document prepared for Large Combustion Plants, 2017. The project will use most advanced technologies that are currently available to reduce environmental impacts.

5. REGULATORY FRAMEWORK

All phases of the E&S management of the proposed the Project shall be conducted in compliance with national and international regulations and standards as well as the standards of financial institutions. The legal framework is explained in the following sections.

5.1 National Environmental Policy and Legal Framework

The Republic of Uzbekistan (RUz) is a presidential constitutional republic, whereby the President of Uzbekistan is both head of state and head of government. According to the Constitution which was signed by the President of Uzbekistan and taken by Oliy Majlis (OM) on December 8, 1992 (as amended on 08.02.2021), have the highest legal power.

On the basis of Article 94 of Constitution Law, "*The President of Uzbekistan, shall issue decrees, resolutions and ordinances binding on the entire territory of the Republic on the basis of and for enforcement of the Constitution and laws of the RUz*".

The Cabinet of Ministers (CM) in accordance with the current legislation issues resolutions and ordinances binding on all bodies, enterprises, institutions, organizations, officials and citizens on the entire territory of the RUz.

Moreover, Article 104 of Constitution Law states, "*The Khokim (Governor of Region) within his vested powers adopt decisions which are binding on all enterprises, institutions, organizations, associations, as well as officials and citizens on the relevant territory."*

The environmental policy of the RUz is aimed at creating favorable conditions for environmental safety and environmental protection of the country, improving the environmental situation, preventing harmful impacts of waste on the environment, improving the quality and standard of living of the population work.

The National environmental legal framework is based on the regulations of the Constitution of Uzbekistan. The Constitution and environmental legislation establish the right of citizens to live in a safe environment. Constitution of the RUz addresses environment protection issues within specific articles are:

- Article 36: "Everyone shall have the right to own property."
- Article 50: "All citizens shall protect the environment";
- Article 53: "The State shall guarantee freedom of economic activity, entrepreneurship and labor with due regard for the priority of consumers' rights, equality and legal protection of all forms of ownership";
- Article 54: "Any property shall not inflict harm to the environment"; and
- Article 55: "Land, subsoil, flora, fauna, and other natural resources are protected by the state and considered as resources of national wealth subject to sustainable use".

In addition, Uzbekistan has enacted several supporting laws and legislation acts for management of environmental, land rights, labor and health and safety requirements, and is a party to several international and regional environmental agreements and conventions. In order to implement the laws efficiently, the majority of them require additional administrative and/or legal instructions for full execution and these are set out in various subordinate regulations, acts and sanitary norms [4]. The most relevant legislation for the Project is described in the following sections.

5.1.1 Environmental Regulator

State administration in the field of ecology, environmental protection, rational use and reproduction of natural resources in accordance with laws and other regulatory legal acts is carried out in the RUz by:

- The Cabinet of Ministers (CM),
- The State Committee on Ecology and Environmental Protection (SCEEP), and
- Government bodies on places.

CM (the Government) is the executive power body of the RUz, ensuring guidance over effective functioning of the economy, social and cultural development, execution of the laws, and other decisions of the Supreme Assembly, as well as decrees and resolutions issued by the President of the RUz.

The RUz are regulated numerous legislative documents, on land, water, forest, subsoil legislation, on the protection and use of atmospheric air, flora and fauna, and other acts of legislation. Relations in the field of environmental protection and rational use of natural resources are carried out by public authorities and regulatory bodies and departments/agencies specifically responsible for nature protection. The SCEEP is the main regulatory governmental body in charge of ecology, environmental protection and rational use of natural resources [4].

The authorized RUz organizations responsible for the nature protection are:

- Cabinet of Ministers;
- State Committee on Ecology and Environmental Protection;
- Ministry of Health;
- Ministry for Emergency Situations;
- Ministry of Labor and Social Welfare;
- State Committee on Industrial Safety;
- Ministry of Internal Affairs;
- Ministry of Agriculture;
- Ministry of Water Resources;
- State Committee on Geology and Mineral Resources;
- Uzbek Hydrometeorological Services (Uzhydromet) and;
- Cadastral Agency under the State Tax Committee.

5.1.2 Key Environmental Laws of Uzbekistan

The key environmental law is the Law "On Nature Protection (No: 754-XII, dated December 09, 1992, as amended on 21.04.2021)". The current Law establishes legal, economic, and organizational fundamentals for the preservation of conditions of natural environment and rational use of natural resources. Its purpose is to ensure balanced relations between man and nature, to protect the environmental system and to guarantee the rights of the population of a clean environment. The influence of economic activity on nature environment is limited by norms and quality standards established for various components of the natural environment to guarantee ecological safety of population, production, and protection of nature resources.

Article 12 of the Law states that *"Residents of the RUz are obliged to use natural resources rationally, treat natural resources with care, and comply with environmental requirements"*.

Article 25 of the Law states, *"State Environmental Expertise (SEE) is a mandatory measure for environmental protection; preceded to the decision-making process"* as saying *"the implementation of the project without a positive conclusion of SEE is prohibited" [4]*.

Furthermore, the other laws, regulating different areas of management and environmental protection are [4]:

- Law "On Environmental Control", No. 63 dated December 27, 2013, (as amended on September 30, 2020);
- Law "On Ecological Expertise", No. 73-II dated May 25, 2000 (as amended on November 22, 2018);
- Law "On Environmental Audit", No. 678 dated March 15, 2021;
- Law "On Ecological Control", No. 363 dated December 27, 2013 (as amended on August 17, 2021);
- Law "On Ambient Air Protection", No. 353-I dated December 27, 1996 (as amended on April 21, 2021);
- Law "On Protection and Use of Flora (new edition)", No. 409 dated September 21, 2016 (as amended on April 21, 2021);
- Law "On Protection and Use of Fauna (new edition)", No. 408 dated September 19,2016 (as amended on April 21, 2021);
- Law "On Protected Natural Territories", No. 13 dated January 08, 2018 (as amended on December 28, 2020);
- Law "On Forests (new edition)", No. 475 dated April 16, 2018 (as amended on April 21, 2021);
- Law "On Subsoil (new edition)", No. 444-II dated December 13, 2002 (as amended on April 21, 2021);
- Law "On Waste", No. 362-II dated April 05, 2002 (as amended on April 21, 2021);
- Law "On Water and Water Use", No. 837-XII dated May 06, 1993 (as amended on April 21, 2021);
- Law "On Rational Use of Energy", No. 412-I dated April 25, 1997 (as amended on July 15, 2020);
- Law "On Industrial Safety of Hazardous Production Facilities", No. 57 dated September 28, 2006;
- Law "On the Protection and Use of Cultural Heritage", No. 269-II dated August 30, 2001 (as amended on April 19, 2019).
- Law "On Accession of the RUz to the Cartagena Protocol on Biosafety to the Convention on Biological Diversity", No: 569 dated October 14,2019;
- Law "On Ratification of the Stockholm Convention on Persistent Organic", No.535 dated May 08, 2019; and
- Law "On Ratification of the Paris Agreement", No. 491 dated October 02,2018.

The decrees of the President of the RUz are [4]:

- "On Approval of the Concept on Environmental Protection in the RUz until 2030" No. 5863 dated October 30, 2019 (as amended on March 17, 2021);
- "On Improving the Public Administration System in the Field of Ecology and Environmental Protection" No. 5024 dated April 21, 2017;

- "On Additional Measures to Improve the Public Governance System in the Ecology and Environmental Protection" No. 3956 dated October 03, 2018;
- "On Measures for Cardinal Improvement and Development of the Waste Management System" No. 2916 dated April 21, 2017; and
- "On Approval of the Strategy on Solid Waste Management in the RUz for the Period 2019-2028" No. 4291 dated April 17, 2019.

The resolutions of the Cabinet of Ministers are [4]:

- "On the Improvement of the System of Environmental Monitoring in the RUz" No. 737 dated September 05,2019;
- "On Approval of the Regulations on the Order of Establishment of Water Protection Zones and Sanitary Protection Zones of Water Bodies in the Territory of the RUz" No. 981 dated December 11, 2019;
- "On Approval of the Regulation on the Procedure for Exercising State Environmental Control" No. 216 dated August 05, 2014;
- Resolution No.14, "On Approval of the Regulations on the Procedure for the Development and Coordination of Proposed Environmental Standards", 2014;
- "On Approval of Regulatory Legal Acts in the Field of Environmental Control" No. 286 dated October 08, 2015;
- "On the Further Improvement of the Environmental Impact Assessment Mechanism No. 541 dated September 07, 2020;
- "On Measures to Further Improve the Regulation of imports into the RUz and exports from the RUz of Ozone-depleting Substances and Products Containing Them" No. 17 dated January 09, 2018;
- "On Measures to Organize the Preparation, Publication and Maintenance of the Red Book of the RUz" No. 1034 dated December 19, 2018;
- "On Approval of Regulatory Acts Aimed at Implementing the Provisions of the Law of the RUz on Protected Natural Territories" No. 339 dated May 04, 2018;
- "On Improving the Monitoring System of the Natural Environment in the RUz" No. 737 dated September 05, 2019;
- "On Measures to Further Improve the Economic Mechanisms for The Protection of Nature" No.820 dated October 11, 2018;
- "On the Further Improvement of the Economic mechanisms of Environmental Protection in the Territory of the RUz" No. 202 dated April 12, 2021;
- "On Approval of the Strategy for the Conservation of Biological Diversity in the RUz for the period, 2019–2028" No. 484 dated June 11, 2019;
- "On Measures to Implement the National Sustainable Development Goals and Targets for the Period Until 2030" No. 841 dated October 20, 2018;
- "On Measures for Further Improvement of the Order of Order of Use of Trees and Shrubs Not Included in the State Forest Fund, as well as Issuing Permits in the Field of Their Use", No.43, dated January 17, 2019; and
- "On Additional Measures for Preserving Valuable Varieties of Trees and Shrubs Not Included in the State Forest Fund" No.93, dated February 18, 2020.

The State standards, and sanitary rules and norms are [4]:

- SanPiN No: 0350-17 "Protection of atmospheric air in populated places of the RUz";
- SanPiN No. 0267-09 "On acceptable noise levels in the premises of residential, public buildings and in residential areas";
- SanPiN No. 0293-11 "List of hygiene standards regarding Maximum allowed concentration (MACs) values of air-polluting substances in populated areas in the RUz";
- SanPiN No: 0318-15 "Hygienic anti-epidemic Requirements for the Protection of Water in reservoirs on the Territory of the RUz";
- SanPiN No. 0255-08 "The main criteria for hygienic assessment of the degree of pollution of water and water bodies in terms of danger to public health in Uzbekistan";
- SanPiN No. 0300-11 "Sanitary rules and standards for the organization of collection, inventory, classification, neutralization, storage and disposal of industrial waste in Uzbekistan";
- SanPiN No. 0325-06 "Sanitary norms and rules to ensure acceptable noise levels in the workplace";
- SanPiN No. 0326-16 "Sanitary Standards for general and local vibration at workplace",
- SanPiN No. 0372-20 (new edition) "Temporary sanitary rules and norms for organizing the activities of state bodies and other organizations, as well as business entities during the application of restrictive measures during the COVID-19 pandemic";
- O'zDSt 1057:2004 "Vehicles. Safety requirements for technical conditions" and O'zDSt 1058:2004 "Vehicles. Technical inspection. Method of control";
- O'zDSt 950:2011 "Drinking water. Hygiene requirements and quality control" (replaces O'zDSt 950:2000);
- O'zDSt 951:2011 "Sources of centralized drinking water supply. Hygiene, technical requirements and selection rules" (replaces O'zDSt 951:2000);
- O'zRH 84.3.6, "Instructions on setting limit values for the discharge of pollutants into water bodies and the ground according to technically achievable indicators of wastewater treatment", 2004.

5.1.3 Land Rights, Acquisition and Resettlement Laws

Land expropriation for public needs in Uzbekistan is carried out under the Land Code. The main objectives of the land legislation are to regulate the relations for the purpose of;

- Providing for the benefit of the present and future generations of evidence-based,
- Rational use and protection of lands,
- Reproduction and increase in fertility of soils,
- Preserving and improvements of the environment,
- Creation of conditions for equal development of all forms of managing,
- Protection of the rights of legal entities and physical persons to the parcels of land, and
- Strengthening of legality in this sphere, including by the prevention of corruption offenses.

The national laws and regulations with which the project will be compliance regarding the land rights, acquisition, and resettlement are [4]:

- Constitution of the RUz dated December 08, 1992 (as amended on February 08, 2021);
- Land Code of the RUz, No. 598-I dated April 30, 1998 (as amended on December 23, 2020);
- Civil Code of the RUz, No. 163-I dated December 21, 1995 (as amended on January 22, 2020);

- Law of the RUz "On State Land Cadastre", No. 666-I dated August 28, 1998 (as amended on July 24, 2018);
- Presidential Decree of the RUz "On Additional Measures to Simplify Procedures for the Implementation of Public Property Objects and Rights to Land Plots" No. 5552 dated October 11, 2018.
- Presidential Decree of the RUz "On Measures for Effective Use of Land and Water Resources in Agricultural Industry" No. 5742 dated June 17, 2019;
- Presidential Decree of the RUz "On Measures to Ensure Equality and Transparency in Land Relations, Reliable Protection of Land Rights and Transfer them into a Market Asset" No. 6243 dated June 08, 2021;
- Presidential Decree of the RUz "About Additional Measures to Strengthen the Protection of Private Property and Guarantees of Owners 'Rights, to Redual Improvement of the System of Organization of Works to Support Entrepreneurial Initiatives and the Support of Initiatives" No. 5780 dated August 13, 2019;
- Decree of the RUz Cabinet Minister "On Additional Measures to Improve the Procedure for Providing Compensations for the Removal and Provision of Land Plots and Providing a Guarantee of Property Rights of Individuals and Legal Entities" No. 911 dated November 16, 2019; and
- Decree of the RUz Cabinet Minister "On Measures for Further Improvement of Procedures for Providing Vacant Land Plots for Business and Urban Construction" No. 1023 dated December 20, 2019.

5.1.4 Employment and Labor Laws

Article 37 of the Constitution of Uzbekistan mentions that *"each has the right to work, to free choice of work, fair terms of work and protection against unemployment under the law"*. Uzbekistan pursues a purposive policy of creating a legal framework for the protection of human rights and freedoms in accordance with international standards.

As a fully-fledged member of the United Nations Organization, Uzbekistan accedes to international human rights acts thus assuming an obligation to comply with them and apply them in its state and legal practice. The Constitution of the RUz includes all the provisions of the Universal Declaration of Human Rights. RUz has already ratified 17 conventions and 1 protocol of International Labor Organization (ILO) (including 8 fundamental conventions) of which 18 are in force.

The bedrock principle of state policy in the field of occupational safety and health is the priority of the life and health of the worker over the results of production activities as well as coordination of occupational safety and health activities with other areas of economic and social policy, all the principles proclaimed under the Law.

The Labor Code of the RUzof December 21, 1995 (as amended on August 02, 2021) treats labor legislation with due account of the interests of the employees, employers and the state and fair and safe labor conditions and the protection of the labor rights and health of the workers.

The national laws and regulations with which the project will be in compliance regarding labor and working conditions, and occupational health and safety issues are *[4]*:

- Labor Code of the RUz, 1995;

- Law "On Compulsory Insurance of Third-Party Liability of Employers", No. 210 dated April 16, 2009;
- Law "On Occupational Health and Safety" No. 410 dated September 22, 2016;
- Law "On Compulsory Industrial Accident and Occupational Disease Insurance", No. 174 dated September 10, 2008;
- Law "On Public Pension Provisions" No. 938-XII dated September 03, 1993;
- Decree "On Improving the Procedure for Determining the Size of Wages, Pensions and Other Payments" No.5723 dated May 21, 2019;
- Decree "On Additional Measures to Create Favorable Conditions for Certain Categories of Pensioners Engaged in Labour Activities", No.5291 dated December 28, 2017;
- Resolution "On Measures to Further Strengthen Guarantees for Labour Rights and Support of Women's Entrepreneurship", No.4235 dated March 07, 2019;
- Decree of the Ministry of Employment and Labor and the Ministry of Health of the RUz "On Approval of the List of Hazardous Occupations for Women Not Recommended to be Used to Employ Women", No.48 dated July 22, 2019;
- Resolution "On Measures to Create Favorable Conditions for Labor Activity in the RUz for Qualified Foreign Specialists", No.4008 dated November 07, 2018;
- Resolution "On Additional Measures to Improve the System of External Labor Migration in the RUz", No.3839 dated July 05, 2018; and
- Resolution "On Measures to Improve Cooperation with International and Foreign Financial Institutions", No.3439 dated December 20, 2017.

5.1.5 National Environmental Impact Assessment Process

There are specific requirements as to the content, development procedure and examination of Environment Impact Assessment (EIA) documents. These are governed by the following legislative acts of the RUz [4]:

- Law "On Nature Protection" No. 754-XII dated December 9, 1992 (as amended on November 15 2019).
- Law "On Ecological Expertise" No. 73-II dated May 25, 2000 (as amended on November 22, 2018).
- Regulation "On the further improvement of the environmental impact assessment mechanism", approved by the Decree of the Cabinet of Ministers of the RUz No. 541 dated September 07, 2020. The regulation defines the legal requirements for EIA in Uzbekistan (referred to as OVOS).
- Regulation "On approval of the regulations on the order of design and approval of draft environmental standards", approved by the Decree of the Cabinet of Ministers of the RUz No 14 dated January 21, 2014.

According to the Regulation on SEE approval of the EIA/OVOS process, should be carried out by specialized expert divisions (also referred to as the competent authority) to review the compliance of the planned activities with environmental requirements, and determine the permissibility of the project under examination. The SEE is carried out by one of the following specialized expert divisions of the SCEEP based upon the category of risk:

- The national state unitary enterprise, the Centre of the State Environmental Expertise of the SCEEP, classifies the projects as I and II as per their risk (high and medium risk)"; and
- The state unitary enterprise, the Centre of the State Environmental Examination of the Surkhandarya Region, classifies the projects as III and IV as per their environmental impact (low and local impact).

According to the Decree of the CM No.541 dated September 07, 2020, all types of activities are classified into one of four categories ranging from Category I (High Risk) to Category IV (Local Impact):

- **Category I** is "high risks" of environmental impact (SEE is conducted by the "Centre of State Environmental Expertise" within 20 days, all stages of the EIA are required);
- **Category II** is "medium risks" of environmental impact (SEE is conducted by "Centre of State Environmental Expertise" within 15 days, all stages of the EIA are required);
- **Category III** is "low risk of impact" (SEE is conducted by the regional offices of the "Centre of State Environmental Examination" within 10 days, all stages of the EIA are required); and
- **Category IV** is "minor risk of environmental impact, local impact" SEE is conducted by regional offices of the "Centre of State Environmental Examination" within 5 days, only the first phase of the EIA process needs to be completed (Draft Statement on Environmental Impact).

The SEE Regulation describes the procedure for arranging the SEE and the procedure undertaken by the Centre of the State Environmental Expertise. The three EIA stages and their required deliverables are summarized in below Table 22 as per the regulation [4].

Table 22: Stages of EIA process

Stage of EIA/OVOS Process	Required Deliverables
Stage-I **Preliminary Statement of the Environmental Impact (PSEI)** ('PZVOS' is the national acronym)	To be conducted at the planning stage of the proposed project prior to development funds being allocated. Public hearing is needed only for this stage. PZVOS is valid until the end of construction. PZVOS will not be valid for the commissioning time
Stage-II **Statement of the Environmental Impact (SEI)** ('ZVOS' is the national acronym)	To be completed where it was identified by the Center for State Environmental Expertise/Regional Center for State Environmental Expertise at Stage-I that additional investigations or analyses were necessary. The Statement shall be submitted to the Center for State Environmental Expertise/Regional Center for State Environmental Expertise prior to the beginning of construction. *Usually this stage is skipped*.
Stage-III **Statement on Environmental Consequences (SEC)** ('ZEP' is the national acronym)	The final stage of the SEE process and is to be performed before the project is commissioned. The report details the modifications to the project design that have been made from the Center for State Environmental Expertise/Regional Center for State Environmental Expertise review at the first two stages of the EIA process. The comments received during the public consultation, the environmental standards applicable to the project and environmental monitoring requirements associated with the project and principal conclusions.

Article 29 of the Law on Environmental Protection states ensuring stakeholder participation is crucial for improving the efficiency of environmental monitoring in the implementation of state and other environmental programs. Uzbekistan, public hearings as part of the EIA is regulated by Appendix 3 of Decree of the Cabinet of Ministers No 541 dated 07.09.2020. According to the Decree all objects divided in four categories and public hearings are mandatory for categories I and II (*almost similar to World Bank A and B categories*). There are no requirements for public hearing or EIA disclosure for Category III and IV projects.

These responsibilities include:

- Public notification (20 days before the public hearings, the customer announces the time and place in the mass media and the Organizer's website in Uzbek and other languages);
- Conducting the consultation (District/city government (Khokimiyat) are the organizers of public hearings and the minimum number of stakeholder participants is 10. For public hearings, a non-technical summary is prepared for disclosure the project);
- Recording the significant findings, conclusions, recommendations, and next steps.

The aim of public hearing is to encourage views of participant (groups or individuals) who may be affected by the Project regarding their environmental concerns. Prior to the scoping meeting, with the intention to inform the public about the investment and gather their opinions and suggestions on the project. In the meeting, the public is informed and consulted and their opinions and suggestions are taken. Any significant issues, established during the public consultation, should be incorporated into the EIA document.

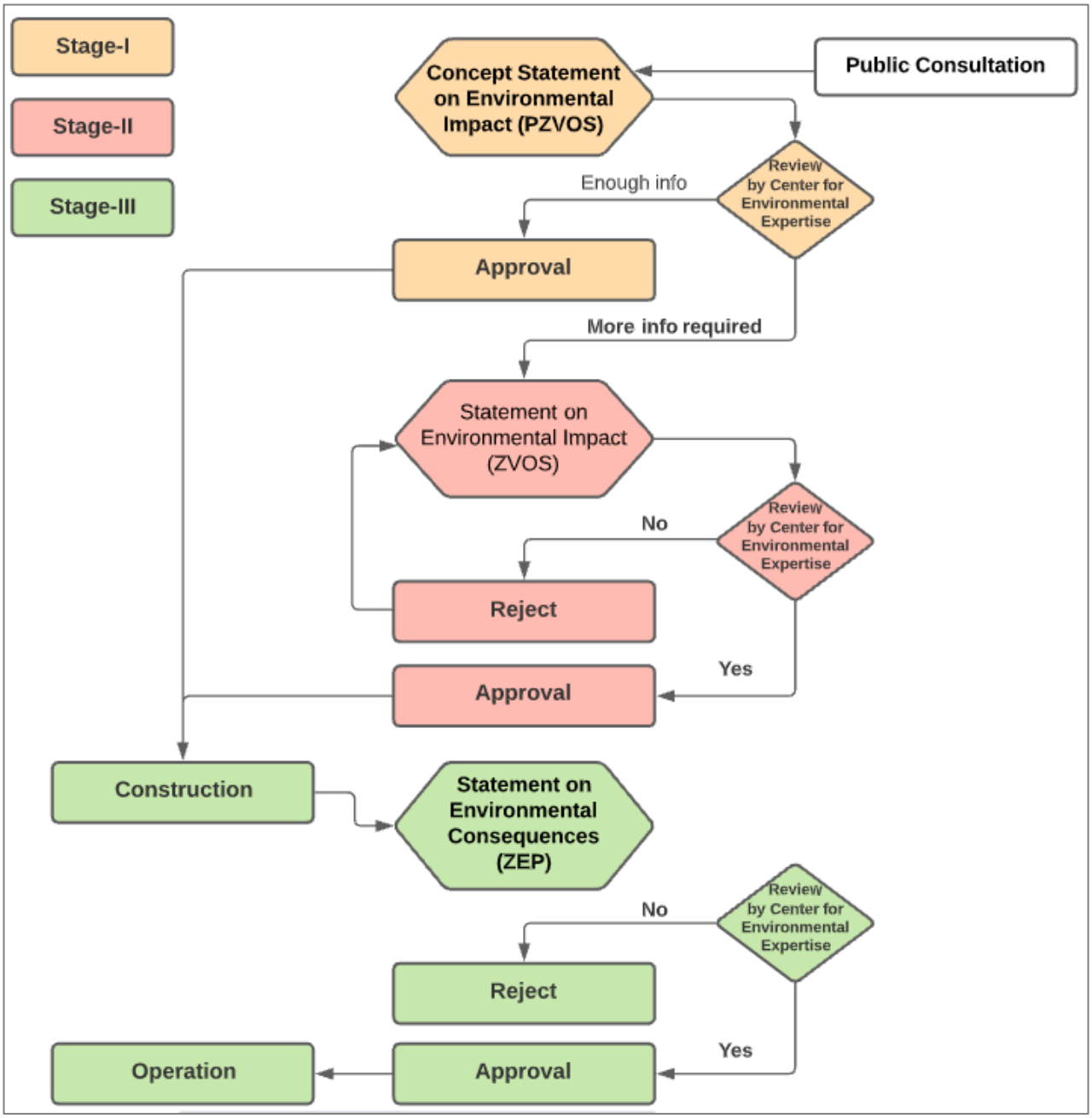


Figure 29: Local EIA Process Flowchart

The conclusion of the SEE is valid for three years from the date of issue. If the project is not implemented within three years from the date of issue of the Conclusion, the EIA report needs to be revised and re-submitted to the Center for environmental expertise for revision and approval. In case of expansion, reconstruction, technical re-equipment or changes in the technological process of existing facilities, affecting the quantitative and qualitative characteristics of emissions, discharges and waste, changes in legislative requirements, as well as by decision of the relevant authorities exercising state control in the field of environmental protection, environmental standards are subject to revised as part of an EIA with a subsequent three-year period. After three years of facility commissioning, it is obligatory to design the ecology normative.

The ecology normative is designed in three directions air (PDV is the national acronym), water (PDS is the national acronym) and wastes (PDO is the national acronym). Ecology normative valid for 5 years. Designing of ecology normative is not in scope of EIA, because decision has made and facility is commissioning.

Ecology normative - the legal limits of permissible negative impact on the environment, environmental standards must be observed by absolutely all economic entities that are included in the list of four categories according to the Decree of the Cabinet of Ministers of the RUz No. 541 dated 07.09.2020 [4].

Three types of normative are designed for the followings:

- **Maximum Permissible Emission:** the mass of pollutants in emissions per unit of time, forming surface concentrations that do not exceed the maximum permissible quotas established for atmospheric air.
- **Maximum Allowable Discharge:** the mass of a substance in wastewater, the maximum allowable for disposal in the established mode at a given point per unit of time in order to ensure water quality standards at the control point.
- **Maximum Permissible Wastes:** the maximum amount of waste allowed for disposal for a certain period in certain place.

5.1.5.1 The Project Environmental Impact Assessment (EIA) Process

The proposed project is categorized as a "Category I" project under the Decree of the Cabinet of Ministers of the RUz No 541 dated 07.09.2020 (high risk, paragraph 32 "Thermal power plants, and other power plants for combustion of the thermal capacity of 300 MW or more") [4].

Consultation activities for the Project have been initiated in accordance with the National EIA Stages. The stages of EIA is given comprehensively in Section 3.1. Decree of the Cabinet of Ministers of the RUz No 541, objects of I and II categories of environmental impact are subject to the procedure for passing public hearings about environmental impact. Considering that the combined cycle power plant with a capacity of 1600 MW belongs to the objects of the I category of impact on the environment, the management of the enterprise under construction together with representatives of Authorities of Angor District, the Inspectorate for Ecology and Environmental Protection, "Kattakum" village community assembly on 17.08.2021 public hearings were organized and held in accordance with the established procedure. During the public hearings, residents of the Kattakum village community assembly did not have any objections to the construction of a combined cycle power plant.

The Public Hearing provided the opportunity for potential stakeholders to be informed about the project and to express their opinions and concerns. As the next phase of the public hearing, The EIA Report has been prepared and submitted to the Centre of SEE and positive decision is granted.

5.2 International Conventions/Protocols

The legal framework valid for the Project also comprises the international conventions/protocols and agreements signed and ratified by the RUz. The relevant international conventions/protocols and agreements with the project are listed in Table 23. In some cases, these have been integrated into national regulations. Moreover, Article 53 of Law "On Nature Protection" requires that *"in cases, when international agreement, concluded by Uzbekistan, states rules other than that contained in the present Law or other legislative act of Uzbekistan on nature protection, the rules of international*

agreement are applied, excluding cases when legislation of Uzbekistan established stricter requirements".

Table 23: Ratified Conventions/Protocols by Uzbekistan Relevant to The Project

Convention/Protocol Name
Applicable ratified conventions of the Environment / Climate Change
United Nations Framework Convention on Climate Change (ratified by Uzbekistan in 1993)
Kyoto Protocol (ratified by Uzbekistan in 1993)
Paris Agreement (ratified by Uzbekistan in 2017)
United Nations Convention on Biological Diversity (ratified by Uzbekistan in 1995)
Agreement on Cooperation in the Field of Ecology and Environmental Protection (ratified by Uzbekistan in 1992)
Agreement on Cooperation in The Field of Joint Water Resources Management and Conservation of Interstate Sources (ratified by Uzbekistan in 1992)
Agreement on The Conservation of African-Eurasian Migratory Water birds (ratified by Uzbekistan in 2004)
Agreement between the Government of Kazakhstan, the Government of Kyrgyzstan and the Government of Uzbekistan on management of water resources in Central Asia (ratified by Uzbekistan in 1996)
Agreement on Joint Activities in Addressing the Aral Sea and The Zone Around the Sea Crisis, Improving the Environment, And Ensuring the Social and Economic Development of The Aral Sea Region (ratified by Uzbekistan in 1993)
United Nations Convention on Desertification to Combat Desertification (ratified by Uzbekistan in 1995)
Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques (ratified by Uzbekistan in 1993)
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (ratified by Uzbekistan in 1996)
Paris Convention Concerning the Protection of the World's Cultural and Natural Heritage (ratified by Uzbekistan in 1993)
Convention for the Safeguarding of the Intangible Cultural Heritage (ratified by Uzbekistan in 2008)
Convention on International Trade in Endangered Species of Wild Fauna and Flora (ratified by Uzbekistan in 1997)
Convention on the Conservation of the Migratory Species of Wild Animals (Bonn Convention) (ratified by Uzbekistan in 1998)
Convention on Wetlands of International Importance Especially as Waterfowl Habitat (ratified by Uzbekistan in 2002)
Convention on Wetlands of International Importance especially the Water Fowl Habitats of Aquatic Birds (RAMSAR Convention) (1975) (ratified by Uzbekistan in 2001)
Convention to Combat Desertification in Those Countries Experiencing Serious Drought And/or Desertification, Particularly in Africa (ratified by Uzbekistan in 1996)
UNECE Convention on The Protection and Use of Transboundary Watercourses and International Lakes (ratified by Uzbekistan in 2007)
Vienna Convention for the Protection of the Ozone Layer (ratified by Uzbekistan in 1993).

Convention/Protocol Name
Montreal Protocol on Substances That Deplete the Ozone Layer (ratified by Uzbekistan in 1993)
Statute of the Interstate Commission for Water Coordination of Central Asia (ratified by Uzbekistan in 1992)
Applicable ratified conventions of the International Labor Organization
C029 - Forced Labour Convention, 1930 (No. 29) (ratified by Uzbekistan in 1992)
C087 - Freedom of Association and Protection of the Right to Organize Convention, 1948 (No. 87) (ratified by Uzbekistan in 2016)
C098 - Right to Organize and Collective Bargaining Convention, 1949 (No. 98) (ratified by Uzbekistan in 1992)
C100 - Equal Remuneration Convention, 1951 (No. 100) (ratified by Uzbekistan in 1992)
C105 - Abolition of Forced Labor Convention, 1957 (No. 105) (ratified by Uzbekistan in 1997)
C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111) (ratified by Uzbekistan in 1992)
C138 - Minimum Age Convention, 1973 (No. 138) (ratified by Uzbekistan in 2009)
C182 - Worst Forms of Child Labor Convention, 1999 (No. 182) (ratified by Uzbekistan in 1992)
C081 - Labor Inspection Convention, 1947 (No. 81) (ratified by Uzbekistan in 2020)
C122 - Employment Policy Convention, 1964 (No. 122) (ratified by Uzbekistan in 1992)
C129 - Labor Inspection (Agriculture) Convention, 1969 (No. 129) (ratified by Uzbekistan in 2020)
C144 - Tripartite Consultation (International Labor Standards) Convention, 1976 (No. 144) ratified by Uzbekistan in 2019)
C047 - Forty-Hour Week Convention, 1935 (No. 47) (ratified by Uzbekistan in 1992)
C052 - Holidays with Pay Convention, 1936 (No. 52) (ratified by Uzbekistan in 1992)
C103 - Maternity Protection Convention (Revised), 1952 (No. 103) (ratified by Uzbekistan in 1992)
C135 - Workers' Representatives Convention, 1971 (No. 135) (ratified by Uzbekistan in 1992)
C154 - Collective Bargaining Convention, 1981 (No. 154) (ratified by Uzbekistan in 1997)
Others
Universal Declaration of Human Right (1948), (ratified by Uzbekistan in 1991)
Convention on the Elimination of All Forms of Discrimination against Women (1979), ratified by Uzbekistan in 1995
International Covenant on Civil and Political Rights (1966), (ratified by Uzbekistan in 1995)
Convention on the Elimination of All Forms of Intolerance and of Discrimination Based on Religion or Belief (1981), (ratified by Uzbekistan in 1997)
EU Partnership and Cooperation Agreement (ratified by Uzbekistan in 1996)

5.3 International Environmental Standards

The EIA Report of the proposed Project was prepared as per the applicable national laws, regulations, standards, and guidelines; whereas the ESIA Report has been carried out in accordance with the following requirements as the Company aims to seek international financing for the Project:

- The Equator Principles (EP),
- Asian Infrastructure Investment Bank (AIIB) Environmental and Social Policy,
- International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability,
- International protocols and conventions to which our country is a party relating to environmental protection, and
- Applicable National Laws, Regulations, Standards and Guidelines.

In this regard, the most stringent regulation or standards are accepted as project limit or project standard.

5.3.1 Equator Principles

The Equator Principles (EPs) (November 18, 2019) is a framework for determining, assessing, and managing the social and environmental impacts that may arise from financing the projects. The Project will be conducted under the listed EPs, below:

- Principle 1: Review and Categorization;
- Principle 2: Environmental and Social Assessment;
- Principle 3: Applicable Environmental and Social Standards;
- Principle 4: Environmental and Social Management System and Equator Principles Action Plan;
- Principle 5: Stakeholder Engagement;
- Principle 6: Grievance Mechanism;
- Principle 7: Independent Review;
- Principle 8: Covenants;
- Principle 9: Independent Monitoring and Reporting; and
- Principle 10: Reporting and Transparency.

The EPs represent a framework for project financing, which is underpinned by the revised IFC Performance Standards (PSs). EPs establish the minimum environmental & social standards to be adopted by EP Financial Institution, which are from IFC PSs on Environmental and Social Sustainability, the World Bank Group Environmental, Health and Safety Guidelines and/or the relevant host country laws, regulations and permits that pertain to environmental and social issues.

5.3.2 AIIB Environmental and Social Policy

The Asian Infrastructure Investment Bank's (AIIB) Environmental and Social Policy (ESP) supports the Bank's clients in achieving environmentally and socially sustainable development outcomes. It does so by integrating the management of environmental and social risks and impacts into decision-making on, and preparation and implementation of, AIIB-financed projects.

The ESP includes an introductory overview, an aspirational Vision Statement, a mandatory Environmental and Social Policy (ESP), accompanied by three mandatory Environmental and Social Standards (ESSs) and an Environmental and Social Exclusion List. The three ESSs comprise:

- ESS 1: Environmental and Social Assessment and Management;
- ESS 2: Land Acquisition and Involuntary Resettlement; and
- ESS 3: Indigenous Peoples.

ESP was approved in February 2016 and amended in February 2019. Revisions to the ESF were approved by AIIB's Board of Directors in May 2021.

Since there are no known communities thought to be living in the Project AoI that meets the criteria of indigenous peoples as characterized in ESS 3, the ESS 2 and ESS 3 are considered not applicable for the Project.

5.3.3 IFC Standards

IFC is a member of the World Bank Group and is the largest global development institution focused exclusively on the private sector in developing countries. The IFC Performance Standards (PSs) are an international benchmark for identifying and managing environmental and social risk and has been adopted by many organizations as a key component of their environmental and social risk management.

The Project will be implemented the requirements of the IFC as set out in the following standards and guidelines:

- IFC Environmental and Social Sustainability Policy (2012);
- IFC E&S Performance Standards (PSs) 2012 and supporting Guidance Notes (GN) (as relevant);
    - PS-1: Assessment and Management of Environmental and Social Risks and Impacts;
    - PS-2: Labor and Working Conditions;
    - PS-3: Resource Efficiency and Pollution Prevention;
    - PS-4: Community Health, Safety, and Security;
    - PS-5: Land Acquisition and Involuntary Resettlement;
    - PS-6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
    - PS-7: Indigenous Peoples
    - PS-8: Cultural Heritage.

However, the PS-7 and PS-8 are considered not applicable for the Project. There are no known communities thought to be living in the project area of influence that meets the criteria of Indigenous Peoples as characterized in IFC's PS 7.

Site visit observations and discussions have not highlighted the presence of critical cultural heritage as characterized in IFC's PS-8. Moreover, The Ministry of Culture of the RUz has an official letter stating that there are no archaeological or cultural sites near or within the proposed Project Site. A chance finds procedure may be required for the construction phase to address potentially unidentified items of cultural significance during the construction works.

In addition to the PSs, the following guidelines and good international industry practice (GIIP) are relaxant for the Project:

- World Bank Group (WBG) Environment, Health and Safety (EHS) Guidelines; including
  - WBG General EHS Guidelines (April 30, 2007) which cover four areas of GIIP related to: Environmental Occupational Health & Safety; Community Health & Safety; Construction; and, Decommissioning,
  - WBG EHS Guidelines Thermal Power Plants (2007 / draft 2017); and
  - WBG EHS Guidelines Electric Power Transmission and Distribution (April 2007).

The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP) and are referred to in the World Bank's Environmental and Social Framework and in IFC's Performance Standards. The EHS Guidelines contain the performance levels and measures that are normally acceptable to the World Bank Group, and that are generally considered to be achievable in new facilities at reasonable costs by existing technology The World Bank Group requires borrowers/clients to apply the relevant levels or measures of the EHS Guidelines. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects will be required to achieve whichever is more stringent. If less stringent levels or measures than those provided in these EHS Guidelines are appropriate, in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment.

5.3.4 Other Relevant Standards, Guidelines and Good Practices

The Project will implement the requirements of the EU Directives and Standards, including:

- Best available techniques (BAT) conclusions for large combustion plant (LCP) of 31 July 2017 were published in the Official Journal on 17 August 2017 (2017/1442/EU),
- Use of Security Forces: Assessing and Managing Risks and Impacts (February 2017),
- Worker's Accommodation: Processes and Standards (Guidance Note by IFC and EBRD, 2009),
- Scottish Natural Heritage Environmental Impact Assessment Handbook, 2014,
- Guidelines for Landscape and Visual Impact Assessment 3rd Edition, 2013,
- EIA Directive 2014/52/EU (amending Directive 2011/92/EU and 97/11/EC),
- Birds Directive 2009/147/EC
- Habitats Directive 92/43/EEC,
- Water Framework Directive 2000/60/EC,
- Dutch Intervention Values 2013 (Soil Remediation Circular Jul, 2013).
- Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on Ambient Air Quality and Cleaner Air for Europe and National Regulation;
- EU BAT Air Emission Limits (AELs), July 31, 2017,
- ASTM D 1586/ D1586M-18: Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils,
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.
- OECD Recommendation of the Council on Common Approaches for Officially Supported Export Credits and Environmental and Social Due Diligence
- Joint MDB Assessment Framework for Paris Alignment for Direct Investment Operations

All phases of the environmental and social management of the proposed project shall be conducted in compliance with national and international regulations and standards as well as the standards of financial institutions. The legal framework is explained in the following sections.

6. AIR EMISSIONS AND AMBIENT AIR QUALITY

6.1 Standards and Regulatory Requirements

6.1.1 National Standards

The relevant legislation related with air emissions and ambient air quality in Uzbekistan are given below:

- Law "*On Ambient Air Protection*", No. 353-I dated December 27,1996 (as amended on April 21,2021);
- Resolution of Cabinet Ministers "On approval of the Regulations on the Order of design and approval of draft environmental standards", No 14 dated January 21, 2014.

Law "*On Ambient Air Protection*" covers the right of citizens to clean air and their obligations to take care of the atmosphere, state management in the field of air protection (responsibilities of SCEEP and the Ministry of Health), standards on air quality, maximum permissible emissions of pollutants from stationary sources, industrial air consumption, standards for emissions from mobile sources (vehicles and other equipment), quality of fuels, production and use of chemicals, protection of the ozone layer, spatial planning for enterprise construction and of waste disposal facilities, responsibilities of enterprises (in terms of monitoring and techniques to reduce emissions) and levies for emissions to the air and damage caused. According to the Law, new activities in industrial areas or areas with dense traffic require a SEE/EIA and a health assessment.

The Ministry of Health of RUz develops air quality standards (sanitary norms) to protect human health and oversees the compliance with hygienic norms and standards associated with air quality. The standards related to air emissions and air quality are given below:

- SanPiN No. 0293-11 "List of hygiene standards regarding Maximum Permissible Concentration (MPCs) values of air-polluting substances in populated areas in the RUz",
- SanPiN No. 0350-17 "Protection of Atmospheric Air in Populated Places of the RUz".

The national air quality standards are defined as maximum allowable concentrations (MPC). These MPC values are set for 485 pollutants (SanPiN No. 0293-11). The values are set for short-term maxima (20 minutes), for daily means, for monthly means and for annual means.

The applicable National Ambient Air Quality Standards (MPCs) are provided in Table 24.

Table 24: National Ambient Air Quality Standards (MPCs)

Pollutant Name	Averaging Period	Maximum Permissible Concentration (MPC)[1](mg/m³)
Carbon monoxide (CO)	One Time Maximum (20-30 min.)	5.0
	Daily	4.0
	Monthly	3.5
	Annually	3.0
Nitrogen oxide (NO)	One Time Maximum (20-30 min.)	0.6
	Daily	0.25
	Monthly	0.12
	Annually	0.12
Nitrogen dioxide (NO_2)	One Time Maximum (20-30 min.)	0.085
	Daily	0.06
	Monthly	0.05
	Annually	0.05
Sulfur dioxide (SO_2)	One Time Maximum (20-30 min.)	0.5
	Daily	0.2
	Monthly	0.1
	Annually	0.1
Dust	One Time Maximum (20-30 min.)	0.15-0.5
	Daily	0.1-0.35
	Monthly	0.08-0.020
	Annually	0.05-0.015

Article 6.2 of the SanPin No.0350-17 requires the establishment of a sanitary protection zone (SPZ, buffer zone) around any new thermal power plants. This is defined as an exclusion zone around an emission point (e.g. stack) for the protection of sensitive receptors. For the proposed Project, this zone will have a radius of 500 m (see Figure 30).

As per provisions of the SanPin No.0350-17:

- Article 2.16: The SPZ or any part of it may not be regarded as a reserve territory of the enterprise and used for expansion of the industrial site

[1] SanPiN RUz No. 0293-11 "The list of maximum permissible concentration (MPC) of pollutants in the ambient air of populated areas on the territory of the Republic of Uzbekistan"., Table 1.

- Article 2.17: It is prohibited to locate within the boundaries of the sanitary protection zone and on the territory of the industrial site:
    - food industry facilities as well as facilities for the production of tableware, containers, equipment etc. for the food industry, warehouses of finished products, beverage and water production facilities for drinking water purposes,
    - complexes of waterworks;
    - wholesale warehouses of food raw materials and food products;
    - residential buildings, kindergartens, other educational institutions;
    - collective or individual dacha and garden plots;
    - sports facilities, parks, health care and recreation facilities for general use
- Article 2.20: It is permitted to locate in the SPZ:
    - enterprises, their separate buildings and structures with production facilities of a lower class of harmfulness;
    - fire industry, bathhouses, laundries, garages, car and motorcycle parking areas, warehouses (excluding public and specialized food warehouses), buildings of offices, design offices, educational buildings, stores, public catering facilities, clinics, research laboratories and other facilities, related to servicing of this and adjacent enterprises;
    - non-residential premises for on-duty emergency personnel and security guards of enterprises, buildings for shift workers, storage facilities for public and individual transport, local and transit communications, power lines, power substations, oil and gas pipelines, artesian wells for technical water supply, water cooling facilities, facilities for technical water preparation, sewage pumping stations, water recycling facilities, industrial sites, plant nurseries for landscaping and sanitary protection of enterprises.

There are no residential area or recreational facility in the sanitary protection zone of the Project.

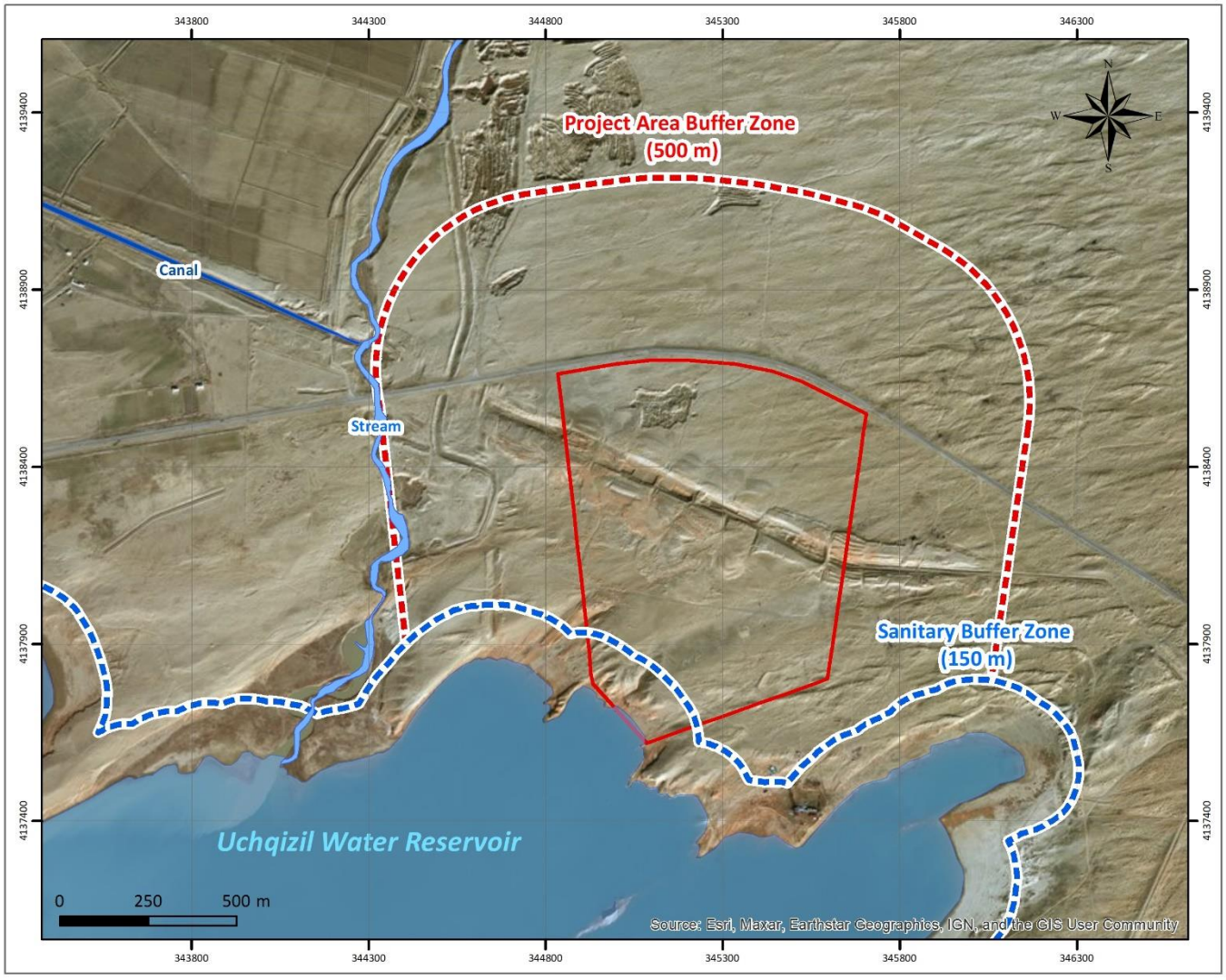


Figure 30: Project Area Buffer Zones

6.1.2 Lender Requirements

The IFI's applicable ambient air quality and air emissions standards are given below:

- IFC General EHS Guidelines: Environmental Air Emissions and Ambient Air Quality, April 30, 2007;
- IFC EHS Guidelines for Thermal Power Plants May 31, 2017;
- Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on Ambient Air Quality and Cleaner Air for Europe and National Regulation;
- EU BAT Air Emission Limits (AELs), July 31, 2017.

The international ambient air quality standards together the with national standards are summarized in Table 25. The values presented in blue refer to the stringent values that are applicable to the Project.

Table 25: Ambient Air Quality Standards

Pollutant Name	Averaging Period	National Ambient Air Quality Standards MPC (mg/m³)	IFC/WB EHS Guideline Ambient Air Quality (mg/m³ (2007))	EU Environmental Standard (mg/m³)
Carbon monoxide (CO)	One Time Maximum (20-30 min.)	**5.0**	-	-
	Daily	**4.0**	-	-
	Monthly	**3.5**	-	-
	Annually	**3.0**	-	-
Nitrogen oxide (NO)	One Time Maximum (20-30 min.)	**0.6**	-	-
	Daily	**0.25**	-	-
	Monthly	**0.12**	-	-
	Annually	**0.12**	-	-
Nitrogen dioxide (NO_2)	One Time Maximum (20-30 min.)	**0.085**		
	1 hour	-	**0.2**	0.2
	Daily	**0.06**		
	Monthly	**0.05**		
	Annually	0.05	**0.04**	0.04
Sulfur dioxide (SO_2)	10 minute	-	0.5 (limit value)	-
	One Time Maximum (20-30 min.)	**0.5**		
	1 hour	-	-	0.35
	Daily	0.2	0.125 (Interim target-1) 0.05 (Interim target-2) **0.02 (limit value)**	0.125
	Monthly	**0.1**	-	-
	Annually	**0.1**	-	0.02
Dust	One Time Maximum (20-30 min.)	**0.15-0.5**		

Pollutant Name	Averaging Period	National Ambient Air Quality Standards MPC (mg/m³)	IFC/WB EHS Guideline Ambient Air Quality (mg/m³ (2007))	EU Environmental Standard (mg/m³)
	Daily	**0.1-0.35**	0.15 (Interim target-1) 0.1 (Interim target-2) 0.75 (Interim target-3) 0.05 (limit value)	0.05
	Monthly	**0.08-0.020**	-	-
	Annually	**0.05-0.015**	0.07 (Interim target-1) 0.05 (Interim target-2) 0.03 (Interim target-3) 0.02 (limit value)	0.04

IFC EHS Guidelines, Environmental Air Emissions, and Ambient Air Quality approach are "*Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines (Table 1.1.1.) or other internationally recognized sources*". The IFC guideline values and EU Environmental Standards given in Table 26 are shown for indicative purposes. According to lenders' requirements, the more stringent standards are applicable for this Project.

However, Russia and other Commonwealth of Independent States countries have reconsidered this standard and harmonized this standard with the European Union and World Health Organization standards (i.e., 0.2 mg/m³ or 200 µg.m³). Similar work in Uzbekistan is still ongoing.

Moreover, Uzbekistan legislation does not set stack emission limits. Therefore, IFC will intend to limit the emissions as per the "IFC EHS Guideline: Thermal Power Plants". The guideline standards applicable for the Project during the operation phase are summarized in Table 26.

Table 26: Nitrogen Oxides (NOx) Air Emission Limits for Combustion Turbine

Pollutant	IFC Thermal Power Guidelines (Table 6B) (mg/Nm³)[2]		
	Combustion Plant/Natural Gas	Non-degraded air-shed[3] [18] (mg/Nm³)	Degraded air shed (mg/Nm³)
NOx	50 (25 ppm)	50 (25 ppm)	30 (15 ppm)

6.2 Observation and Baseline Conditions

Field measurements of meteorological parameters were carried out and atmospheric air Measurement were measured at 3 (three) observation points (A-01, A-02, A-03). Table 27 shows the coordinates and location of sampling points for atmospheric air while Figure 31 shows the locations where measurements Measurement were conducted.

Baseline air quality measurement stations are selected in accordance with the dominant wind direction and the possible receptors. Dominant wind direction is blowing from southwest direction. Since there is no receptor within 5 km radius, no air quality monitoring point was determined at this direction. Second dominant wind direction is blowing from north east and north-northeast direction. Point 1 and Point 3 are represents nearest residential receptors at the downwind directions. In addition, Point 2 is selected to represent nearest settlement, which is Kattakum Village.

[2] *The Environmental Assessment (EA) may need to justify more stringent or less stringent guideline values due to environmental, community health, technical and economic considerations, whilst not exceeding nationally legislated limits. In all cases, the EA will be demonstrate that ambient impacts from emissions comply with air quality limit guidelines as set out in Section 1.1 of the General EHS Guidelines.*

[3] *Under definitions provided by IFC EHS guidelines for thermal power plant, an air-shed will be considered as degraded if relevant ambient air quality standards (as defined in the General EHS Guidelines) are exceeded; DA/NDA to be determined for each pollutant.*

Table 27: Atmospheric Air Measurement Station Coordinates

Monitoring Stations	Station Location	Coordinates (deg/min/sec)	Description of the Monitoring Station	Distance to the border of the Project Site
A-01	Garden, next to the village, 300 m from the cell tower.	N = 37°20’58,29" E = 67°11’36,42"	This station is located at south of the Uchkizil Reservoir. There are agricultural fields and residential areas nearby. Located at downwind direction	5500 m
A-02	SSG Kattakum	N = 37°22’53,43" E = 67°13’38,52"	This station is located west part of Kattakum Village. There are agricultural fields, residential areas, and a main road nearby. Nearest residential area	1850 m
A-03	Former sanatorium, 15-20 m from the lake.	N = 37°20’42,20" E = 67°13’22,06"	This station is located at southwest of the Uchkizil Reservoir. There are dense residential areas nearby. Located at downwind direction	3850 m

Figure 31: Map showing the Location of Atmospheric Air Measurement Stations

CO and dust measurements were conducted between 10 and 16 July 2021 by an accredited laboratory which is Yuksak Musaffo Tabiat" Llc Company in accordance with the established state standards as specified by the corresponding regulatory, methodological and instructive documents.

During CO and dust measurements, meteorological parameters (air temperature, wind speed, wind direction and atmospheric pressure) were also measured. CO and Dust measurements and meteorological measurements were carried out simultaneously.

Meteorological observations were carried out using meteorological equipment in accordance with GOST 17.2.3.01-86 "Nature protection. Atmosphere. Air quality control rules for settlements" and GOST 31296.2-2006 "Noise. Description, measurement and assessment of noise on the ground. Part 2. Determination of sound pressure levels". To measure the ambient temperature and wind speed, a modern digital instrument, Testo 425, which measures the data of meteorological parameters automatically, (see Figure 32) was used. Air pressure was measured using an aneroid barometer (see Figure 33) and wind direction was determined by using a compass.

Figure 32: Digital Instrument Testo 425

Figure 33: Measurements of Atmospheric Pressure Using Aneroid Barometer

Air quality measurements were carried out in accordance with GOST 17.2.3.01-86 "Nature protection. Atmosphere Air quality control rules for settlements". Measurement of atmospheric air for determining nitrogen dioxide, carbon monoxide, sulfur dioxide content were conducted by using an ECOLAB gas analyzer (modification A) and suspended particles (dust) measurement in the atmospheric air were carried out on a DustTrak DRX dust analyzer (see Figure 34).

Figure 34: DustTrak DRX dust analyzer

Table 28 provides a list baseline air quality measurement parameters and the methods of their analysis.

The level of atmospheric CO and Dust was assessed in accordance with SanPiN No: 0293-11 which was developed and approved by the Ministry of Health of the RUz

Table 28: Methods of CO, Dust and Meteorological Parameters Measurements

Defined Ingredient	Measurement Method
Meteorological parameters: air temperature, pressure, wind direction and speed	GOST 17.2.3.01-86 "Nature protection. Atmosphere. Air quality control rules for settlements"
Carbon oxide	Working procedure for testing with the use of automatic gas analyzers EKOLAB for monitoring atmospheric air. MIP 03897485.001: 2019.
Dust	Test procedure for mass concentration of aerosol particles of various origins, as well as total dust content using a portable aerosol analyzer "Dust Trak DRX 8534".

On the other hand, SO2 and NO2 was measured via passive diffusion tubes for one month between 20 July and 20 August 2022 at A-01, A-02 and A-03 stations (see Figure 35). Sampling and measurement were conducted by Çevre Endüstriyel Analiz Laboratuvarı which is accredited for TS EN 13528 method. The details of passive diffusion tubes sampling are given in Table 29.

A-01 A-02 A-03

Figure 35: Passive Diffusion Tubes at Measurement Points

Table 29: Methods of SO_2 and NO_2 Measurements, Measurement Period and Notes

Parameter	Method	Measurement Period	Notes
SO_2	TS EN 13528-1,2,3	20 July and 20 August 2022	Passive Diffusion tubes at A-01 point was damaged. Therefore, tubes collected from A-01 is not analysed.
NO_2	TS EN 13528-1,2,3	20 July and 20 August 2022	

6.2.1 Local Meteorological Conditions

Surkhandarya is the region of the southernmost administrative-territorial unit of Uzbekistan. The climate in the area of the proposed construction of the thermal power plant is sharply continental: dry with long frost-free periods (250-270 days). The high average annual air temperature and its sharp daily fluctuations, hot dry summers, insignificant amount of atmospheric precipitation and high evaporation determine the desert like character of the region's climatic conditions. Average monthly air temperatures range from 0.5-7.7 (December-January) to 25.5-28.2 (July-August). The air temperature varies considerably over the year, from 16°C in winter to 40-42°C in the summer months. Sub-zero winter temperatures were mostly observed in the period before 1977.

Since 1994, there has been a general tendency towards an increase in average annual air temperatures from 13.0 to 14.5°C. In general, the distribution of average annual temperatures corresponds to the identified periods in terms of the water content of the year. The amount of annual precipitation varies from 185.8 mm to 781 mm, with the norm of the total average annual precipitation being 441.94 mm. The greatest amount of precipitation in the year occurs in the winter-autumn months, from December to May. However, in some years this period becomes somewhat extended

and may span the months of October to June. Considering the historical data belonging to the 2021 year, annual average air humidity is 43%, with a monthly average of 22-68%[4].

Termez meteorological station is the closest meteorological station to the project site, which is nearly 12 km and altitude and terrain around of this station is similar with the Project site. The following meteorological evaluations are conducted in accordance with the long-term data obtained from Termez station.

The monthly average temperature, maximum temperature, minimum temperature observed at Termez Meteorological Station beween 2005 and 2021 is given in Table 30 and Figure 36. As can be seen from the table and figure, temperature is increasing towards the summer and decreasing towards winter. While maximum air temperature is observed between 2005 and 2021 as 45.1 °C at May 2005 and July 2021, minimum temperature is observed as -20.00 in February 2014.

Table 30: Montly Average Temperature, Maximum Temperature, Minimum Temperature Observed at Termez Meteorological Station (As of February 2005 – End of 2021) (°C)[4,5]

Month	Average Temp.	Maximum Average Temp.	Minimum Average Temp.	Max Recorded Temp. and date	Min Recorded Temp. and date
1	4.2	7.3	-5.7	37.8 / 02.01.2007	-19.2 / 26.01.2008
2	7.0	10.8	0.0	28.8 / 25.02.2016	-20.00 / 04.02.2014
3	13.8	17.8	10.5	37.0 / 31.03.2018	-11.7 / 07.03.2007
4	19.6	22.3	16.0	38.0 / 29.04.2021	1.0 / 25.04.2008
5	25.8	27.7	22.9	41.1 / 15.05.2006	1.6 / 06.05.2012
6	29.8	31.0	27.8	45.1 / 22.06.2005	14.2 / 20.06.2013
7	31.2	33.1	30.0	45.1 / 09.07.2021	4.5 / 06.07.2005
8	28.7	29.9	27.7	45.0 / 06.08.2019	1.6 / 28.08.2008
9	23.8	25.7	22.2	39.1 / 05.09.2005	1.6 / 12.09.2005
10	16.9	20.4	14.1	36.6 / 05.10.2013	0.9 / 30.10.2014
11	9.9	11.9	7.8	32.5 / 01.11.2017	-9.2 / 27.11.2016
12	5.3	7.9	1.9	23.7 / 02.12.2021	-15.9 / 29.12.2012

[4] https://rp5.ru/Weather_archive_in_Termez_(airport)

[5] Air temperature at 2 metre height above the earth's surface

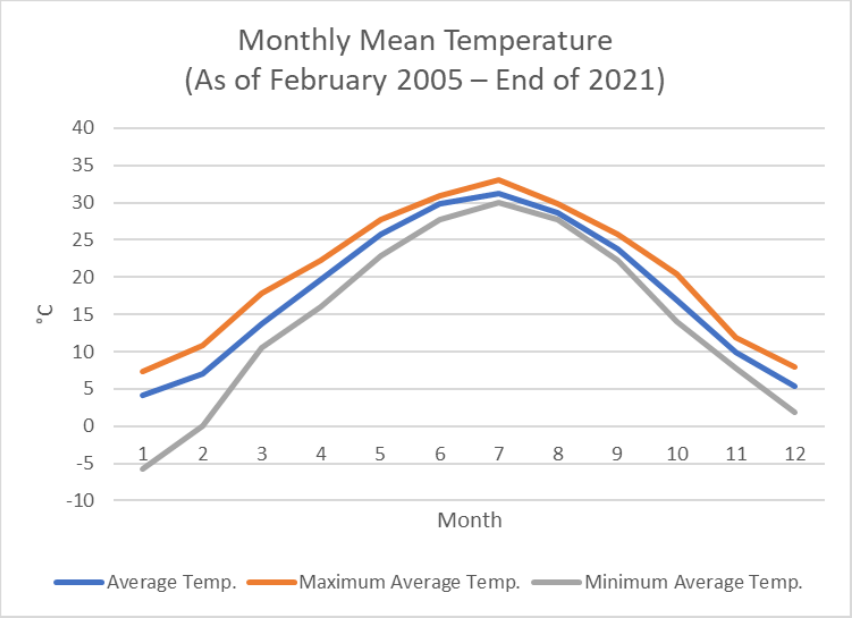


Figure 36: Montly Average, Maximum and Minimum Temperatures Observed at Termez Meteorological Station (As of February 2005 – End of 2021) (°C)

Additionally, annual temperature trends between 2005 and 2021 is investigated and given in Table 31 and Figure 37. Average mean temperature is similar through 2005 and 2021. It can be said that, no increase trend is observed since 2005.

Table 31: Annual Average, Minimum and Maximum Temperatures Observed at Termez Meteorological Station (°C)[4] (As of February 2005 – End of 2021)

Year	Temperature		
	Average Value	Max. Value	Min. Value
2005	19.1	45.1	-4.2
2006	18.2	42.6	-9.8
2007	17.9	44.1	-11.7
2008	17.5	43.8	-19.2
2009	17.9	42.0	-2.6
2010	18.4	44.6	-8.3
2011	18.0	44.2	-8.6
2012	17.2	43.3	-15.9
2013	18.4	43.4	-9.5
2014	17.3	42.9	-20.0
2015	18.2	44.1	-4.7

Year	Temperature		
	Average Value	Max. Value	Min. Value
2016	18.8	44.8	-10.8
2017	18.2	43.5	-6.8
2018	18.4	44.2	-9.0
2019	18.6	45.0	-2.0
2020	17.3	43.9	-7.6
2021	18.8	45.1	-8.3

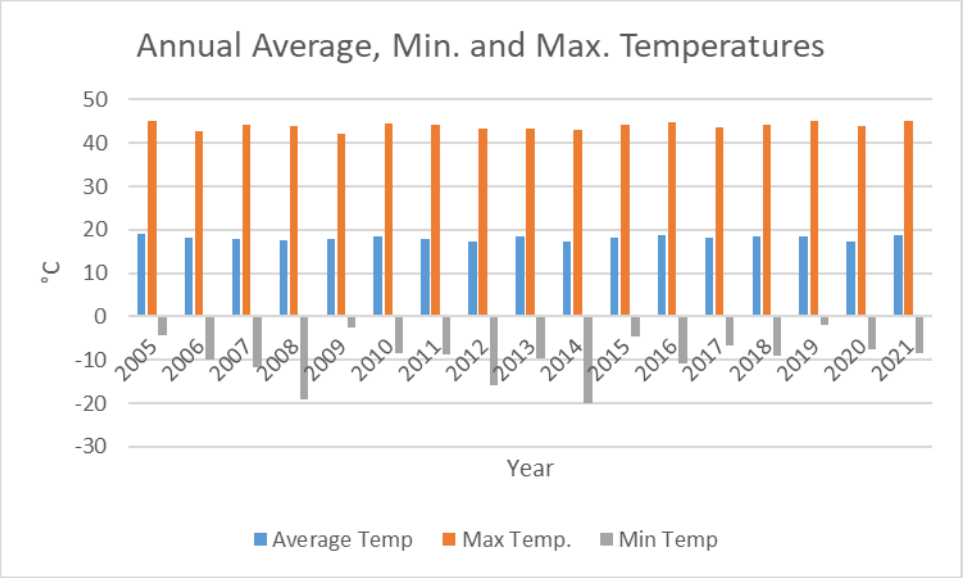


Figure 37: Annual average, minimum and maximum temperatures observed at Termez Meteorological Station (°C) (As of February 2005 – End of 2021)

Wind speed trends between 2005 and 2021 are investigated. Average and maximum values of annual wind speeds are given in Table 31 and Figure 37. Average mean wind speed is similar through 2005 and 2021. The trend increased between 2005-2007 and in 2009.

Table 32: Annual Average and Maximum Wind Speeds Observed at Termez Meteorological Station (m/s) (As of February 2005 – End of 2021) [4,6]

Year	Wind Speed	
	Average Value	Max. Value
2005	2.8	44.0
2006	2.7	50.0
2007	2.7	41.0
2008	2.6	23.0
2009	3.0	50.0
2010	2.7	19.0
2011	3.1	17.0
2012	2.8	16.0
2013	2.9	17.0
2014	2.8	14.0
2015	2.7	19.0
2016	2.7	22.0
2017	2.7	16.0
2018	2.9	15.0
2019	2.8	15.0
2020	2.8	17.0
2021	2.7	20.0

[6] Wind speed at a height of 10-12 metres above the earth's surface over the 10-minute period immediately preceding the observation

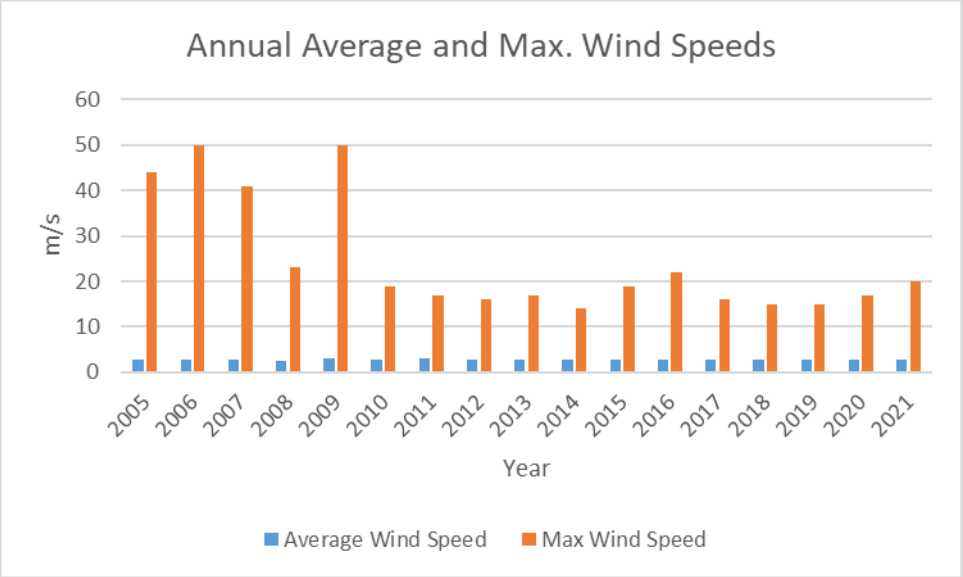
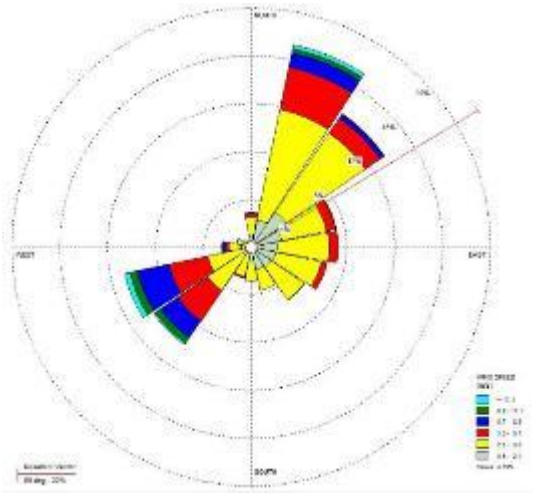
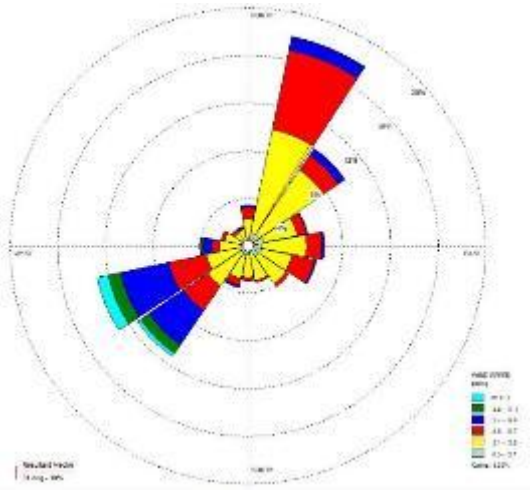


Figure 37: Annual average and maximum wind speeds observed at Termez Meteorological Station (m/s) (As of February 2005 – End of 2021)

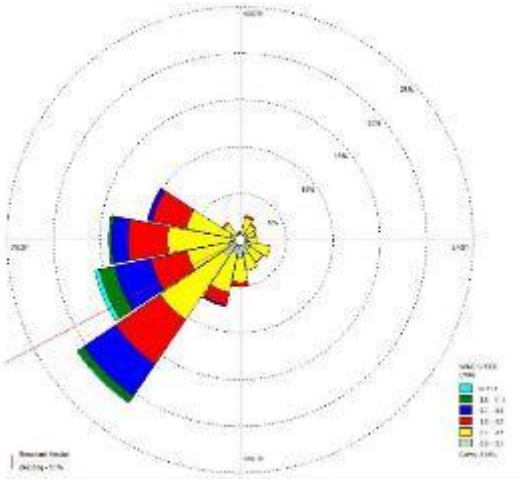
The dominant wind direction of the Termez Meteorological Station is blowing from WSW and NNE through the year. On the other hand, wind pattern changes through the year. Wind blows mainly from NNE and NE between January to June and between July and September wind blows mainly from WSW and SW direction (see Figure 38).



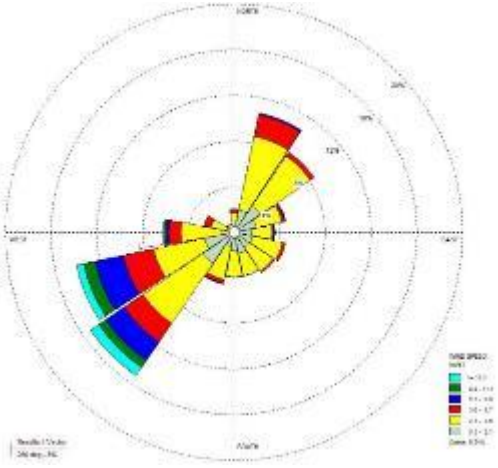
January – March 2018



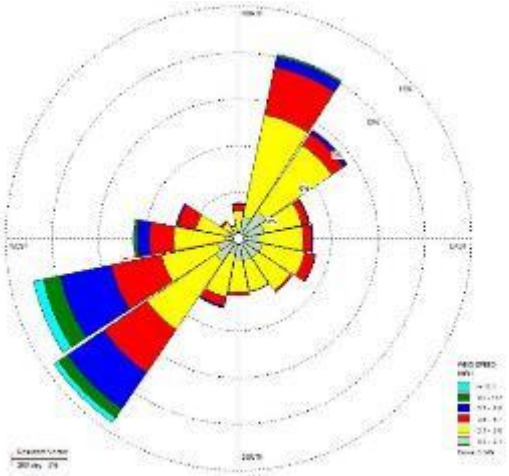
April- June 2018



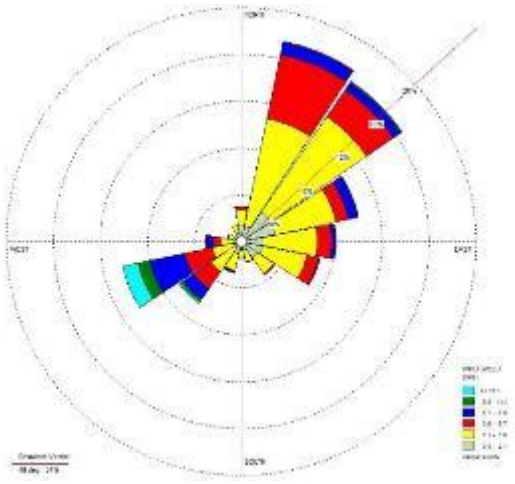
July- September 2018



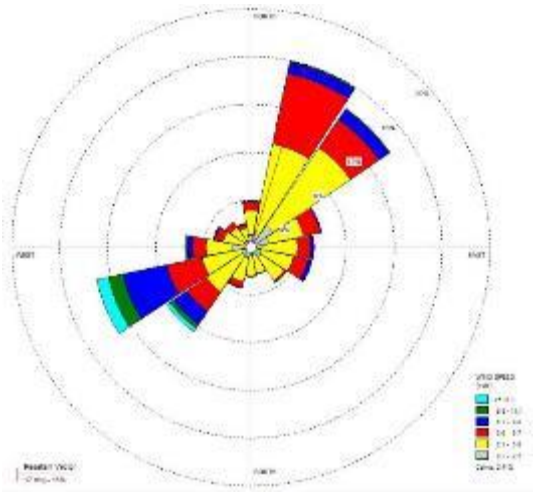
October – December 2018



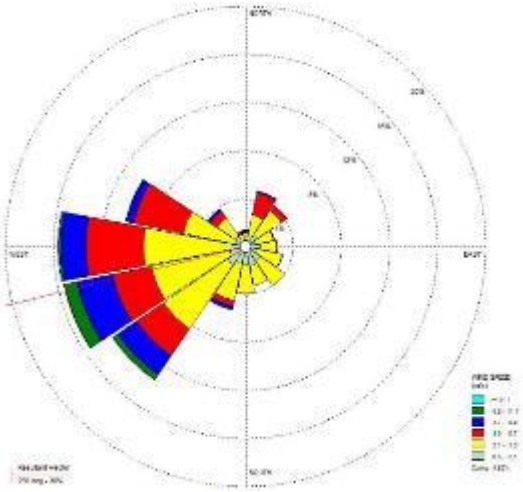
January – December 2018



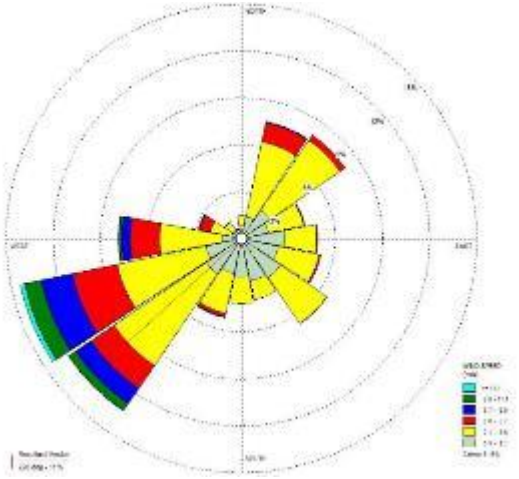
January – March 2019



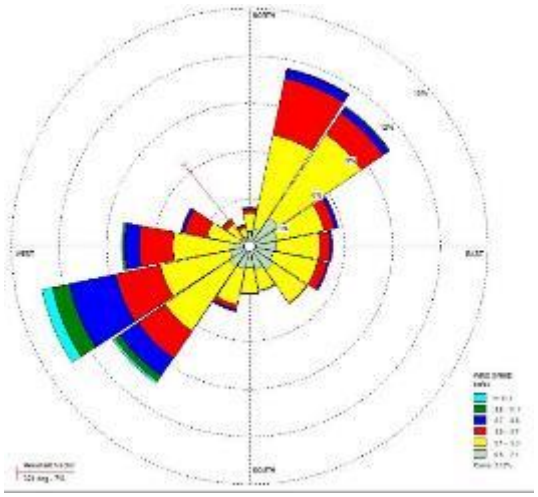
April- June 2019



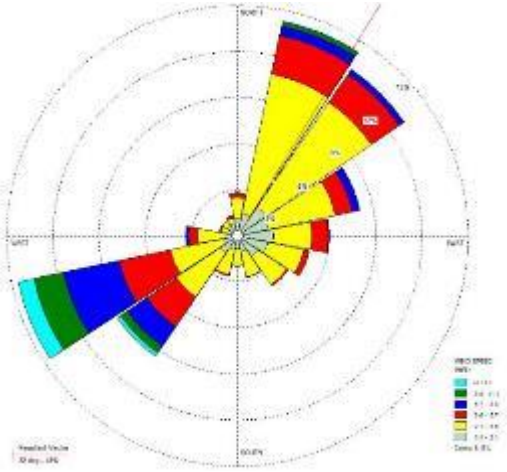
July- September 2019



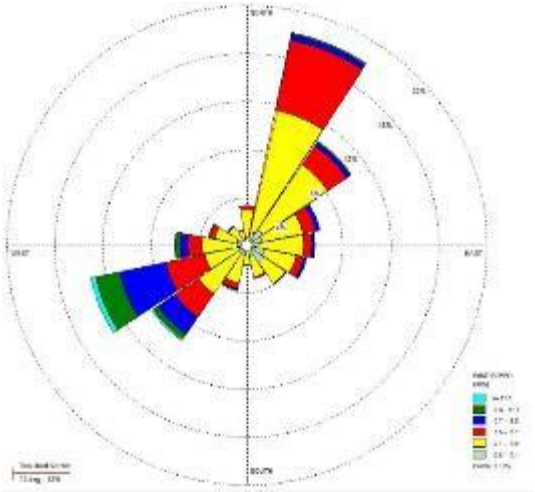
October – December 2019



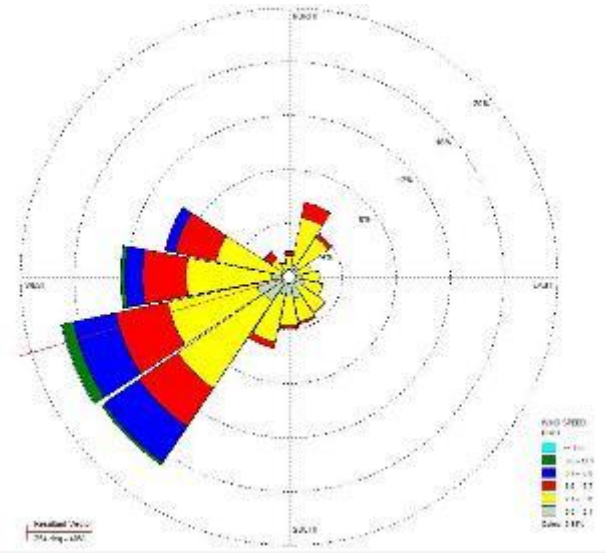
January – December 2019



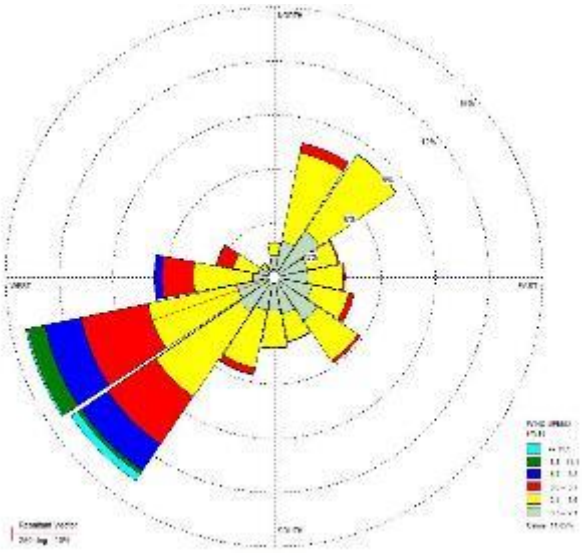
January – March 2020



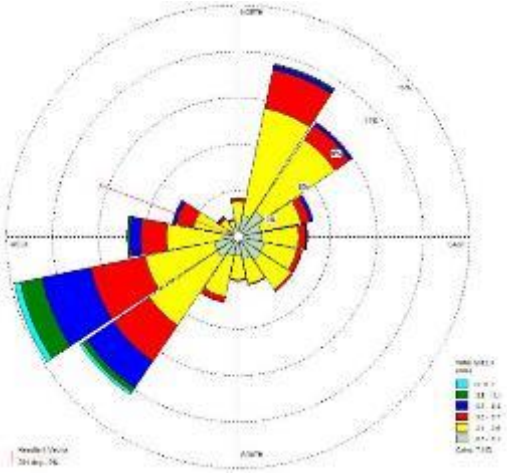
April- June 2020



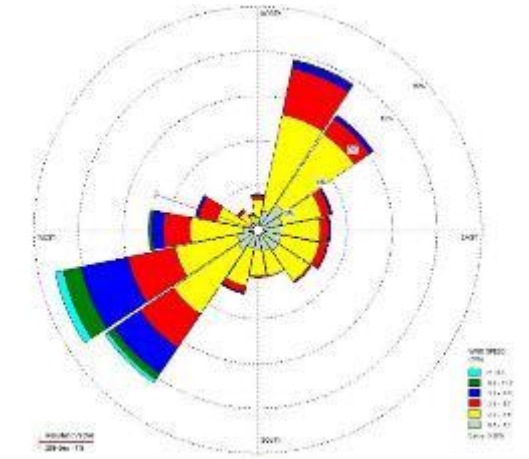
July- September 2020



October – December 2020



January – December 2020



January 2018– December 2020

Figure 38: Quarterly and Annual Wind Rose Diagrams of Termez Station (2018-2020 – blowing from)

In accordance with the precipitation data gathered at Termez Meteorological station, approximately 175 mm precipitation is observed through the year (see Table 33). The majority of rain events are observed between December and May. The most precipitation is observed in 2006 between 2005 and 2021.

As can be seen from the Table 33, 2006 year is the most snow event is observed at Termez Station between 2005 and 2021. The majority of snow events are observed between December and February months.

Table 33: Annual Precipitation (mm) and Snow Depth (cm) Observed at Termez Meteorological Station (As of February 2005 – End of 2021)[4]

Year	Precipitation (mm)	Snow depth (cm)
2005	87	10.0
2006	514.0	15.2
2007	137.0	4.0
2008	84.0	6.7
2009	134.0	1.0
2010	152.0	0.0
2011	213.0	2.0
2012	180.0	2.0
2013	120.0	1.2
2014	163.0	8.1
2015	203.0	1.3
2016	175.0	7.2
2017	220.0	1.3

Year	Precipitation (mm)	Snow depth (cm)
2018	116.0	1.3
2019	188.0	0.0
2020	185.0	1.8
2021	119.0	1.0

Relative air humidity trends between 2005 and 2021 are investigated. Average and minimum values of annual relative air humidity are given in Table 31 and Figure 37. Except from the year 2006 when a decrease was recorded, average mean humidity is similar through 2005 and 2021. It can be said that; no increase trend is observed since 2005.

Table 34: Annual Average and Minimum Relative Air Humidities Observed at Termez Meteorological Station (%) (As of February 2005 – End of 2021) [4,7]

Year	Relative Air Humidity	
	Average Value	Min. Value
2005	51.0	6.0
2006	-	-
2007	55.0	7.0
2008	52.0	8.0
2009	56.0	8.0
2010	55.0	5.0
2011	52.0	7.0
2012	55.0	10.0
2013	52.0	7.0
2014	54.0	8.0
2015	55.0	6.0
2016	52.0	6.0
2017	50.0	6.0
2018	47.0	5.0
2019	49.0	7.0

[7] Relative humidity at a height of 2 metres above the earth's surface

Year	Relative Air Humidity	
	Average Value	Min. Value
2020	49.0	7.0
2021	43.0	6.0

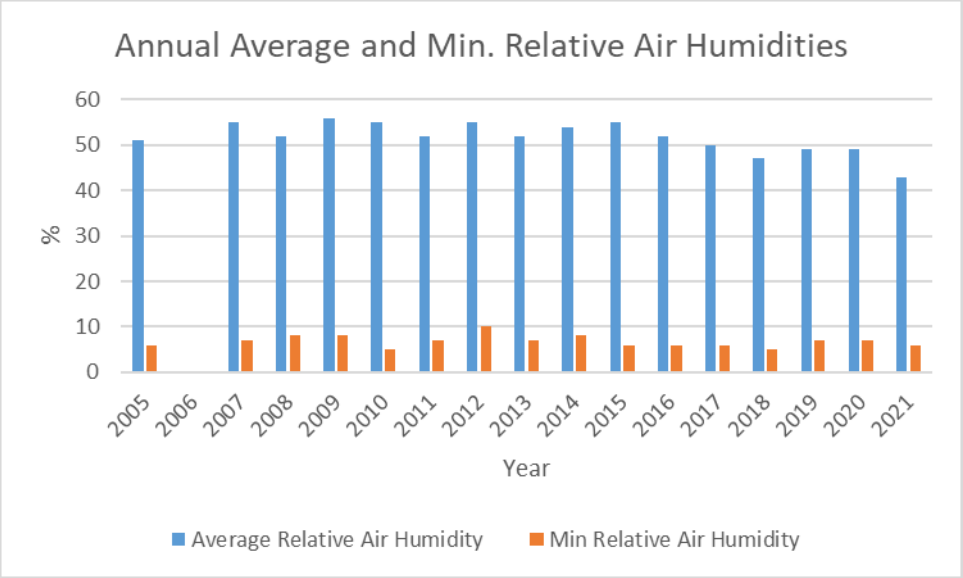


Figure 39: Annual average and minimum relative air humidities observed at Termez Meteorological Station (%) (As of February 2005 – End of 2021)

Atmospheric pressure trends between 2005 and 2021 are investigated. Average, minimum and maximum values of annual atmospheric pressures are given in Table 35 and Figure 42. Average and maximum atmospheric pressures are similar through 2005 and 2021. Whereas minimum atmospheric pressure was relatively low between 2005-2008, it started to increase in 2009 and has been similar since that year.

Table 35: Annual Average, Minimum and Maximumu Atmospheric Pressures Observed at Termez Meteorological Station (mm of Hg) (As of February 2005 – End of 2021) [4,8]

Year	Atmospheric Pressure		
	Average Value	Min. Value	Max. Value
2005	731.6	123.7	812.1
2006	731.7	136.4	818.5
2007	733.4	275.4	800.6

[8] Atmospheric pressure at weather station level

Year	Atmospheric Pressure		
	Average Value	Min. Value	Max. Value
2008	732.8	76.6	753.2
2009	733.2	669.5	752.7
2010	733.5	716.0	754.2
2011	733.4	718.7	753.7
2012	733.5	719.7	753.1
2013	733.2	718.6	750.8
2014	734.3	719.8	754.6
2015	734.2	717.0	752.8
2016	733.8	720.8	753.1
2017	734.1	718.3	715.9
2018	733.8	718.0	752.2
2019	733.6	719.4	784.4
2020	734.6	719.7	752.8
2021	733.8	719.7	753.4

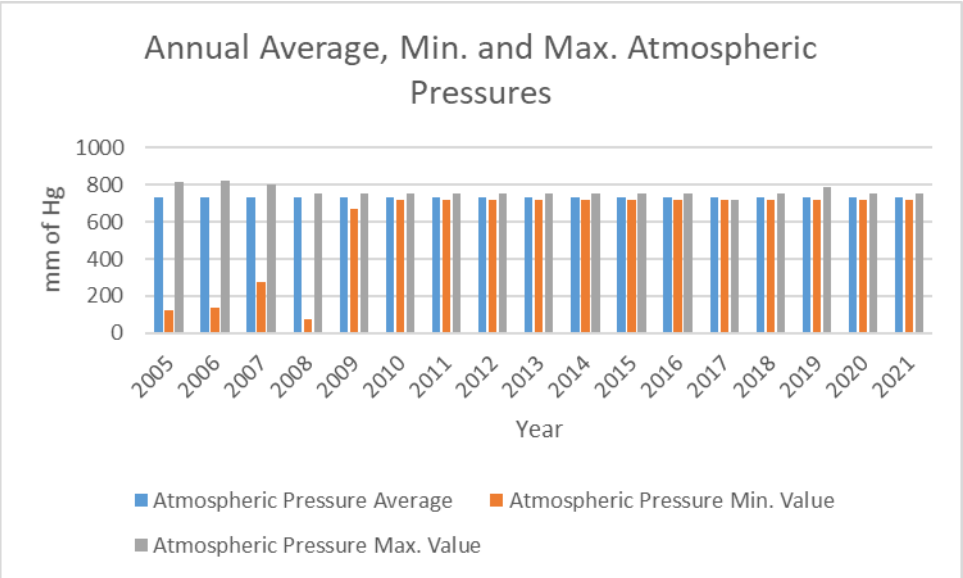


Figure 40: Annual average, minimum and maximum atmospheric pressures observed at Termez Meteorological Station (mm of Hg) (As of February 2005 – End of 2021)

6.2.2 Local Influences on Air Quality

Dust and engine emissions created by construction activities (i.e. earthworks, demolition and operation of machinery) can influence the local ambient air quality.

The release of vehicle exhaust emissions into the atmosphere due to the highway around the project area may have an impact on the local ambient air quality.

6.2.3 Existing Ambient Air Quality Data

Baseline data on atmospheric air pollution in the territory of the Project was obtained from the results of air quality measurement from the 3 (three) observation station for 7 days period in July 2021.

Together with this sulfur dioxide, nitrogen dioxide, nitrogen oxide, carbon monoxide and dust measurements were carried out.

The assessment of baseline atmospheric air pollution was carried out by comparing the measurement results with the corresponding maximum permissible concentrations of the estimated parameters (carbon monoxide, air dust content) in accordance with SanPiN No: 0293-11 (see Table 36).

Table 36: CO and Dust Measurement Results

MPC limit value (one-time) (mg/m³)			Carbon monoxide (mg/m³) 5.0 (mg/m³)	Dust (mg/m³) 0.5 (mg/m³)
Sampling Point A01				
1.	**10.07.2021**	Morning	0.53	0.310
2.		Day	<BDL*	0.067
3.		Evening	<BDL	0.069
4.	**11.07.2021**	Morning	<BDL	0.201
5.		Day	<BDL	0.076
6.		Evening	<BDL	0.017
7.	**12.07.2021**	Morning	<BDL	0.151
8.		Day	<BDL	0.079
9.		Evening	<BDL	0.085
10.	**13.07.2021**	Morning	<BDL	0.110
11.		Day	<BDL	0.049
12.		Evening	<BDL	0.079
13.	**14.07.2021**	Morning	<BDL	0.067
14.		Day	<BDL	<BDL
15.		Evening	<BDL	0.022
16.	**15.07.2021**	Morning	<BDL	0.048

MPC limit value (one-time) (mg/m³)			Carbon monoxide (mg/m³) 5.0 (mg/m³)	Dust (mg/m³) 0.5 (mg/m³)
17.		Day	<BDL	0.056
18.		Evening	<BDL	0.026
19.	**16.07.2021**	Morning	<BDL	0.085
20.		Day	<BDL	0.234
21.		Evening	<BDL	0.037
Sampling Point A02				
1.	**10.07.2021**	Morning	1.36	0.519
2.		Day	<BDL	0.306
3.		Evening	<BDL	0.240
4.	**11.07.2021**	Morning	<BDL	0.276
5.		Day	<BDL	0.072
6.		Evening	<BDL	0.110
7.	**12.07.2021**	Morning	<BDL	0.123
8.		Day	<BDL	0.039
9.		Evening	<BDL	0.122
10.	**13.07.2021**	Morning	<BDL	0.108
11.		Day	<BDL	0.069
12.		Evening	<BDL	0.714
13.	**14.07.2021**	Morning	<BDL	0.068
14.		Day	<BDL	0.045
15.		Evening	<BDL	0.139
16.	**15.07.2021**	Morning	<BDL	0.044
17.		Day	<BDL	0.031
18.		Evening	<BDL	0.019
19.	**16.07.2021**	Morning	<BDL	0.201
20.		Day	<BDL	0.391
21.		Evening	<BDL	0.121
Sampling Point A03				
1.	**10.07.2021**	Morning	<BDL	0.530
2.		Day	<BDL	0.610

MPC limit value (one-time) (mg/m³)			Carbon monoxide (mg/m³) 5.0 (mg/m³)	Dust (mg/m³) 0.5 (mg/m³)
3.		Evening	<BDL	0.082
4.	**11.07.2021**	Morning	<BDL	0.103
5.		Day	<BDL	0.050
6.		Evening	<BDL	0.055
7.	**12.07.2021**	Morning	<BDL	0.142
8.		Day	<BDL	0.081
9.		Evening	<BDL	0.054
10.	**13.07.2021**	Morning	<BDL	0.083
11.		Day	<BDL	0.066
12.		Evening	<BDL	0.036
13.	**14.07.2021**	Morning	<BDL	0.098
14.		Day	<BDL	0.020
15.		Evening	<BDL	0.015
16.	**15.07.2021**	Morning	<BDL	0.076
17.		Day	<BDL	0.015
18.		Evening	<BDL	0.019
19.	**16.07.2021**	Morning	<BDL	0.151
20.		Day	<BDL	0.508
21.		Evening	<BDL	0.015

* *BDL= Below Detection Limit*

Table 37: NO_2 and SO_2 Measurement Results

Measurement Point MPC limit value (Monthly -µg/m³)	Measurement Period	NO_2 50 µg/m³	SO_2 100 µg/m³
A-01*	20.07.2022 – 20.08.2022	-	-
A-02	20.07.2022 – 20.08.2022	29.38	18.13
A-03	20.07.2022 – 20.08.2022	31.68	23.61

**Passive Diffusion tubes at A-01 point was damaged. Therefore, tubes collected from A-01 is not analysed.*

The results of the field studies of the state of atmospheric air carried out in July 2021 on the territory of the Project shows that:

- The carbon monoxide concentration in the atmospheric air was below the level of the established standard maximum permissible concentration at all observation points
- Dust concentrations are observed (see Table 36), generally significantly lower than the established MPC standards, with the exceptions of outlier one-time excesses of 1.4 times on the evening of July 13th at Monitoring Point 2 and 1.2 times in the afternoon of July 10th at Monitoring Point 3. Since the area around the monitoring points contains sand and limited amount of vegetation cover, dust concentrations can be increased via wind.

In addition, 1-month SO2 and NO2 measurements were performed via passive tube sampling between 20 July 2022. and 20 August 2022. As seen from Table 37, all measurement results are below the regulatory limits. It can be said that, airshed around project area is non-degraded by considering measurement. It should be noted that non-existence of industrial zones around the project site and village type of settlements in the vicinity of the project area are the main reason for having non-degraded air quality shed.

The nearest long-term air quality monitoring station that is operated by the state is located nearly 130 km to the Project site. Therefore, the data collected in this station is not considered to be used in this ESIA Report.

6.3 Sensitive Receptors

Sensitive receptors were determined in the scoping process given in Table 38 and Figure 17 and background air quality measurements were performed at three points which are shown in Figure 31. The table below shows the receptors around the project area regarding the impacts on air quality.

Table 38: Air Quality Receptors of the Project

Receptor	Receptor Type	Distance from Project Border (m) and Direction to the Plant	Sensitivity	Justification
A-01	Residential area Garden, next to the village, 300 m from the cell tower.	5500 m SW	Medium	Permanent residents in residential areas, would be vulnerable to changes in ambient air quality,
A-02	Residential area Kattakum	1850 m W	Medium	Permanent residents in residential areas, would be vulnerable to changes in ambient air quality,
A-03	Residential area Former sanatorium, 15-20 m from the lake.	3850 m SSW	Medium	Permanent residents in residential areas, would be vulnerable to changes in ambient air quality,
IR-1	Industrial Receptor	250 m N	Low	Waste processing facility near the project area
HR-1	Human Receptor	1350 m W	Medium	Permanent residential area
HR-2	Human Receptor	1850 m S	Medium	Permanent residential area
HR-3	Human Receptor	4100 m SW	Medium	Permanent residential area

Receptor	Receptor Type	Distance from Project Border (m) and Direction to the Plant	Sensitivity	Justification
AR-1	Agricultural Receptor	980 m NW	Medium	Agricultural area near Project area
AR-2	Agricultural Receptor	4810 m SW	Medium	Agricultural area near Project area
AR-3	Agricultural Receptor	3060 m SSW	Medium	Agricultural area near Project area

6.4 Potential Impacts, Mitigation, Management & Residual Impact

6.4.1 Construction Phase

During construction phase, local ambient air quality may potentially be affected by increased dust, particularly during the site preparation stage (site clearance and earthworks etc.) and by the exhaust gas of construction vehicles, equipment and temporary power generators. The typical air emissions resulting from these activities include nitrogen oxides (NO_X), sulphur dioxides (SO_2), carbon monoxide (CO), carbon dioxide (CO_2), volatile organic compounds (VOC), particulates and benzene, toluene, ethylbenzene and xylene (BTEX).

- Sources of air emissions during construction phase are;
- Excavations and earthworks (dust),
- Vehicle movements on unpaved, or compacted roads and surfaces (dust);
- Particulate matter dispersion from uncovered truckloads;
- Vehicle and construction equipment emissions (e.g. NO_X, SO_X and CO, CO_2, VOCs, particulates and BTEX) and particulates from vehicles, generators and other mechanical equipment;
- Stored VOCs and other volatile hazardous materials (VOCs) and;
- Odour from temporary wastewater facilities, or containment

6.4.1.1 Dust

The main sources of dust and particulate matter emissions during construction phase will be:

- Excavations and earthworks, such as cutting, filling and levelling;
- Vehicle movements on unpaved, or compacted surfaces; and
- Particulate matter dispersion from uncovered truckloads.

Dust Emissions from Site Preparation

Excavations and earthworks cause dust which typically comprises large diameter particles, settle rapidly and close to the source.

According to the screening guidance of the UK's Institute of Air Quality Management (IAQM) for construction dust, detailed assessment relating to dust generation is required where there is a 'human receptor' within 350m of the boundary of the site[95]. In the case of this Project and with respect to the screening criteria above, although there is no any settlement within the sanitary buffer zone (500m

around the project area), there is a waste processing facility 250 m away from Project's north border. In addition to this, the closest residential receptors to the project site is about 1 km m away from the west border of project site. There are no expected impacts relating to dust emissions on the settlements. However, the existing facility (waste processing facility) can be affected. In addition to this, the magnitude of dust impacts from construction works will depend on the wind speed and wind direction at the project site. As shown in Figure 41, dominant wind direction is from the southeast for the year 2018, 2019 and 2020 and as a result, the potential of emissions impact to the facility can be considered as negligible.

In addition to vehicle movements on unpaved surfaces, dust generation from truck movements and particulate dispersion from truckloads would only occur where mitigation measures are not effectively implemented at the site, or by contractors bringing materials to the site.

Uncontained and/or un-sheeted trucks may be subject to losses of material where the containment is not effective (e.g. spills), or where wind or other air turbulence may disturb the contents and result in dispersion of materials. Such impacts have the potential to degrade local air quality in the immediate area of such movements.

In accordance with the UK's IAQM Guidance on the Assessment of Dust from Demolition and Construction, detailed assessment of vehicle movements should only be required where 'human' receptors are located within 50m of the route used by construction vehicles on public roads, up to 500m from the project site entrance [95]

In the instance of this Project, there are residential and commercial receptors within 50m of the route to be used by construction vehicles and as a result there is potential for impacts the receptors within 50m of the routes to be used by construction vehicles include residential and commercial receptors and there is potential for impacts relating to dust generation or particulate emissions as a result of increase vehicle movement on these routes.

6.4.1.2 Gaseous Emissions

The operation of Project related vehicles and fuel consuming construction equipment will be the only sources of gaseous emissions during construction phase. List of construction machinery, which will be used during land preparation and construction phases of the project, are given in Table 10.

The quantity of gaseous emissions from this equipment will depend on the number of vehicles/equipment deployed on site, hours of operation and efficiency. The exhaust emissions due to construction machinery are negligible. In addition to this, details of the overall GHG emissions during construction phase are provided in Section 14.

Table 39: List of Vehicles and Construction Equipment During Construction Phase

Vehicles & Equipment Name	Quantity	Fuel
750t Crawling Crane	1	Diesel
150t Crawling Crane	1	Diesel
Hydraulic Lifting Device and Lifting Frame	1	Electrical
250t Crawling Crane	1	Diesel
50t Crawling Crane	1	Diesel
50t Truck Crane	1	Diesel
Gantry Crane	2	Electrical

Vehicles & Equipment Name	Quantity	Fuel
Truck	3	Diesel
Forklift	2	Diesel
Electric Welding Machine	301	Electrical
Diesel Generator	1	Diesel
Tower Crane	2	Electrical
Vehicle Crane	2	Diesel
Wheel Loader	1	Diesel
Backhoe Excavator	7	Diesel
Crawler Bulldozer	1	Diesel
Road Roller	2	Diesel
Dump Truck	10	Diesel
Platform Lorry	1	Diesel
Batch Plant	2	Electrical
Concrete Pump Truck	3	Electrical
Concrete Delivery Truck	6	Electrical
Piling Machine	4	Diesel

6.4.1.3 Emission of Volatile Organic Compounds (VOCs)

Small quantity of fuels, paints, solvents and other volatile substances are likely to be required during the construction phase, which will be stored in secure areas within the construction area. If not adequately contained, such substances have the potential to result in the dispersion of volatile emissions to the immediate air shed. Given that the storage of such volatile substances will be in small quantities, any potential impacts will be temporary and limited to the immediate surrounding area, likely to be within the Project site or in close proximity to the construction boundaries.

6.4.1.4 Odours

On site sanitation and toilet facilities (including septic tanks) will be provided for construction staff. There is the potential for release of odour to the immediate surrounding areas from inappropriate containment and coverage associated with wastewater holding/septic tanks. Any such impacts are likely to be temporary and limited to the Project site or in close proximity to the construction site boundaries.

6.4.1.5 Assessment of Impacts and Mitigation Measures

By using impact assessment significance criteria approach, key potential impacts and countermeasures on air quality for the construction phase are presented in Table 40. In addition to mitigation measures, following studies are recommended;

- Provide information such as construction site utilization plan, excavation schedule, amount of material to be excavated and used for backfilling, machinery list and types, amount of fuel to be used, etc.
- Develop a Traffic Management Plan to establish speed limits.

- Conduct air quality monitoring in line with the plan.
- Prepare an Authority Approval Manual and obtain permits for batching plant(s).
- Conduct periodic site audits and report including findings.

Table 40: Impacts Significance of the Air Quality during – Construction Phase

Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Dust emissions– Generated as a result of site preparatory works and movement of vehicles on unpaved surfaces	Residential Areas	Medium	Medium	Moderate	Any land grading, excavations and moving of uncovered waste/materials will not be carried out during strong wind movements Where sand and other dusty materials are transported to the site, trucks will not be overloaded and will be appropriately covered/sheeted to avoid loses. Vehicle speed on all site roads and along the access road into the site will be restricted to 20 km/h. Speed limits will be established in the Traffic Management Plan will be adhered to. Wetting down of any unpaved site roads in order to reduce dust generation. Full PPE kit will be provided to the workers including dust masks. No burning of wastes will be allowed onsite. Dusty material stockpiles (i.e. any fine powders and sand) dust generating activities will be to be located away from the site boundaries and be contained to avoid dust dispersion during storage or use. Cement and other fine powders will be sealed after use or put in bunded containers. Concrete batching plant(s) will be located away from sensitive receptors.	Minor
	Workers at the Site	High	Medium	Major		Moderate
	Industrial Facilities	Low	High	Moderate		Minor
Gaseous emissions – From vehicle exhaust	Residential Areas & Workers at the Site	Medium	Medium	Moderate	Unnecessary usage of vehicles, plant and equipment will be minimized - No unnecessary idling. Exhaust fumes and particulates emitted from trucks and vehicles will be minimized by ensuring the use of good condition vehicles (e.g. compliant to vehicle emission requirements). Lorries and truck engines will be turned off while waiting on site to minimize gaseous emissions. Internal roads inside the project site will be compacted as it reduces vehicular power consumption. Construction roads in the site will be designated and made clear to the drivers with signage for directions and speed limits placed all along the roads.	Minor
Emissions of VOCs and other hazardous volatiles	Residential Areas & Workers at the Site	Medium	Medium	Moderate	Hazardous materials stored in sealed containers and used on site with potential gas emissions will be located in well-ventilated, but secure low-risk areas, away from major transport routes and away from the site boundary (where possible). Fires and material burning will not be allowed on the Project site. Chemical storage areas will be purpose built and well maintained. A data log of all chemicals with MSDSs will be provided at the storage facility within easy access.	Minor

Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Odour from Onsite	Residential Areas & Workers at the Site	Medium	Medium	Moderate	Adequate and sufficient sanitary facilities for site workers will be provided. Effective cleaning and maintenance of toilets to be undertaken to avoid odour dispersion and cleaning records/inspection sheets displayed in the toilets. All septic tanks will be sealed and fully functioning. Septic tanks will be operated and maintained according to manufacturer recommendations. Sanitary waste will be removed from site by licensed contractors and disposed in waste treatment facilities approved by the local government.	Minor

6.4.2 Operational Phase

Activities associated with the operational phase of the Project will result in the emissions of gaseous pollutants from the operation of the CCGT power blocks. These emissions will occur under combined cycle operating modes using natural gas fuel only. Impacts from the CCGT are likely to be associated with emissions from the two main stacks associated with the HRSG.

The key pollutants arising from natural gas combustion and emitted via the stacks will be oxides of nitrogen (NO and NO_2) and carbon monoxide (CO). The use of natural gas is generally accepted as being preferred over fuel oils or other solid fuels and there will be no (or negligible) emissions content of SO_2 and no particulates [13].

6.4.2.1 Air Dispersion Modelling

By means of modeling studies, how the pollutants to be discharged from the stack of the planned plant into the atmosphere under the current meteorological conditions and the possible ground level concentration values of the pollutants are investigated.

AERMOD software is used within the scope of Air Quality Dispersion Modeling. This model is a typical Gaussian dispersion model and is used to calculate the distribution of various pollutants such as gas or dust in three dimensions. It is possible to model the pollutant distribution of area, point, linear or volumetric sources within the scope of the model. The model, which was developed to replace ISC in 2000, has been proposed by USEPA (US Environmental Protection Agency) since 9 November 2005.

AERMOD is used for the modeling of atmospheric dispersion for air pollutants originating from a fixed plant in areas up to 50 kilometers, in simple or complex terrain.

A detailed air quality dispersion modelling assessment has been undertaken to determine impacts associated with the proposed Project. Dispersion modelling has been carried out using the United States (US) Environmental Protection Agency (EPA) Breeze AERMOD (version 10.0.0.15 and US EPA version 21112) dispersion model, three years of meteorological data from Termez (2018, 2019 and 2020) and terrain data for the local area.

The key pollutants considered in this assessment are: oxides of nitrogen (NOx) and carbon monoxide (CO) are the key pollutants emitted from combustion of natural gas that may potentially lead to exceedances of any relevant standards. Predicted concentrations are compared with the most stringent applicable standards and guidelines incorporated into Uzbekistan law and, the International Finance Corporation (IFC) guidelines.

In the scope of modelling studies, worst case approach was implemented. In this case, it is assumed that, the power plant will be operated at full load throughout the year. Technical details of the modelling inputs and amount of pollutants are given below.

Table 41: Modelling Study Inputs

Parameter		Unit	Characteristics		IFC Thermal Power Guidelines
Fuel Type		-	Natural gas	Natural gas	
Coordinates (UTM WGS84)		-	42S 345260E 4137909N	42S 345295E 4137945N	
Unit		-	Unit-1	Unit-2	
Number of Stack		Piece	1	1	
Inner Diameter of Stack		m	8.24	8.24	
Stack Height		m	65	65	
Flue Gas Volumetric Flow		m³/h	5,363,604	5,363,604	
Flue Gas Outlet Temperature		°C	120	120	
Flue Gas Output Speed		m/s	27.94	27.94	
Pollutant Concentrations	NOx	mg/Nm³	50	50	51
	CO	mg/Nm³	218.07	218.07	-
Pollutant Mass Flows Per Stack	NOx	g/s	74.5	74.5	
	CO	g/s	324.9	324.9	

The model considers all nitrogen emissions as NOx and will provide the ground level concentrations for NO2.Modelling results of NO_2 parameter is obtained from the in-built chemistry available module within AERMOD software by modelling NOx to calculate NO_2 concentrations.

Stack Height and Building Downwash Effect

In accordance with the information given by the Client, stack height is determined as 65 m for the Project.

As per the IFC Air Emissions And Ambient Air Quality Guideline: "*The stack height for all point sources of emissions, whether 'significant' or not, should be designed according to Good International Industry Practice (GIIP) to avoid excessive ground level concentrations due to downwash, wakes, and eddy effects, and to ensure reasonable diffusion to minimize impacts. For projects where there are multiple sources of emissions, stack heights should be established with due consideration to emissions from all other project sources, both point and fugitive.*" The guideline suggests to use the following formula as GIIP.

$$HG = H + 1.5L$$

Where;

HG = Good engineering practice stack height measured from the ground level elevation at the base of the stack

H = Height of nearby structure(s) above the base of the stack.

L = Lesser dimension, height (h) or width (w), of nearby structures

"Nearby structures" = Structures within/touching a radius of 5L but less than 800 m.

In accordance with the information provided by the Client, the highest project building is ACC building, which is 46m. Length of this building is 12m and width of the building is 6m.

The distance between ACC building and nearest stack is 120m.

In accordance with the nearby structure definition given above, structures within/touching a radius of 5L is accounted as nearby structure. In order to consider worst case scenario L is taken as 12m. Therefore,

$$5L = 5*12m = 60m \text{ (which is } < 120m)$$

Accordingly, ACC building is not considered as nearby structure. Therefore, no building downwash effect is of concern.

The GIIP stack height is calculated in case project layout change in the future and ACC building is moved to 60m near the stacks. In this case;

$$HG = H + 1.5L$$

$$HG = 46m + (1.5*12m)$$

$$HG = 64\ m$$

In this scenario, Project stack height (65m) is higher than GIIP stack height estimation (64m).

Therefore, in every scenario, stack height is in line with GIIP and no building downwash effect is of concern.

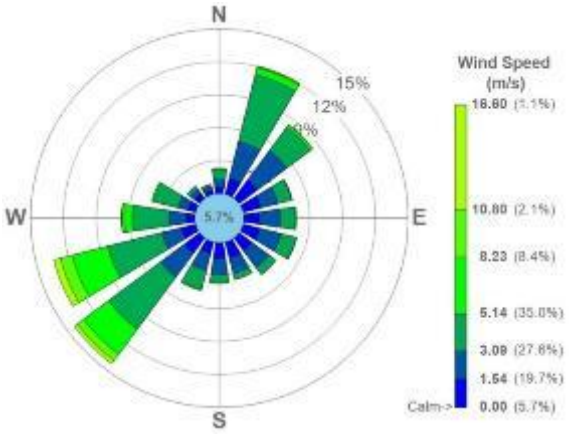
Baseline Data

As discussed in Section 6.2.3 , ambient air quality monitoring was undertaken for the Project with passive diffusion tubes for 1 month at three observation points (see Table 36).

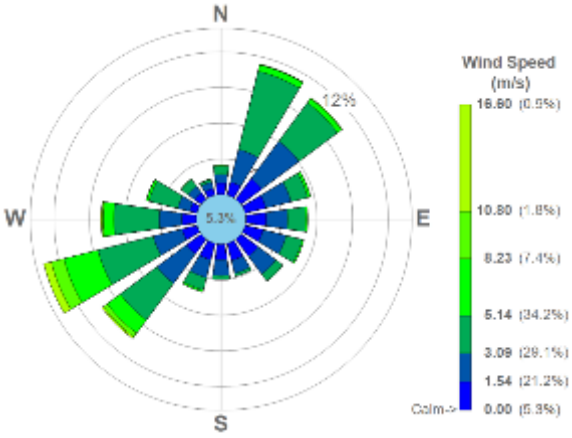
Meteorological Data

The Termez meteorological station is used for the air dispersion modeling studies. The station is the closest meteorological station to the project site, which is nearly 12 km and altitude and terrain around of this station is similar with the Project site. Therefore, this station is selected as representative station for this Project. The modelling has been carried out by using three years (2018, 2019 and 2020) of hourly sequential meteorological data (temperature, pressure, cloudiness, and wind speed and direction) in order to take account of inter-annual variability and reduce the effect of any atypical conditions. Data from meteorological station at Termez has been used for the assessment. Wind rose for each of these years are presented in the figures below. For all years, dominant wind direction is blowing from the southwest. Apart from this, upper atmospheric data was also used during the modelling study.

2018



2019



2020

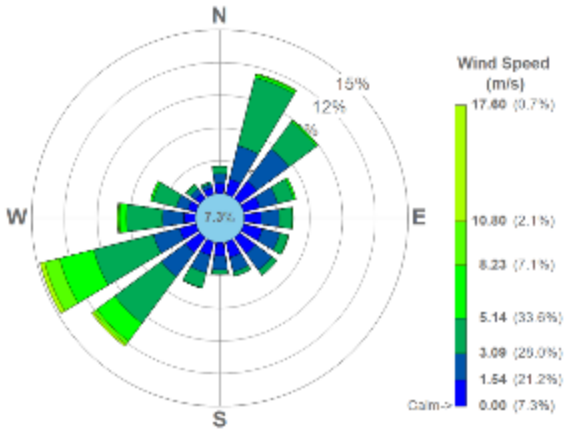


Figure 41: Wind Roses for the Years 2018, 2019 and 2020

Surface Roughness and Terrain

During surface roughness determination, the definitions and values that is determined in AERMET User Guide is used. The area is divided into sectors and each sector is defined by its characteristics. For the sections fall into Uchkizil Reservoir is defined as "Water (fresh and sea)" and the rest is defined as "Desert Shrubland".

The digital elevation data is used for terrain data.

Receptors

For the AERMOD model, a working area must be defined and allocated to the receiving environment elements. For this purpose, ground-level pollutant concentrations have been predicted at both the sensitive receptor points (see Section 6.3) and over a Uniform polar grid having 6.25 km radius (diameter 12.5 km) with 50 m ring increment and 36 radials. For this study, the central area of the Uniform polar grid area, defined as the midpoint of the Project area

In addition to this, ten discreet receptor points, were added to the modelling study. Among these ten discreet receptors;

- 3 of them are baseline air quality measurement points;
- 1 of them is industrial receptor;
- 3 of them are human receptors and;
- 3 of them are agricultural receptors.

As a result, total receptor point number is 9010 and in air quality modelling study, all of receptor points are evaluated. Satellite view of Uniform polar grid and discreet receptors with Project area given in Figure 42.

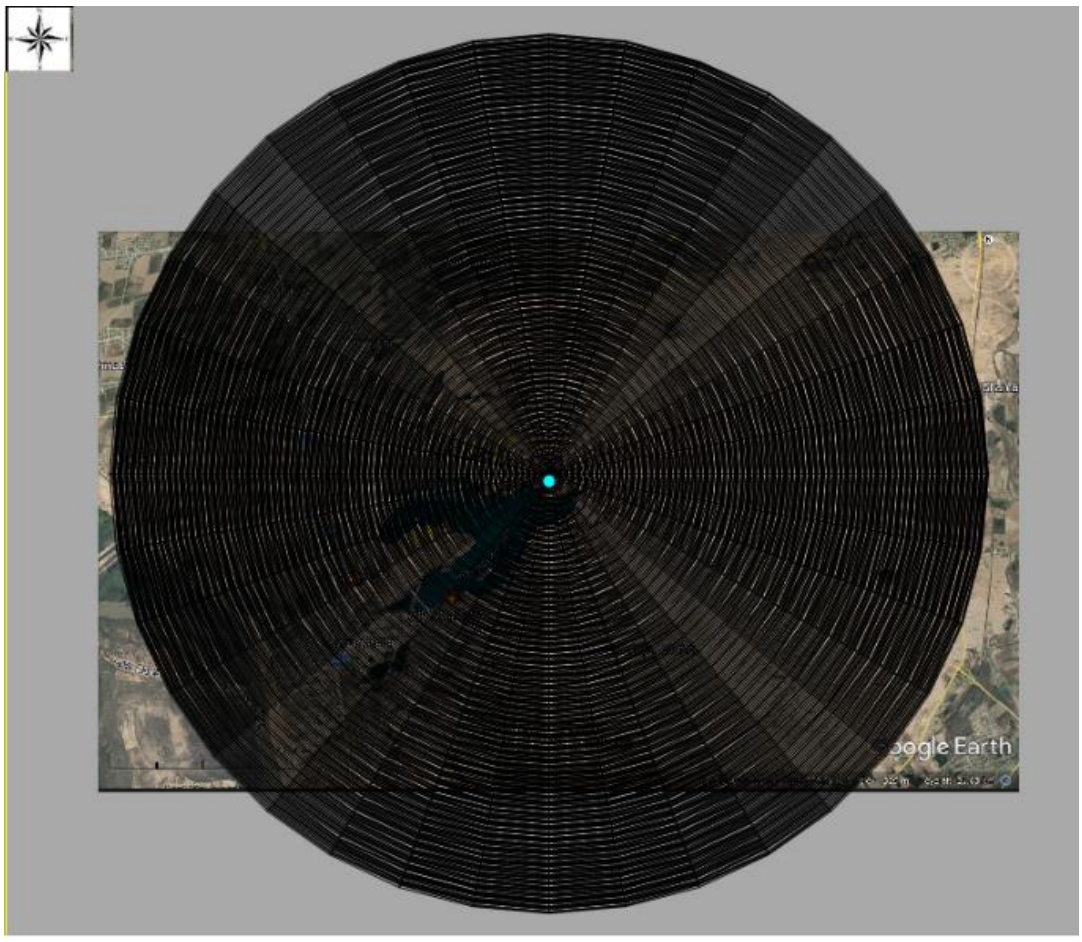


Figure 42: Air Quality Receptor Points

Modelling Result Evaluation Criteria

Modelling results are discussed in the context of the 25% rule as suggested by IFC General EHS Guidelines- Air Emissions and Ambient Air Quality. As a general rule, this Guideline suggests 25% of the applicable air quality standards to allow additional, future sustainable development in the same airshed. In this context; 25% rule is applied to Project air quality standards determined in Section 6.1 and the modelling results criteria is calculated and given in Table 42.

Table 42: Modelling result Evaluation Criteria as Per IFC 25% Rule

Pollutant Name	Averaging Period	Project Air Quality Standards	Modelling result evaluation criteria as per 25% rule	
		(mg/m³)	(mg/m³)	(µg/m³)
Carbon monoxide (CO)	One Time Maximum (20-30 min.)	5.0	3.75	3750
	Daily	4.0	3.00	3000
	Monthly	3.5	2.63	2630
	Annually	3.0	2.25	2250
Nitrogen dioxide(NO_2)	One Time Maximum (20-30 min.)	0.085	0.0638	63.8
	1 hour	0.2	0.1500	150
	Daily	0.06	0.0450	45
	Monthly	0.05	0.0380	38
	Annually	0.04	0.0300	30

Conversion of hourly modelling results to 30 min average results

AERMOD model calculates ground level concentrations for minimum 1 hour duration. In order to evaluate modelling results in accordance with local legislation (i.e. One time maximum (20-30 min)), peak-to-mean approach is used as given in the following formula [120]:

$$Ct1 = Ct2*(t2/t1)^{0.2}$$

Where;

Ct1: Concentration at shorter time average

Ct2: 1-hour AERMOD concentration

t2: 60 minutes

t1: 30 minutes

6.4.2.2 Modelling Results

In the scope of modelling studies, worst case approach was implemented. In this case, it is assumed that, the power plant will be operated at full load throughout the year. In addition to this, to determine the burden of air quality in the region, to compare this burden with the limit values given in the regulations and to create a cumulative impact assessment to provide solutions that can provide these limit values. Within the scope of the study, the pollutant ground level concentration obtained from the existing air quality measurements was taken as the present pollution load of the region and this result was collected with the results obtained from the modeling study and cumulative impact assessment was made.

The results of the modeling study and total pollution values on NO_2, and CO parameters that will occur during the operation phase are given below, separately.

NO_2 Modelling Results

The highest ground level concentrations and coordinates determined by the modelling study for NO2 pollutant during operation phase, background measurement results, the total pollution value which equals to the total of modelling result and background measurement value and the modelling result evaluation criteria are given in Table 43 and ground level concentration distributions are presented between Figure 43 and Figure 46.

As seen in modelling results, for all periods, the highest ground level concentration values are under the modelling result evaluation criteria.

Table 43: Highest Ground Level Concentrations of NO_2 via Modelling and Limit Values

Parameter	Period	Modelling Results of the Project				Modelling result evaluation criteria as per 25% rule ($\mu g/m^3$)
		Highest Ground Level Concentration ($\mu g/m^3$)	Coordinates where Highest Ground Level Concentrations Observed		Distance to the Project Area (m) and Direction	
			X	Y		
NO_2	One Time Max (20-30 min)*	50.12	343891.3	4136987	1,290 m SW	63.8
	Hourly	43.63	343891.3	4136987	1,290 m SW	150
	Daily	12.30	346320.2	4138144	700 m E	45
	Monthly	5.21	346022	4137871	450 m E	38
	Annual	1.73	346107.3	4138292	520m E	30

**One Time Max values are calculated via peak-to-mean approach.*

Ground Level Concentrations at Sensitive Receptors

During modelling studies, sensitive receptors defined in 6.3 are also defined as discreet receptors. As stated in the Section 6.4.2.1, ten discreet receptors were defined as follows;

- 3 of them are baseline air quality measurement points;
- 1 of them is industrial receptor;
- 3 of them are human receptors and;
- 3 of them are agricultural receptors.

Ground level concentrations are obtained for these receptors and evaluations are conducted accordingly. Additionally, where baseline air quality measurement conducted, total pollution value is also calculated (see Table 44). Accordingly, all modelling results and total pollution values are below the modelling result evaluation criteria.

For the receptors where the NO_x baseline concentrations were not measured (AQ-1, AR-1, AR-2, AR-3, HR-1, HR-2, HR-3 and IR-1), the highest baseline result (31.61 µg/m^3) was taken into account and all modelling results and total pollution values are below the modelling result evaluation criteria.

Table 44: Modelling Results at Sensitive Receptors, Background Measurements and Total Pollution Values

Point	Period	Modelling Results of the Project			Distance to project area and Direction	Background Measurement Result (µg/m³)	Total Pollution Value (µg/m³)	Modelling result evaluation criteria as per 25% rule (µg/m³)
		Highest Ground Level Concentration (µg/m³)	Coordinates X	Y				
AQ-1	One Time Max (20-30 min)*	27.09	**339777.7**	**4135189**	5500 m SW	-	27.09	63.8
	Hourly	23.58				-	23.58	150
	Daily	2.55				-	2.55	45
	Monthly	0.73				-	0.73	38
	Annual	0.37				-	0.37	30
AQ-2	One Time Max (20-30 min)*	39.48	**343059**	**4138735**	1850 m W	-	39.48	63.8
	Hourly	34.37				-	34.37	150
	Daily	4.09				-	4.09	45
	Monthly	0.96				29.38	30.34	38
	Annual	0.52				-	0.52	30
AQ-3	One Time Max (20-30 min)*	41.59	**342508.7**	**4134598**	3850 m SSW	-	41.59	63.8
	Hourly	36.21				-	36.21	150
	Daily	4.10				-	4.10	45
	Monthly	1.01				31.61	32.62	38
	Annual	0.54				-	0.54	30

Point	Period	Modelling Results of the Project			Distance to project area and Direction	Background Measurement Result (µg/m³)	Total Pollution Value (µg/m³)	Modelling result evaluation criteria as per 25% rule (µg/m³)
		Highest Ground Level Concentration (µg/m³)	Coordinates X	Y				
AR1	One Time Max (20-30 min)*	27.43	**344166**	**4139105**	980 m NW	-	27.43	63.8
	Hourly	23.88				-	23.88	150
	Daily	3.24				-	3.24	45
	Monthly	1.08				-	1.08	38
	Annual	0.51				-	0.51	30
AR2	One Time Max (20-30 min)*	32.21	**341416**	**4136240**	4810 m SW	-	32.21	63.8
	Hourly	28.04				-	28.04	150
	Daily	2.96				-	2.96	45
	Monthly	0.86				-	0.86	38
	Annual	0.45				-	0.45	30
AR3	One Time Max (20-30 min)*	41.56	**344953**	**4135180**	3060 m SSW	-	41.56	63.8
	Hourly	36.18				-	36.18	150
	Daily	2.96				-	2.96	45
	Monthly	0.79				-	0.79	38
	Annual	0.44				-	0.44	30

Point	Period	Modelling Results of the Project			Distance to project area and Direction	Background Measurement Result (µg/m³)	Total Pollution Value (µg/m³)	Modelling result evaluation criteria as per 25% rule (µg/m³)
		Highest Ground Level Concentration (µg/m³)	Coordinates X	Y				
HR1	One Time Max (20-30 min)*	39.24	**343756**	**4138579**	1350 m W	-	39.24	63.8
	Hourly	34.16				-	34.16	150
	Daily	6.25				-	6.25	45
	Monthly	1.31				-	1.31	38
	Annual	0.59				-	0.59	30
HR2	One Time Max (20-30 min)*	47.38	**344840**	**4136159**	1850 m S	-	47.38	63.8
	Hourly	41.25				-	41.25	150
	Daily	4.06				-	4.06	45
	Monthly	1.24				-	1.24	38
	Annual	0.59				-	0.59	30
HR3	One Time Max (20-30 min)*	33.53	**341925**	**4136481**	4100 m SW	-	33.53	63.8
	Hourly	29.19				-	29.19	150
	Daily	3.10				-	3.10	45
	Monthly	0.91				-	0.91	38
	Annual	0.49				-	0.49	30

Point	Period	Modelling Results of the Project			Distance to project area and Direction	Background Measurement Result (µg/m³)	Total Pollution Value (µg/m³)	Modelling result evaluation criteria as per 25% rule (µg/m³)
		Highest Ground Level Concentration (µg/m³)	Coordinates X	Y				
IR1	One Time Max (20-30 min)*	23.90	**344863**	**4138897**	250 m N	-	23.90	63.8
	Hourly	20.81				-	20.81	150
	Daily	3.91				-	3.91	45
	Monthly	1.22				-	1.22	38
	Annual	0.57				-	0.57	30

**One Time Max values are calculated via peak-to-mean approach.*

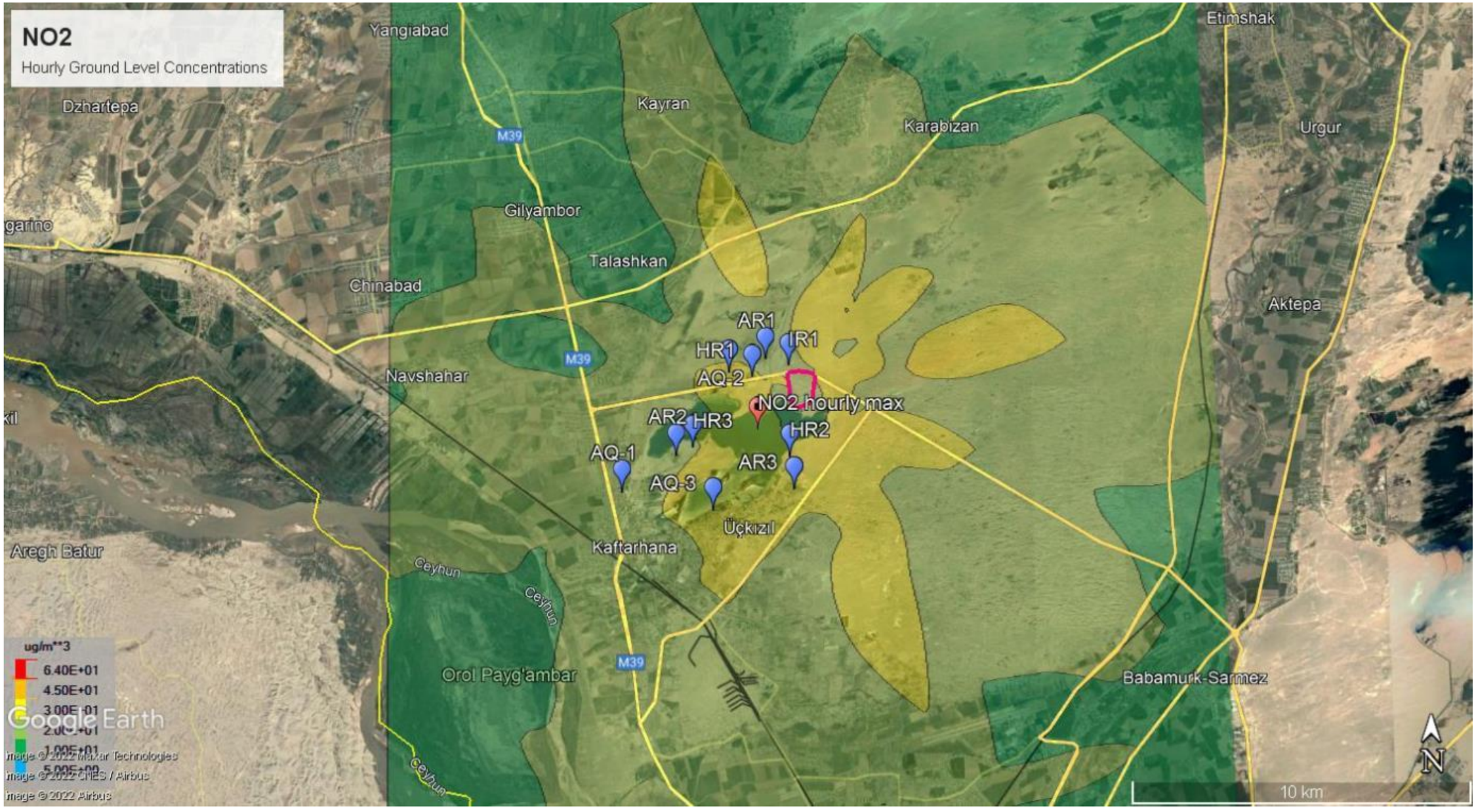


Figure 43: Maximum Hourly NO2 Distribution

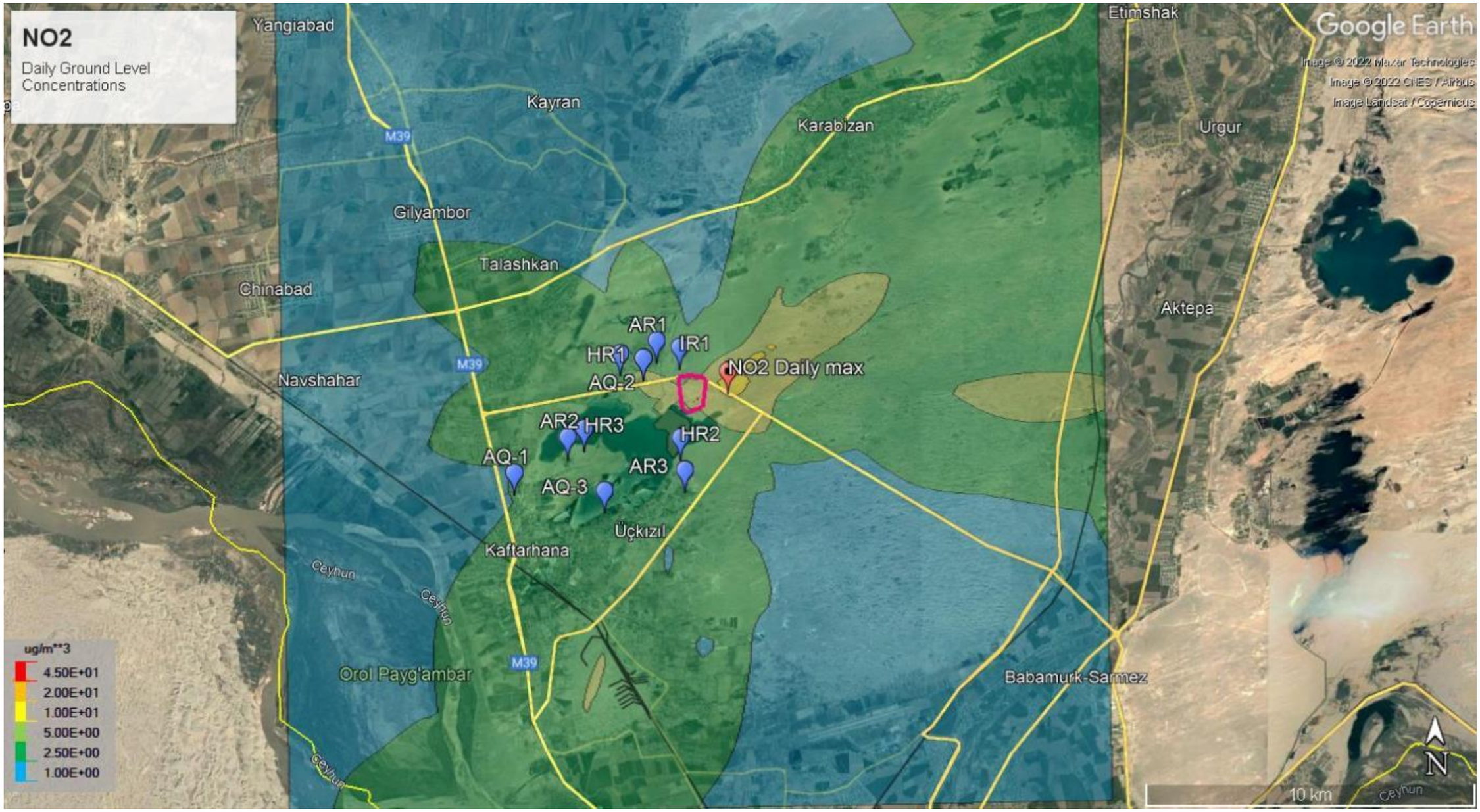


Figure 44: Maximum Daily NO_2 Distribution

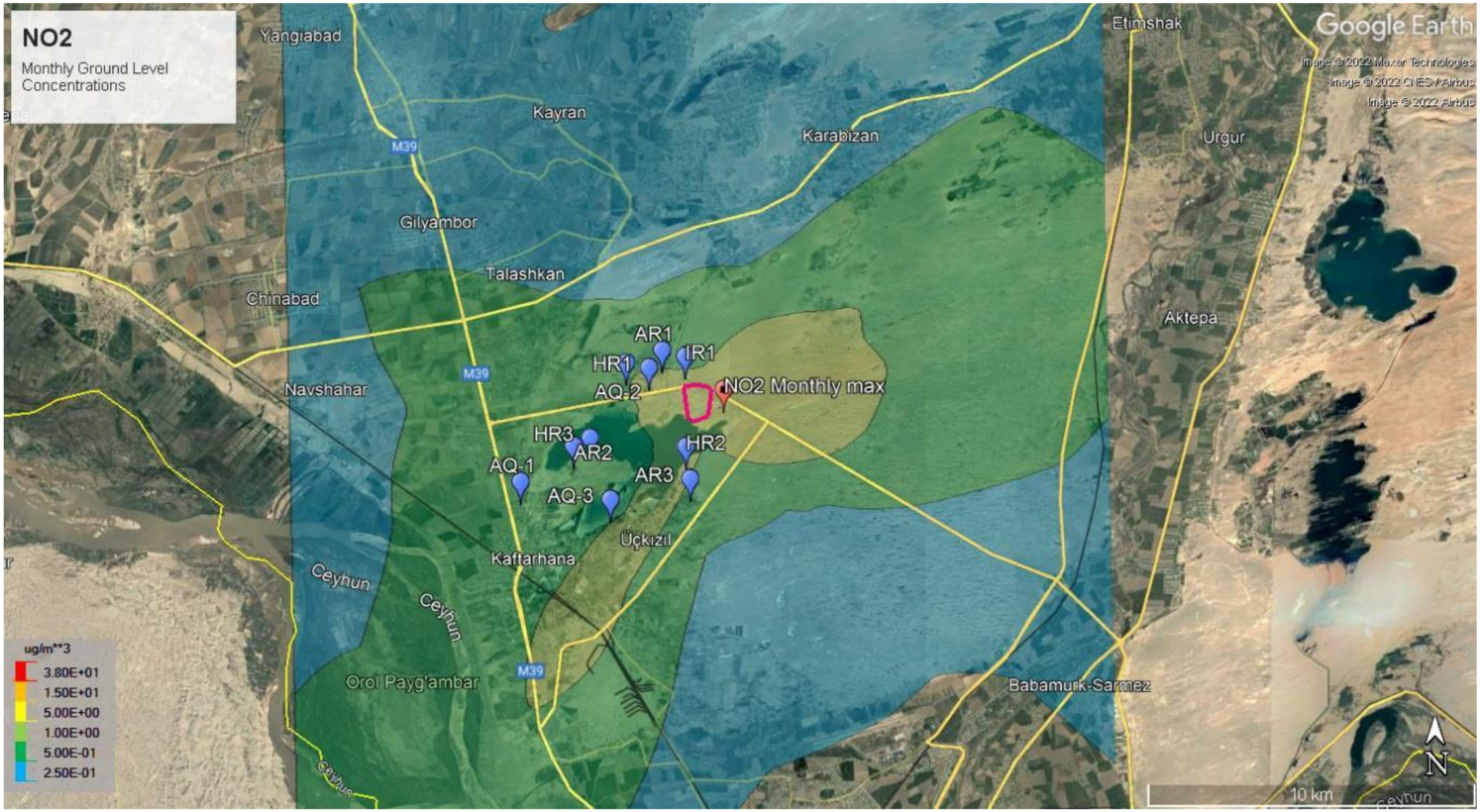


Figure 45: Maximum Monthly NO_2 Distribution

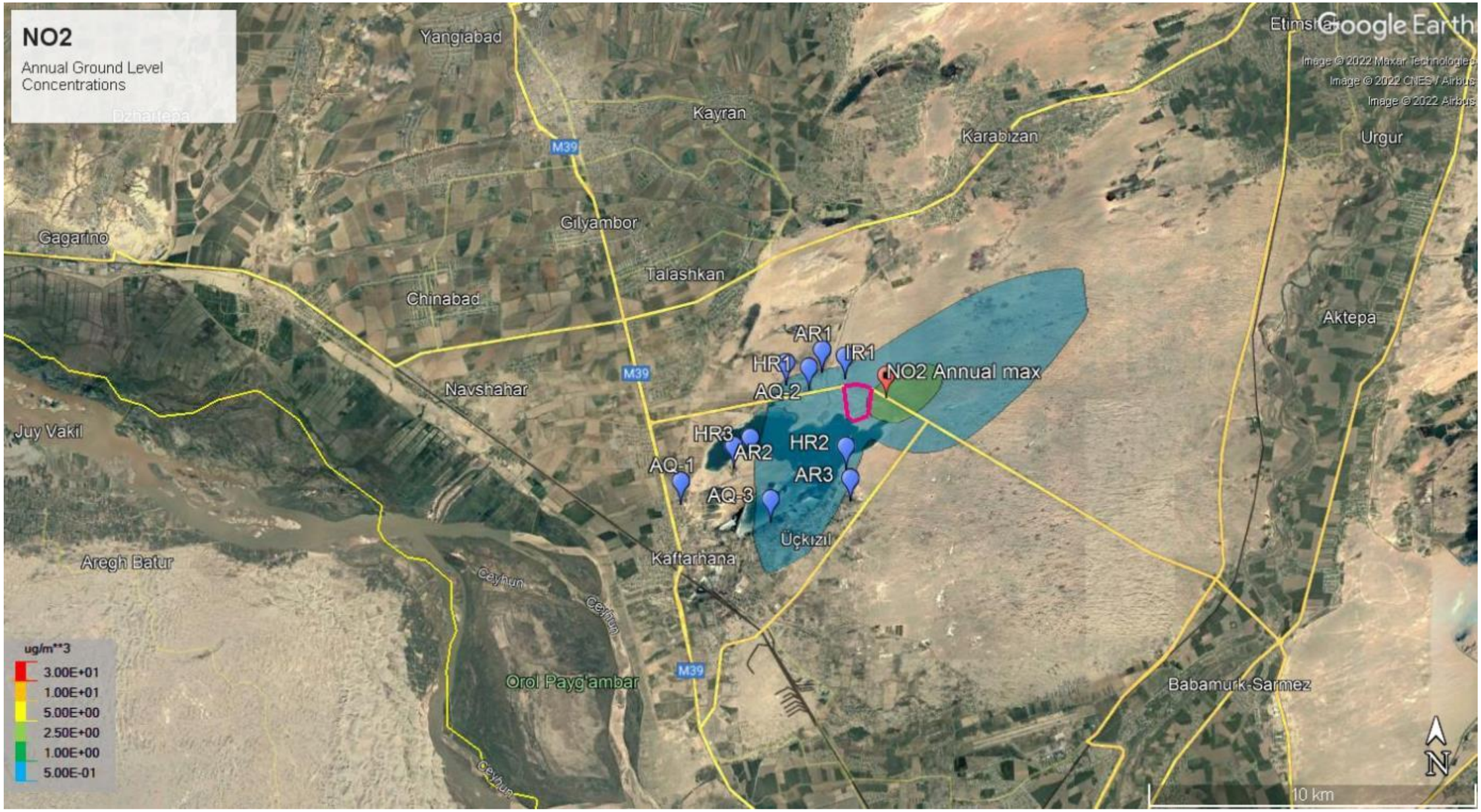


Figure 46: Maximum Annual NO2 Distribution

CO Modelling Results

The highest ground level concentrations and coordinates determined by the modelling study for CO pollutant during operation phase, background measurement results, the total pollution value which equals to the total of modelling result and background measurement value and the limits specified in the national and international legislations are given in Table 45 and ground level concentration distributions are presented between Figure 47 and Figure 50.

Table 45: Highest Ground Level Concentrations of CO via Modelling and Limit Values

Parameter	Period	Modelling Results of the Project			Distance to the Project Area (m) and Direction	Modelling result evaluation criteria as per 25% rule ($\mu g/m^3$)
		Highest Ground Level Concentration ($\mu g/m^3$)	Coordinates where Highest Ground Level Concentrations Observed			
			X	Y		
CO	One Time Max (20-30 min)*	242.8	343891.3	4136987	1,290 m SW	3750
	Daily	59.64	346320.2	4138144	1,290 m SW	3000
	Monthly	25.24	346022	4137871	700 m E	2630
	Annual	8.41	346107.3	4138292	450 m E	2250

**One Time Max values are calculated via peak-to-mean approach.*

According to modelling results, for all periods highest level concentration values are under the Modelling result evaluation criteria.

Ground Level Concentrations at Sensitive Receptors

During modelling studies, sensitive receptors defined in 6.3 are also defined as discreet receptors. As stated in the Section 6.4.2.1, ten discreet receptors were defined as follows;

- 3 of them are baseline air quality measurement points;
- 1 of them is industrial receptor;
- 3 of them are human receptors and;
- 3 of them are agricultural receptors.

Ground level concentrations are obtained for these receptors and evaluations are conducted accordingly. Additionally, where baseline air quality measurement conducted, total pollution value is also calculated (see Table 44). Accordingly, all modelling results and total pollution values are below the modelling result evaluation criteria.

Table 46: Sensitive Receptor Modelling Results, and Total Pollution Values at Measurements Points

Point	Period	Modelling Results of the Project			Distance to project area and Direction	Background Measurement Result (µg/m³)	Total Pollution Value (µg/m³)	Modelling result evaluation criteria as per 25% rule (µg/m³)
		Highest Ground Level Concentration (µg/m³)	Coordinates X	Y				
AQ-1	One Time Max (20-30 min)*	132.80	339777.7	4135189	5500 m SW	530	662.8	3750
	Daily	12.37				-	12.37	3000
	Monthly	3.55				-	3.55	2630
	Annual	1.80				-	1.80	2250
AQ-2	One Time Max (20-30 min)*	191.30	343059	4138735	1850 m W	1360	1551.3	3750
	Daily	19.80				-	19.80	3000
	Monthly	4.67				-	4.67	2630
	Annual	2.51				-	2.51	2250
AQ-3	One Time Max (20-30 min)*	201.55	342508.7	4134598	3850 m SSW	-	201.55	3750
	Daily	19.88				-	19.88	3000
	Monthly	4.89				-	4.89	2630
	Annual	2.61				-	2.61	2250
AR1	One Time Max (20-30 min)*	132.92	344166	4139105	980 m NW	-	132.92	3750
	Daily	15.70				-	15.70	3000
	Monthly	5.24				-	5.24	2630
	Annual	2.49				-	2.49	2250
AR2	One Time Max (20-30 min)*	156.06	341416	4136240	4810 m SW	-	156.06	3750
	Daily	14.32				-	14.32	3000
	Monthly	4.18				-	4.18	2630

Point	Period	Modelling Results of the Project			Distance to project area and Direction	Background Measurement Result (µg/m³)	Total Pollution Value (µg/m³)	Modelling result evaluation criteria as per 25% rule (µg/m³)
		Highest Ground Level Concentration (µg/m³)	Coordinates X	Y				
	Annual	2.18				-	2.18	2250
AR3	One Time Max (20-30 min)*	201.37	344953	4135180	3060 m SSW	-	201.37	3750
	Daily	14.34				-	14.34	3000
	Monthly	3.82				-	3.82	2630
	Annual	2.17				-	2.17	2250
HR1	One Time Max (20-30 min)*	190.12	343756	4138579	1350 m W	-	190.12	3750
	Daily	30.31				-	30.31	3000
	Monthly	6.37				-	6.37	2630
	Annual	2.88				-	2.88	2250
HR2	One Time Max (20-30 min)*	229.62	344840	4136159	1850 m S	-	229.62	3750
	Daily	19.68				-	19.68	3000
	Monthly	6.00				-	6.00	2630
	Annual	2.89				-	2.89	2250
HR3	One Time Max (20-30 min)*	162.52	341925	4136481	4100 m SW	-	162.52	3750
	Daily	15.01				-	15.01	3000
	Monthly	4.43				-	4.43	2630
	Annual	2.37				-	2.37	2250
IR1	One Time Max (20-30 min)*	115.81	344863	4138897	250 m N	-	115.81	3750
	Daily	18.96				-	18.96	3000

Point	Period	Modelling Results of the Project			Distance to project area and Direction	Background Measurement Result (µg/m³)	Total Pollution Value (µg/m³)	Modelling result evaluation criteria as per 25% rule (µg/m³)
		Highest Ground Level Concentration (µg/m³)	Coordinates X	Y				
	Monthly	5.89				-	5.89	2630
	Annual	2.75				-	2.75	2250

One Time Max values are calculated via peak-to-mean approach.

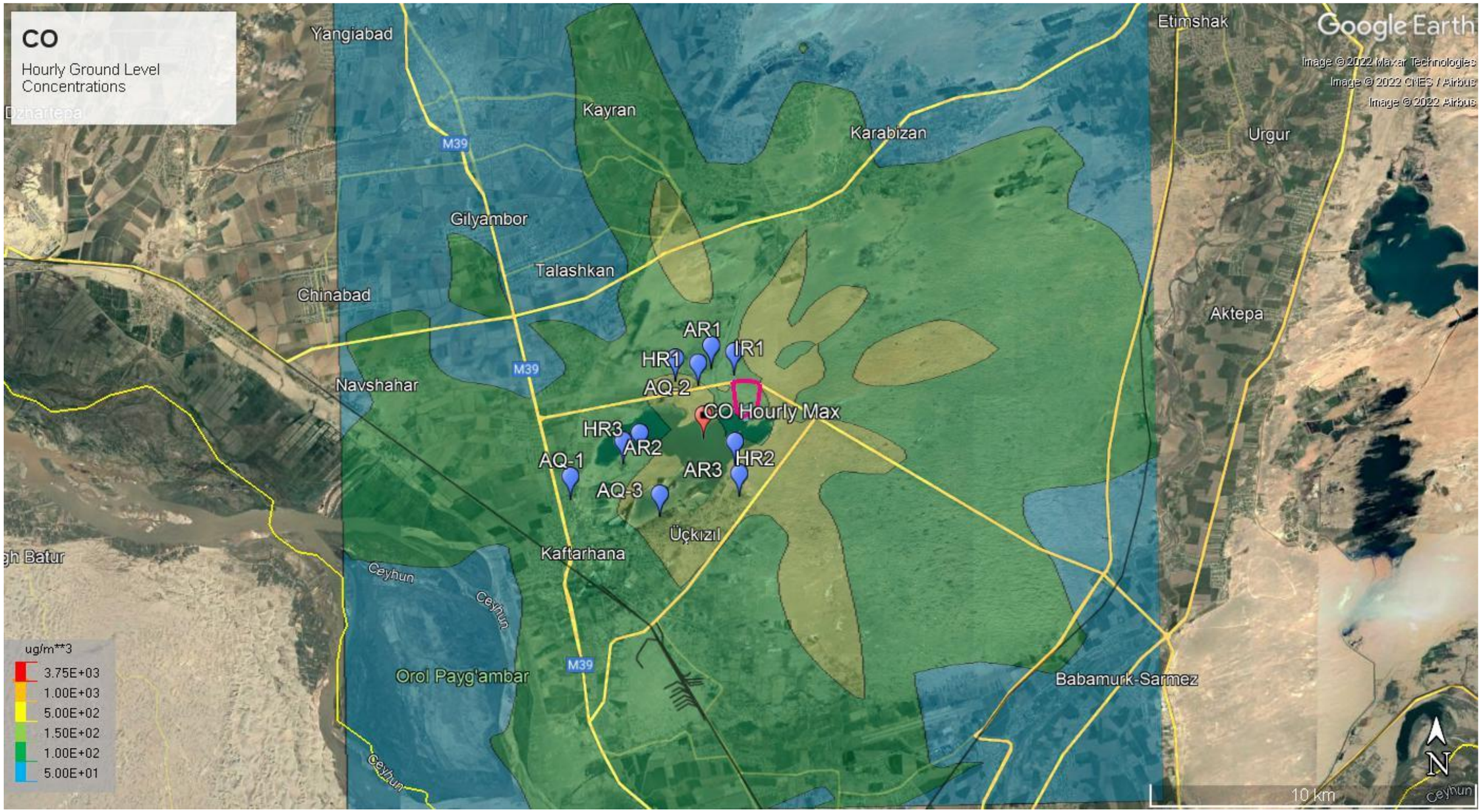


Figure 47: Maximum Hourly CO Distribution

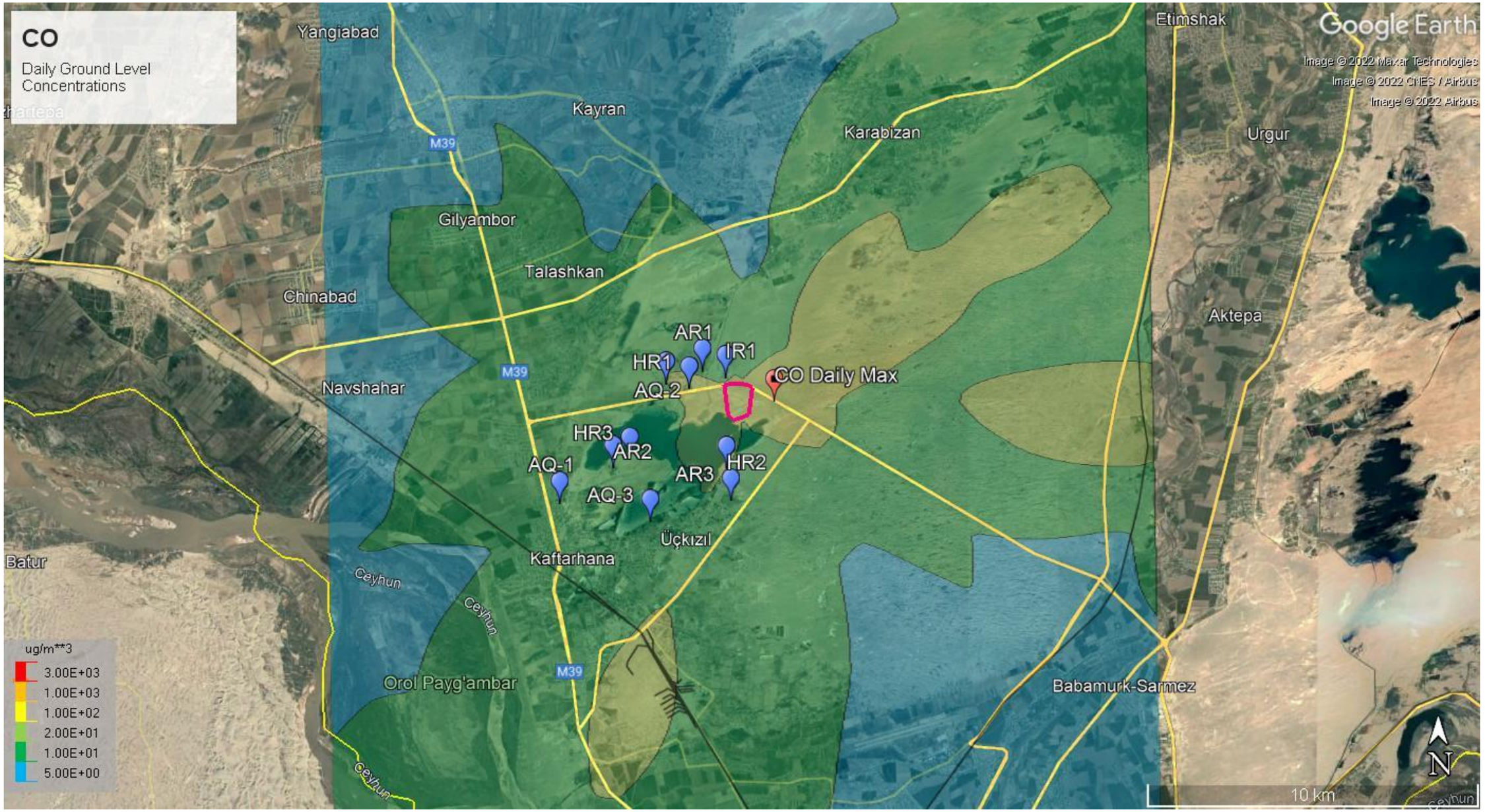


Figure 48: Maximum Daily CO Distribution

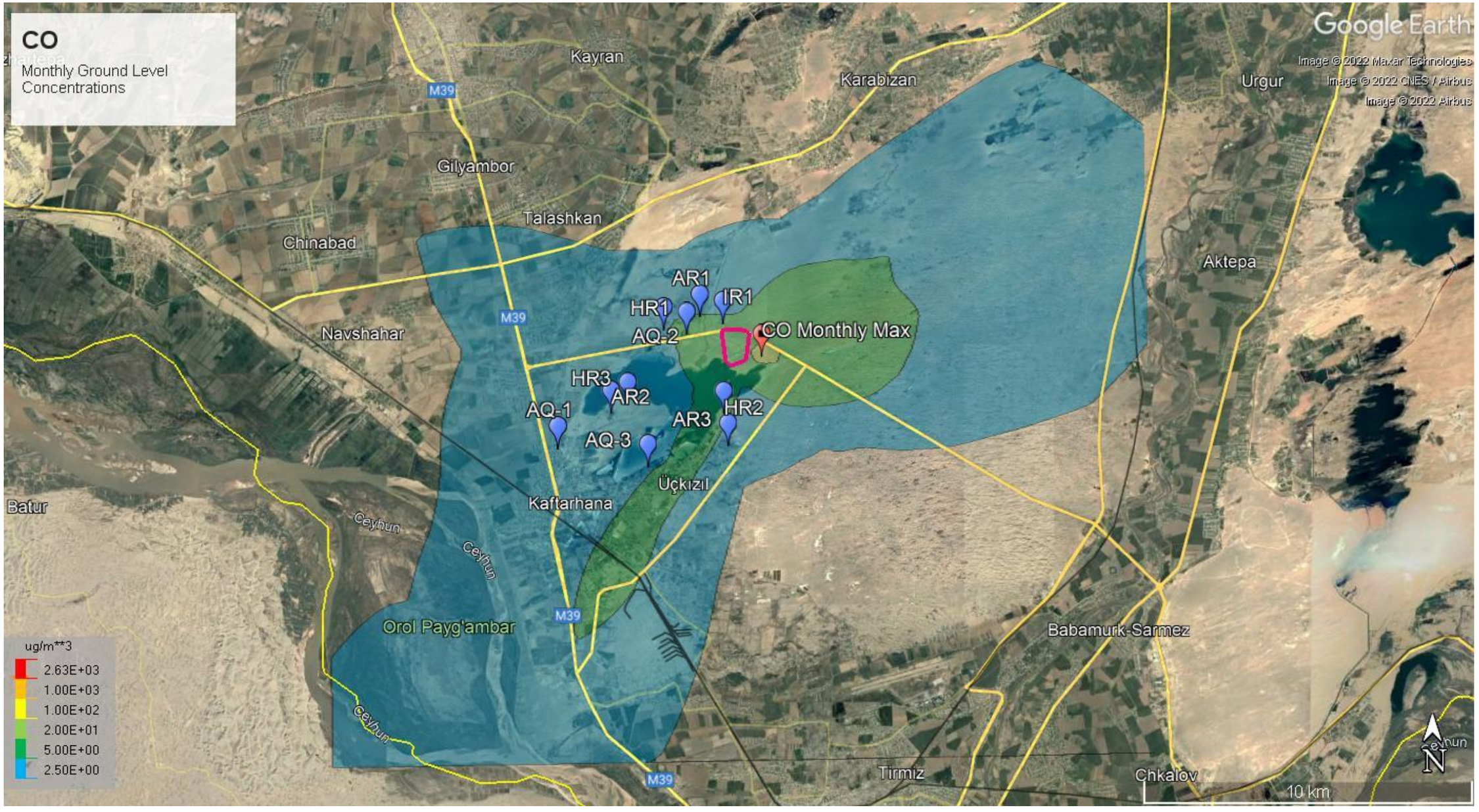


Figure 49: Maximum Monthly CO Distribution

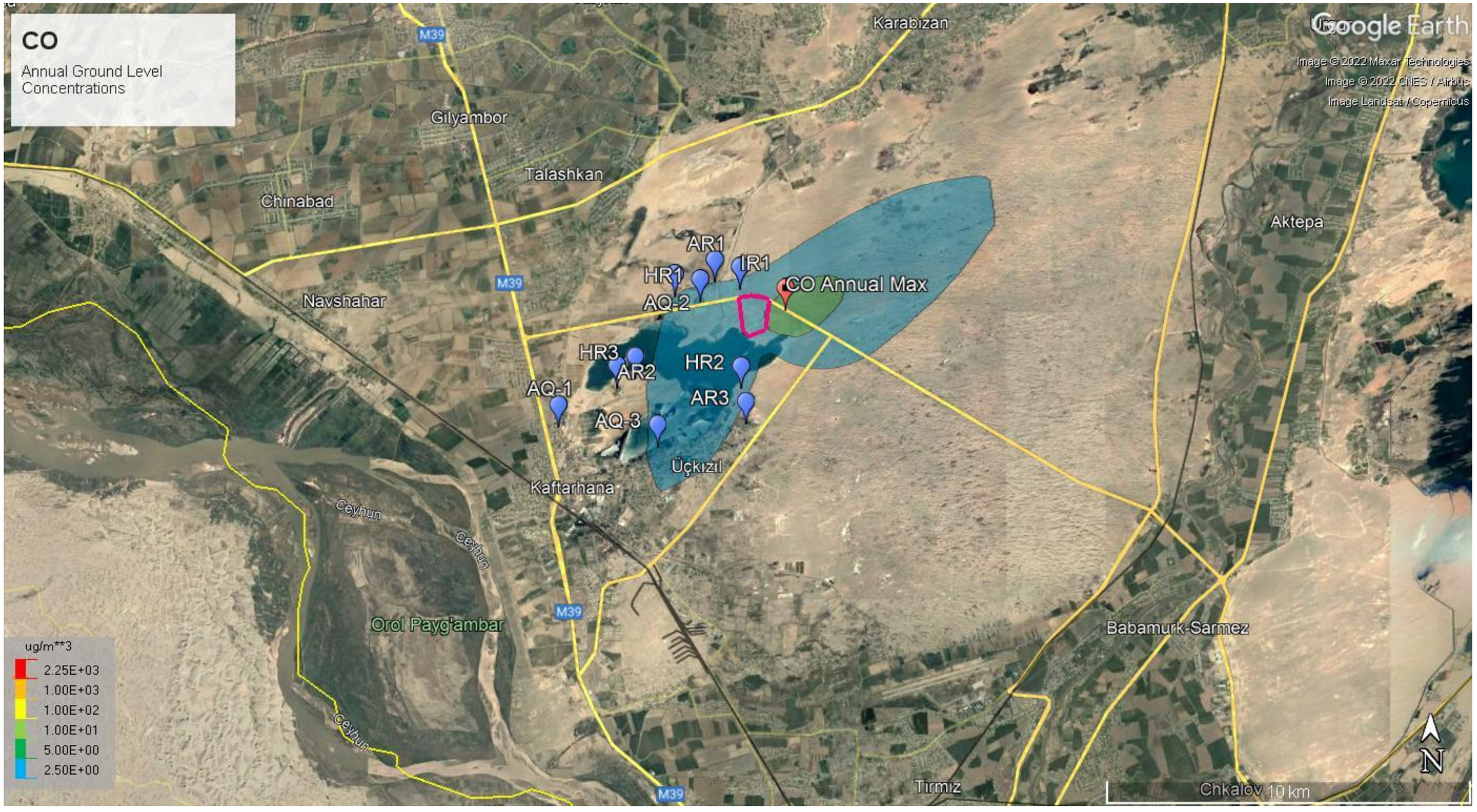


Figure 50: Maximum Annual CO Distribution

As can be seen from the modelling results, ground level concentrations of NO_2 and CO are below the modelling result evaluation criteria. This modelling study is conducted by using preliminary design data. When the final design is conducted by the EPC contractor, final air quality modelling will be performed by the EPC contractor by using up-to-date stack height, stack velocity, stack location, and emission rates.

6.4.2.3 Operational Vehicle Emissions

The facility is likely to result in the small additional number of vehicles and delivery/removal vehicles along the local roads. Emissions from these vehicles will likely result in a negligible impact and as such detailed assessment has not been conducted.

6.4.2.4 Assessment of Impacts and Mitigation Measures

Activities associated with the operational phase of the Project will result in the emissions of gaseous pollutants from the operation of the power blocks. The key pollutants arising from natural gas combustion and emitted via the stacks will be oxides of nitrogen (NO and NO_2) and carbon monoxide (CO). The use of natural gas is generally accepted as being preferred over fuel oils or other solid fuels and there will be no (or negligible) emissions content of sulfur dioxide (SO_2) and no particulates. By using impact assessment significance criteria approach, key potential impacts and countermeasures on air quality for the operation phase are presented in Table 47.

Table 47: Impacts Significance of the Air Quality during – Operation Phase

Potential Impacts	Receptor	Sensitivity of Receptors	Magnitude of Impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Stack Emissions	Residential Areas	Medium	High	Major	During commissioning, the stack emissions will be tested for NO, NO_2, CO to ensure that the control systems are operating correctly and that emission values comply with applicable standards and guidelines. During operation there will be continuous emission monitoring system (CEMS) of stack emissions of NO, NO_2 and CO to ensure compliant conditions are maintained through appropriate process controls. The project company will establish a didital billboard at the gate of the plant which will present the CEMS reselt of stack emissions. Regular scheduled maintenance activities will be undertaken to ensure that equipment is operating in its most effective manner, to reduce emissions. As a requirement of reporting and transparency in compliance with the EP 10, the Project Company shall publicly report the GHG emissions on an annual basis. In operation phase, ambient air quality measurement should be conducted.	Minor
	Industrial Facilities	Low	High	Moderate		Minor
Gaseous emissions – From vehicle exhaust	Residential Areas & Workers at the Site	Medium	Medium	Moderate	Unnecessary usage of vehicles, plant and equipment will be minimized - No unnecessary idling. Exhaust fumes and particulates emitted from trucks and vehicles will be minimized by ensuring the use of good condition vehicles (e.g. compliant to vehicle emission requirements). Vehicle engines will be turned off while waiting on site to minimize gaseous emissions. Appropriate quality of fuel used – Fuel to International standards to be sourced through a licensed company. Emissions from vehicles should be free from significant black smoke - remedial measures shall be taken if this is observed. Ensure emissions comply with Maximum allowable limits for air pollutants emitted by mobile vehicles established by law. Implement a regular maintenance program of vehicles, and keep documentary evidence.	Minor

6.5 Cumulative Impacts

The purpose of a cumulative impact assessment is to determine how the potential impacts of a proposed development might combine cumulatively, with the potential impacts of other projects or human activities as well as natural stressors such as droughts or extreme climatic events. Summary of Cumulative Impacts of Air Emissions & Ambient Air is presented in Table 48.

Table 48: Summary of Cumulative Impacts of Air Emissions & Ambient Air

Environmental & Social Aspects	Construction	Operation
Air Emissions & Ambient Air		
Cumulative Impacts	There is no known Project which will be in the construction phase at the same time period as the Surkhandarya Project. No cumulative impact will occur if the construction periods do not overlap. If the construction periods coincide, cumulative impact on air quality with respect to dust generation and gaseous emissions from construction activities at the Project is anticipated. However, with the implementation of management and mitigation measures, the cumulative impacts are expected to be Minor.	There is no known project which is planned within the Project Impact Area. Therefore, no cumulative impact assessment is of concern for the time being. .

6.6 Monitoring

Air quality monitoring should be undertaken by the EPC Contractor/s and the Project owner during both the construction, commissioning, and operational phases of the Project respectively (see Table 49).

Table 49: Monitoring Requirements of Air Quality

Source	Parameters	Duration	Frequency	Location	Responsibility
Construction Phase					
Dust Generation & Dispersion	Dust PM_{10}	Visual observation Dust measurements PM_{10} measurements	Daily Quarterly Quarterly	Access Road to the Project site, Construction site and laydown areas, Dispersion to external receptors from point of generation.	EPC contractor
Emissions from Engines	Emissions from Vehicles	Ambient Air Quality monitoring of SO2, NO2, CO and dust	In every six months	Baseline Air Quality Monitoring Stations	EPC contractor
Emissions from Engines	Emissions from Vehicles	Visual assessment of emissions to be undertaken on a daily basis while vehicles & equipment are in use and annual inspection of vehicles. This will include an inspection during the initial acceptance criteria of such vehicles to site.	Daily- visual Annual-inspection	All vehicles and engines	EPC contractor
Sanitary Facilities & Hazardous Material Storage	Odour & VOCs	Daily olfactory observations – as part of maintenance and inspection checks Daily inspection of hazardous materials storage areas for any leaks or emission of VOCs	Daily	All sanitary facilities available within the laydown areas, subcontractor camps and work fields.	EPC contractor
Commissioning & Operation					
Emissions from Stacks	NOX (NO and NO_2) and CO	Continuous Emissions Monitoring System (CEMS). Manual testing if the CEMS is not calibrated at the start of the commissioning stage.	Continuous	Stacks	Contractor of the Project Company

Source	Parameters	Duration	Frequency	Location	Responsibility
Emissions from Stacks	CO, NOX (NO and NO_2)	Ambient Air Quality monitoring of CO, NO and NO2,	Monthly – during commissioning phase Quarterly- during operation	Baseline Air Quality Monitoring Stations	Contractor of the Project Company
Emissions from Vehicles	Vehicles Emissions	Regular maintenance & servicing of project vehicles and planned annual inspection.	Annual- Inspection	All road and non-road vehicles and engines	Contractor of the Project Company

7. NOISE LEVEL

7.1 Standards and Regulatory Requirements

7.1.1 National Standards

Noise, vibration, and electromagnetic fields are regulated through sanitary norms and standards in Uzbekistan which are given below:

- SanPiN No. 0267-09 "Sanitary norms and rules to ensure acceptable noise levels inside residential and public buildings and in residential areas";
- SanPiN No. 0325-16 "Sanitary norms and rules to ensure acceptable noise levels in the workplace";
- SanPiN No. 0326-16 "Sanitary Standards for general and local vibration at workplace".

Noise standards established by SanPiN No. 0267-09 set the rules for ensuring residential/public areas in Uzbekistan. This standard indicates a table of noise levels for a variety of internal and external applications. The most significant permissible noise levels for the Project are summarized in Table 50.

Regarding this standard, assessment of the sound level at the determining point is performed for the day and night period of the selected day and takes into account the maximum intensity of the sound level during the half-hour period.

Additionally, noise standards established by SanPiN No. 0325-16 set the rules for ensuring the health of workers in the workplace in Uzbekistan. This standard indicates a table of noise levels for various types of work. The most significant permissible noise level at workplaces for the Project is summarized in Table 50.

Table 50: National Noise Levels for Residential / Commercial Areas

Purpose of premises or territories .	Sound pressure Level dB(A) of inconstant noise (SanPİN No. 0267-09 : Sanitary norms and rules to ensure acceptable noise levels inside residential and public buildings and in residential areas. (Table 1))	
	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
Territories adjacent to residential buildings, clinics, outpatient clinic, dispensaries, rest homes, boarding houses, nursing homes, childcare facilities, schools and other educational institutions, libraries	55	45
Living room of apartments, holiday homes,	40	30

Table 51: National Noise Levels for Workplace

Type of work, Workplace	Sound pressure Level dB(A) of inconstant noise (SanPiN No. 0325-16: Sanitary standards for permissible noise levels in the workplace (Table 2))	
	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)
Performance of all types of work at permanent workplaces in industrial premises and at enterprises operated since March 12, 1985.	80	

7.1.2 Lender Requirements

The IFI's applicable noise standards for the Project are given below:

- IFC General EHS Guidelines: Environmental, Noise Management, April 30, 2007;
- IFC General EHS Guidelines: Occupational Health and Safety, Noise, April 30, 2007;

The Project is required to comply with the strictest of the noise limit values defined in guideline noise levels set out in the IFC/WBG General EHS Guidelines and national standards, as presented in Table 52 and Table 53.

IFC/WBG General EHS Guidelines recommend that noise levels presented in Table 52 should not result in a maximum increase in background levels of 3 dB(A) at the nearest receptor location off-site and that noise levels at the boundary of an industrial property should not exceed 70 dB(A).

According to noise limits for various working environments in IFC/WBG General EHS Guidelines, no employee should be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection (see Table 53). Although hearing protection is preferred for any period of noise exposure in excess of 85 dB(A), an equivalent level of protection can be obtained, but less easily managed, by limiting the duration of noise exposure. For every 3 dB(A) increase in sound levels, the 'allowed' exposure period or duration should be reduced by 50 percent.

Table 52: Summary of the IFC/WBG General EHS Guidelines, Noise Level Guidelines with National Standards

Type	National Noise Level Standard (SanPİN No. 0267-09) (30 min LAeq (dB(A))		IFC/WBG General EHS Guidelines (2007), Table 1.7.1. (One-hour LAeq (dB(A))	
	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)	Daytime (07:00 to 22:00)	Night-time (22:00 – 07:00)
Residential, institutional, educational	55	45	55	45
Industry, commercial			70	70

As can be seen from the Table 52, IFC/WBG General EHS Guidelines establish night time noise levels between 22:00 and 07:00. Since, this approach covers 1 hour more night time than National Noise Level Standards, IFC/WBG General EHS Guidelines is used during determination of day-time and night-time noise levels.

Table 53: IFC/WBG General EHS Guidelines, Occupational Health and Safety, Noise Limits for Various Working Environments with National Standards

Type	Sound pressure Level dB(A) of inconstant noise (SanPiN No. 0325-16: Sanitary standards for permissible noise levels in the workplace (Table 2))	IFC/WBG General EHS Guidelines (2007), Table 2.3.1. One-hour LAeq (dB(A))	
		Equivalent level LAeq,8h	Maximum LAmax,fast
Performance of all types of work at permanent workplaces in industrial premises and at enterprises operated since March 12, 1985.	80 dB(A)		
Heavy Industry (no demand for oral communication)		85	110
Light industry (decreasing demand for oral communication)		50-65	110

The national standards (SanPiN No. 0267-09 and SanPiN No. 0325-16) are fundamentally aligned with IFC/WBG General EHS Guidelines standards (see Table 52 and Table 53).

Moreover, the Project commits that the following room average sound pressure levels will not be exceeded inside the Plant in rooms which are provided for or which require the constant presence of staff:

- Main control room and offices 45 dB(A),
- Local control rooms 45 dB(A),
- Electronic equipment rooms 45 dB(A),
- Electric equipment rooms, 70 dB(A),
- Workshop and stores 70 dB(A).

The contribution of noise caused by the inventory in these rooms, e.g., workshop machines, as well as that caused by the staff is not taken into consideration.

Under consideration of an unabsorbing inner lining, the following room averaged sound pressure levels will be expected during normal operation: (excluding offices and recreation rooms):

- Turbine building 90 dB(A),
- Circulating water pump area 90 dB(A),
- Building for water treatment plant 85 dB(A).

Additionally, IFC/WBG General EHS Guidelines indicate that "Limits for vibration and action values, (i.e. the level of exposure at which remediation should be initiated) are provided by the American Conference of Governmental Industrial Hygienists. Exposure levels should be checked on the basis of daily exposure time and data provided by equipment manufacturers."

7.2 Observation and Baseline Conditions

The noise level in the environment was measured at four observation points to determine the baseline noise conditions in the project area between 20-23 August 2022 by accredited laboratory (Çevre Endüstriyel Analiz Laboratuvar Hiz. Tic. A.Ş.) with TS ISO 1996-1 and TS ISO 1996-2 standards. Table 54 shows the coordinates of the points of measurement of the noise level. The locations of the noise measurement points are presented in Figure 51.

Noise level measurement locations were selected to determine baseline noise levels at the possible nearest receptors near the Project Area. Point 1 is the nearest possible noise receptor, which is a waste processing facility. Point 2, Point 3, and Point 4 are the nearest residential areas to the project site in different directions, which can be affected by the project activities. Point 5 is selected within the Project area. These measurement points are selected to determine baseline noise levels because the workers at the waste processing facility are exposed to noise and residents living in the residential areas that are likely to be affected by the increased noise levels.

Table 54: Coordinates of Points of Measurement of Noise Levels and Measurements of Meteorological Parameters

No.	Number of monitoring point	Coordinates, deg/min/sec	Distance to border of the Project Area (m)	Measurement Period	Frequency
1.	Noise-1	N= 37°23'0.5" E= 67°14'43.1"	250	20-23 August 2022	Total 2 days Each day: Daytime for 2 hours and at nighttime for 2 hours
2.	Noise-2	N= 37°22'48.9" E= 67°13'48.4"	990	20-23 August 2022	Total 2 days Each day: Daytime for 2 hours and at nighttime for 2 hours
3.	Noise-3	N= 37°21'31.8" E= 67°14'47.7"	1,690	20-23 August 2022	Total 2 days Each day: Daytime for 2 hours and at nighttime for 2 hours
4	Noise-4	N= 37°21'45.3" E= 67°12'55.8"	2,980	20-23 August 2022	Total 2 days Each day: Daytime for 2 hours and at nighttime for 2 hours
5	Noise-5	N= 37°22'40.8" E= 67°15'4.6"	-	20-23 August 2022	Total 2 days Each day: Daytime for 2 hours and at nighttime for 2 hours

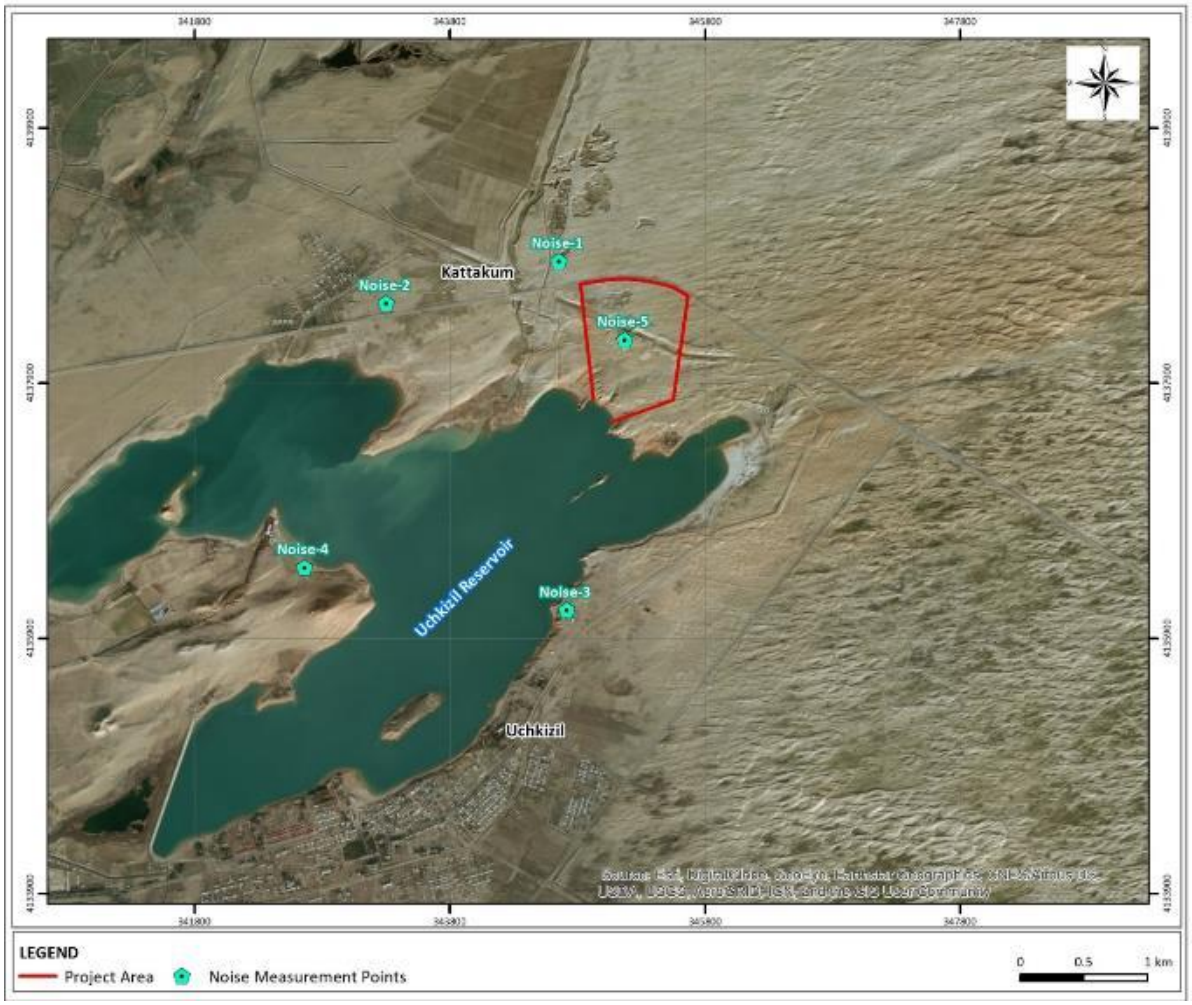


Figure 51: Location of Noise Measurement Points

Measurement of the background noise levels were carried out in accordance with TS ISO 1996-1 and TS ISO 1996-2 (Determination of environmental noise level (L_{aeq}, L_{aeqt}, L_{regt}, $L_{da}y$, L_{den}, $L_{evening}$, LAFNT, LE, L_{afmax}, L_{cenmax}, L_{rdn}, L_{rden})). According to these standards, the specifications below are followed during the measurement process:

- The reference time interval referred to in the rating of sound during measurements are specified in national and international standards or by local authorities to cover general human activities and variations in the operation of sound sources. The reference time intervals may be, part of the day, the whole day, or the whole week.
- The rating level is calculated from the measured or estimated sound over different reference time intervals. Adjustments are added to the reference time interval equivalent continuous sound pressure levels based on any time of the day.
- Frequency weighting A is generally used to evaluate all sound sources except for high-energy sudden sounds or sounds where the majority is low frequencies. Frequency weight A should not be used to measure peak pressure sound levels.
- The measurement time interval should be chosen to include all significant deviations in noise emission and emission. If the noise includes periodicities, the measurement time interval must

include at least three full periods. If continuous measurement cannot be made during such a period, the measurement time intervals should be chosen such that each time interval represents a part of the cycle and together they represent the whole cycle.

- In multi-storey residential areas, (4.0 m ± 0.5) m should be used as microphone height. In single-storey residential areas, (1.2 m ± 0.1) m or (1.5 m ± 0.1) m should be used as microphone height. In general, the difference in sound pressure level between two adjacent grid points should not be more than 5 dB. When significantly larger differences are encountered, intermediate grid points should be added.
- If the frequency content of the noise has to be determined, sound pressure levels should be measured using octave band filters whose center midband frequencies are the following frequencies, unless otherwise specified:
- 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, 8000 Hz. Optionally, measurements can be made in 1/3 octave bands from 50 Hz to 10000 Hz.
- According to TS ISO 1996-2 standard Article 8.4.7, if the noise characteristics at the receiver's location include audible tone(s), an objective measurement of the salience of these tones should be made.
- According to TS ISO 1996-2 standard Annex D, "The test for detecting the presence of significant discrete frequency spectrum component (tone) is typically time-averaged sound pressure level in a portion of the 1/3 octave band and time-averaged in two adjacent 1/3 octave bands. This is done by comparing sound pressure levels.
- To demonstrate the presence of a significant discrete frequency spectrum component, the time-averaged sound pressure level in the 1/3 octave band of interest must exceed the time-averaged sound pressure levels in the two adjacent 1/3 octave bands by a certain constant level difference.
- Fixed level difference may vary with frequency. Possible options for level differences are given below:
    - 5 dB in low frequency 1/3 octave bands (25 Hz -125 Hz).
    - 8 dB in the mid-frequency bands (160 Hz - 400 Hz).
    - In high frequency bands (500 Hz-10000 Hz), the difference of 5 dB should not exceed.

Figure 52 shows noise level measurements and measurements of meteorological parameters at observation points during the period of monitoring the baseline noise levels.

Figure 52: Noise Measurement Photographs

The list of methods used during measurement of noise and meteorological parameters are given in Table 55 Measurements of the noise level and meteorological parameters and description and assessment of the characteristics of noise levels at measurement points were selected in accordance with the internatational requirements.

Table 55: List of Noise Level Measurement Methods

Defined parameters	Measurement technique
Meteorological parameters: air temperature, relative humidity, and wind direction	TS ISO 1996-1 and TS ISO 1996-2 « Determination of environmental noise level (Laeq, Laeqt, Lregt, Lday, Lden, Levening, LAFNT, LE, Lafmax, Lcenmax, Lrdn, Lrden) »

Simultaneously with the measurements of the noise level at the observation points: meteorological parameters were also measured which are air temperature, relative humidity, and wind speed. The meteorological measurement results are presented in Table 56.

Table 56: The Meteorological Measurement Results

Measurement Point	Day Time (07:00 – 22:00)				Night Time (22:00 – 07:00)			
	Date	Air Temperature (°C)	Relative Humidity (%)	Wind Speed (m/s)	Date	Air Temperature (°C)	Relative Humidity (%)	Wind Speed (m/s)
Noise-1	22.08.2022	37.9	13.2	0.87	20.08.2022	26.7	13.3	0.39
	23.08.2022	36.8	13.2	1.05	21.08.2022	30.6	13.3	0.84
Noise-2	22.08.2022	33.1	16.1	0.87	21.08.2022	29.0	14.0	0.80
	23.08.2022	37.7	13.1	0.48	22.08.2022	29.1	13.4	0.41
Noise-3	21.08.2022	36.7	16.8	0.94	21.08.2022	32.9	26.1	0.99
	22.08.2022	37.9	16.7	0.90	22.08.2022	32.8	25.8	0.87
Noise-4	21.08.2022	37.8	16.8	0.85	21.08.2022	27.4	17.9	0.89
	22.08.2022	37.4	16.9	0.90	22.08.2022	27.0	17.1	0.80
Noise-5	22.08.2022	37.6	14.7	0.75	20.08.2022	28.4	15.2	0.92
	23.08.2022	38.1	14.1	0.85	21.08.2022	30.6	15.1	0.81

Environmental noise measurement report from accredited laboratory are presented in the Appendix H and the summary of the noise measurement results are presented in Table 57. The average of the noise levels recorded between 07:00 and 22:00 as the daytime noise level, and the average of the noise levels recorded between 22:00 and 07:00 as the night noise level were calculated.

Table 57: Noise Level Measurement Results

Measurement Point	Day Time (07:00 – 22:00)			Night Time (22:00 – 07:00)		
	Date	Measurement Period	Leq (dBA)	Date	Measurement Period	Leq (dBA)
Noise-1	22.08.2022	14:01 - 16:01	44.8	20.08.2022	23:20 - 01:20	38.7
	23.08.2022	11:41 - 13:41	47.2	21.08.2022	23:01 - 01:01	44.8
Average			**46.0**			**41.7**
Noise-2	22.08.2022	09:08 - 11:08	40.5	21.08.2022	21:00 - 23:00	45.3
	23.08.2022	09:03 - 11:03	48.9	22.08.2022	02:04 - 04:04	43.1
Average			**44.7**			**44.2**
Noise-3	21.08.2022	12:22 - 14:22	46.5	21.08.2022	02:22 - 04:22	44.0
	22.08.2022	12:10 - 14:10	54.0	22.08.2022	23:06 - 01:06	43.7
Average			**50.2**			**43.8**
Noise-4	21.08.2022	14:31 - 16:31	43.3	21.08.2022	04:28 - 06:28	41.7
	22.08.2022	14:55 - 16:55	46.1	22.08.2022	04:35 - 06:35	45.4
Average			**44.7**			**43.5**
Noise-5	22.08.2022	11:37 - 13:37	36.1	20.08.2022	23:26 - 01:26	43.6
	23.08.2022	14:36 - 16:36	41.1	21.08.2022	23:23 - 01:23	44.8
Average			**38.6**			**44.2**

As can be seen from the Table 57, all day time measurement results are below the IFC Noise level guideline value (55 dBA). For the night time measurements, all measurement results are below the IFC Noise level guideline value (45 dBA) except for Noise-2 and Noise-4 as 45.3 dBA and 45.4 dBA,

respectively. The average noise measurement results, on the other hand, are below the IFC Noise level guideline value although minor exceedances were observed on some of the 2-houred measurement results. No site-specific activities that may cause an increase in the noise levels were observed during the measurement studies. However, temporary antropogenic activities may cause these slight changes.

7.2.1 Sensitive Receptors

In the scope of the Projects, sensitive receptors were determined in scoping process and background noise measurements were implemented at those points. Background noise measurement points are shown in Figure 33. The table below show these receptors in representative clusters and have been identified based on the nearest receptors to the Project site in each cluster group.

Table 58: Potential Noise Receptors of the Project

Receptor	Receptor Type	Distance from the Project Border (m)	Sensitivity	Justification
Noise-1	Waste Processing Facility	250	Medium	Workers at the site are exposed to noise.
Noise-2	Residential	990	Medium	Residents living in these residential areas will be particularly vulnerable to increase in ambient noise levels.
Noise-3	Residential	1,690	Low	Residents living in these residential areas can be particularly vulnerable to increase in ambient noise levels. It is far away from Project site.
Noise-4	Residential	2,980	Low	Residents living in these residential areas can be particularly vulnerable to increase in ambient noise levels. It is far away from Project site.
Noise-5	Project Area	-	Medium	Workers at the site are exposed to noise.

7.3 Potential Impacts, Mitigation, Management & Residual Impact

7.3.1 Construction Phase

The construction phase of the Project is planned to be conducted only during the day-time. However, if it is required to work during evening and night times, the necessary permits should be received from the authority. The permit will identify the type of construction activities that are allowed to be performed during night-time.

There will be no blasting during construction activities; therefore, vibration effect will not be of concern on the environment and human health. Nevertheless, there will be vibration due to heavy machinery. Vibrations resulted from the machines or buildings including machinery emerge from the dynamic force from the moving parts of the machines. Different parts of the machines generally make different

frequency and vibration. Vibrations cause mechanical weathering in time. Generally, most important factor of a machine malfunction is vibration. Therefore, necessary maintenance shall be performed for the construction machines and equipment.

The main noise sources during construction phase are the heavy machineries. Heavy machinery planned to use during construction phase provided by Project owner and noise data for the anticipated plant/equipment to be used at the site has been obtained from 'British Standards: Code of practice for noise and vibration on construction and open sites [11] and are listed in Table 59.

Construction activities in relation to noise and vibration are likely to include:

- Site Preparation
- Civil Works
- Construction and mechanical Installation;
- Internal Road Paving/Compacting; and
- Works at associated facilities; and
- Movement of vehicles (on and off-site)

Table 59: Construction Machine & Equipment Types, Quantities and Expected Sound Levels

Vehicles & Equipment Name	Quantity	Sound Power Level (dB)
Site Preparation and Earth and Civil Works		
Wheel Loader	1	76
Backhoe Excavator	7	78
Crawler Bulldozer	1	88
Road Roller	2	79
Dump Truck	10	79
Diesel Generator	1	74
Truck	3	66
Forklift	2	77
Building and Foundation Works		
Platform Lorry	1	80
Concrete Pump Truck	3	79
Concrete Delivery Truck	6	80
Piling Machine	4	89
Diesel Generator	1	74
Truck	1	66
Forklift	2	77
Mechanical and Installation Works		
750t, 250t and 150t Crawling Crane	3	75
Hydraulic Lifting Device and Lifting Frame	1	67
50t Crawling Crane	1	71
50t Truck Crane	1	67

Vehicles & Equipment Name	Quantity	Sound Power Level (dB)
Gantry Crane	2	75
Electric Welding Machine	301	73
Tower and Vehicle Crane	2	76
Vehicle Crane	2	71
Diesel Generator	1	74
Truck	1	66
Forklift	2	77

The accumulation of noise from the above activities can introduce potential impacts for nearby receptors at different construction phases as discussed below. It is assumed that all construction machines will work at the same time and same location (worst case)

Total Sound Power Level (L_W) can be calculated via following formula:

$$Lw = 10 * log \sum_{i=1}^{n} 10^{\mathrm{Lwi}/10}$$

L_{Wi} = Sound Power Level of Each Construction Machine (dB)

L_W = Total Sound Power Level (dB)

Site Preparation and Earth and Civil Works

The sound power level of each noise source was calculated by distributing it to 4-octave bands (see Table 60). Total sound power level, 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz octave band sound power level calculations are used in the following formula. In the calculations, it is assumed that the total sound power levels are equally distributed on 4-octave bands.

Lw (i) = 10 * log (10 (Lw / 10) / 4)

Lw = Sound power level of the source (dB)

Table 60: Distribution of Noise Sources Sound Power Levels in Octave Bands in Site Preparation and Earth and Civil Works

Noise Sources	Total	Sound Power Level (dB)			
		500 Hz	1000 Hz	2000 Hz	4000 Hz
Wheel Loader	76	70	70	70	70
Backhoe Excavator	78	72	72	72	72
Crawler Bulldozer	88	82	82	82	82
Road Roller	79	73	73	73	73
Dump Truck	79	73	73	73	73
Diesel Generator	74	68	68	68	68
Truck	66	60	60	60	60
Forklift	77	71	71	71	71

Sound pressure levels of each sources based on 4-octave bands are given in Table 61.

Table 61: Sound Pressure Levels of Noise Sources in Site Preparation and Earth and Civil Works

Noise Source		Sound Pressure Level (dB)			
	Distance (m)	500 Hz	1000 Hz	2000 Hz	4000 Hz
Wheel Loader	50	25.01	25.01	25.01	25.01
	100	18.99	18.99	18.99	18.99
	250	11.03	11.03	11.03	11.03
	500	5.01	5.01	5.01	5.01
	1000	-1.01	-1.01	-1.01	-1.01
	2000	-7.03	-7.03	-7.03	-7.03
	4000	-13.05	-13.05	-13.05	-13.05
Backhoe Excavator	50	27.01	27.01	27.01	27.01
	100	20.99	20.99	20.99	20.99
	250	13.03	13.03	13.03	13.03
	500	7.01	7.01	7.01	7.01
	1000	0.99	0.99	0.99	0.99
	2000	-5.03	-5.03	-5.03	-5.03
	4000	-11.05	-11.05	-11.05	-11.05
Crawler Bulldozer	50	37.01	37.01	37.01	37.01
	100	30.99	30.99	30.99	30.99
	250	23.03	23.03	23.03	23.03
	500	17.01	17.01	17.01	17.01
	1000	10.99	10.99	10.99	10.99
	2000	4.97	4.97	4.97	4.97
	4000	-1.05	-1.05	-1.05	-1.05
Road Roller	50	28.01	28.01	28.01	28.01
	100	21.99	21.99	21.99	21.99
	250	14.03	14.03	14.03	14.03
	500	8.01	8.01	8.01	8.01
	1000	1.99	1.99	1.99	1.99
	2000	-4.03	-4.03	-4.03	-4.03
	4000	-10.05	-10.05	-10.05	-10.05
Dump Truck	50	28.01	28.01	28.01	28.01
	100	21.99	21.99	21.99	21.99

Noise Source	Sound Pressure Level (dB)				
	Distance (m)	500 Hz	1000 Hz	2000 Hz	4000 Hz
	250	14.03	14.03	14.03	14.03
	500	8.01	8.01	8.01	8.01
	1000	1.99	1.99	1.99	1.99
	2000	-4.03	-4.03	-4.03	-4.03
	4000	-10.05	-10.05	-10.05	-10.05
Diesel Generator	50	23.01	23.01	23.01	23.01
	100	16.99	16.99	16.99	16.99
	250	9.03	9.03	9.03	9.03
	500	3.01	3.01	3.01	3.01
	1000	-3.01	-3.01	-3.01	-3.01
	2000	-9.03	-9.03	-9.03	-9.03
	4000	-15.05	-15.05	-15.05	-15.05
Truck	50	15.01	15.01	15.01	15.01
	100	8.99	8.99	8.99	8.99
	250	1.03	1.03	1.03	1.03
	500	-4.99	-4.99	-4.99	-4.99
	1000	-11.01	-11.01	-11.01	-11.01
	2000	-17.03	-17.03	-17.03	-17.03
	4000	-23.05	-23.05	-23.05	-23.05
Forklift	50	26.01	26.01	26.01	26.01
	100	19.99	19.99	19.99	19.99
	250	12.03	12.03	12.03	12.03
	500	6.01	6.01	6.01	6.01
	1000	-0.01	-0.01	-0.01	-0.01
	2000	-6.03	-6.03	-6.03	-6.03
	4000	-12.05	-12.05	-12.05	-12.05

As a result of the calculation with the correction factors, the sound levels of the 4-octave bands of each noise source were calculated (see Table 62).

Table 62: Sound Pressure Levels of Corrected Noise Sources in Site Preparation and Earth and Civil Works

Noise Source	Sound Power Level (dB)				
	Distance (m)	500 Hz	1000 Hz	2000 Hz	4000 Hz
Wheel Loader	50	21.81	25.01	26.21	26.01

Noise Source	Sound Power Level (dB)				
	Distance (m)	500 Hz	1000 Hz	2000 Hz	4000 Hz
	100	15.79	18.99	20.19	19.99
	250	7.83	11.03	12.23	12.03
	500	1.81	5.01	6.21	6.01
	1000	-4.21	-1.01	0.19	-0.01
	2000	-10.23	-7.03	-5.83	-6.03
	4000	-16.25	-13.05	-11.85	-12.05
Backhoe Excavator	50	23.81	27.01	28.21	28.01
	100	17.79	20.99	22.19	21.99
	250	9.83	13.03	14.23	14.03
	500	3.81	7.01	8.21	8.01
	1000	-2.21	0.99	2.19	1.99
	2000	-8.23	-5.03	-3.83	-4.03
	4000	-14.25	-11.05	-9.85	-10.05
Crawler Bulldozer	50	33.81	37.01	38.21	38.01
	100	27.79	30.99	32.19	31.99
	250	19.83	23.03	24.23	24.03
	500	13.81	17.01	18.21	18.01
	1000	7.79	10.99	12.19	11.99
	2000	1.77	4.97	6.17	5.97
	4000	-4.25	-1.05	0.15	-0.05
Road Roller	50	24.81	28.01	29.21	29.01
	100	18.79	21.99	23.19	22.99
	250	10.83	14.03	15.23	15.03
	500	4.81	8.01	9.21	9.01
	1000	-1.21	1.99	3.19	2.99
	2000	-7.23	-4.03	-2.83	-3.03
	4000	-13.25	-10.05	-8.85	-9.05
Dump Truck	50	24.81	28.01	29.21	29.01
	100	18.79	21.99	23.19	22.99
	250	10.83	14.03	15.23	15.03
	500	4.81	8.01	9.21	9.01
	1000	-1.21	1.99	3.19	2.99

Noise Source		Sound Power Level (dB)			
	Distance (m)	500 Hz	1000 Hz	2000 Hz	4000 Hz
	2000	-7.23	-4.03	-2.83	-3.03
	4000	-13.25	-10.05	-8.85	-9.05
Diesel Generator	50	19.81	23.01	24.21	24.01
	100	13.79	16.99	18.19	17.99
	250	5.83	9.03	10.23	10.03
	500	-0.19	3.01	4.21	4.01
	1000	-6.21	-3.01	-1.81	-2.01
	2000	-12.23	-9.03	-7.83	-8.03
	4000	-18.25	-15.05	-13.85	-14.05
Truck	50	11.81	15.01	16.21	16.01
	100	5.79	8.99	10.19	9.99
	250	-2.17	1.03	2.23	2.03
	500	-8.19	-4.99	-3.79	-3.99
	1000	-14.21	-11.01	-9.81	-10.01
	2000	-20.23	-17.03	-15.83	-16.03
	4000	-26.25	-23.05	-21.85	-22.05
Forklift	50	22.81	26.01	27.21	27.01
	100	16.79	19.99	21.19	20.99
	250	8.83	12.03	13.23	13.03
	500	2.81	6.01	7.21	7.01
	1000	-3.21	-0.01	1.19	0.99
	2000	-9.23	-6.03	-4.83	-5.03
	4000	-15.25	-12.05	-10.85	-11.05

Atmospheric absorption values at specific distances for each frequency were calculated using the following formula and calculated values are given in Table 63.

Waste (Atmospheric Swallow) = 7.4 * 10-8 (f2 * r / H) dB

f = frequency of noise source / center frequency of frequency band (Hz)

r = Distance from source (m)

H = Relative humidity of air (%) (According to the data recorded in Termez Meteorological Station for the years 2018, 2019 and 2020, 47% is taken.)

Table 63: Atmospheric Absorption Values Calculated Based on Distance

Frequency (Hz)	Distance (m)	Atmospheric Swallow
500	50	0.020
500	100	0.039
500	250	0.098
500	500	0.197
500	1000	0.394
500	2000	0.787
500	4000	1.574
1000	50	0.079
1000	100	0.157
1000	250	0.394
1000	500	0.787
1000	1000	1.574
1000	2000	3.149
1000	4000	6.298
2000	50	0.315
2000	100	0.630
2000	250	1.574
2000	500	3.149
2000	1000	6.298
2000	2000	12.596
2000	4000	25.191
4000	50	1.260
4000	100	2.519
4000	250	6.298
4000	500	12.596
4000	1000	25.191
4000	2000	50.383
4000	4000	100.766

After deducting the atmospheric absorption values, the net sound levels of the 4-octave bands of each noise source were calculated using the formula LP = LPort - Aatm (see Table 64).

Table 64: Clear Sound Levels of Noise Source Based on Distance in Site Preparation and Earth and Civil Works

Noise Source	Distance (m)	Sound Level (dBA)				Total Sound Level (dBA)
		500 Hz	1000 Hz	2000 Hz	4000 Hz	
Wheel Loader	50	21.79	24.93	25.90	24.75	30.605
	100	15.75	18.83	19.56	17.47	24.153
	250	7.73	10.64	10.66	5.73	15.170
	500	1.61	4.22	3.06	0.00	8.523
	1000	0.00	0.00	0.00	0.00	6.021
	2000	0.00	0.00	0.00	0.00	6.021
	4000	0.00	0.00	0.00	0.00	6.021
Backhoe Excavator	50	23.79	26.93	27.90	26.75	32.605
	100	17.75	20.83	21.56	19.47	26.153
	250	9.73	12.64	12.66	7.73	17.170
	500	3.61	6.22	5.06	0.00	10.292
	1000	0.00	0.00	0.00	0.00	6.021
	2000	0.00	0.00	0.00	0.00	6.021
	4000	0.00	0.00	0.00	0.00	6.021
Crawler Bulldozer	50	33.79	36.93	37.90	36.75	42.605
	100	27.75	30.83	31.56	29.47	36.153
	250	19.73	22.64	22.66	17.73	27.170
	500	13.61	16.22	15.06	5.41	20.019
	1000	7.40	9.42	5.89	0.00	12.813
	2000	0.98	1.82	0.00	0.00	6.789
	4000	0.00	0.00	0.00	0.00	6.021
Road Roller	50	24.79	27.93	28.90	27.75	33.605
	100	18.75	21.83	22.56	20.47	27.153
	250	10.73	13.64	13.66	8.73	18.170

Noise Source	Distance (m)	Sound Level (dBA)				Total Sound Level (dBA)
		500 Hz	1000 Hz	2000 Hz	4000 Hz	
	500	4.61	7.22	6.06	-3.59	11.019
	1000	-1.60	0.42	-3.11	-22.20	3.591
	2000	-8.02	-7.18	-15.43	0.00	1.392
	4000	-14.83	-16.35	-34.04	0.00	0.239
Dump Truck	50	24.79	27.93	28.90	27.75	33.605
	100	18.75	21.83	22.56	20.47	27.153
	250	10.73	13.64	13.66	8.73	18.170
	500	4.61	7.22	6.06	-3.59	11.019
	1000	-1.60	0.42	-3.11	-22.20	3.591
	2000	-8.02	-7.18	-15.43	0.00	1.392
	4000	-14.83	-16.35	0.00	0.00	3.130
Diesel Generator	50	19.79	22.93	24.21	22.75	28.714
	100	13.75	16.83	18.19	15.47	22.383
	250	5.73	8.64	10.23	3.73	13.794
	500	-0.39	2.22	4.21	-8.59	7.290
	1000	-6.60	-4.58	-1.81	-27.20	0.890
	2000	-13.02	-12.18	-7.83	0.00	1.056
	4000	-19.83	-21.35	-13.85	0.00	0.249
Truck	50	11.79	14.93	15.90	14.75	20.605
	100	5.75	8.83	9.56	7.47	14.153
	250	-2.27	0.64	0.66	-4.27	5.170
	500	-8.39	-5.78	-6.94	-16.59	-1.981
	1000	-14.60	-12.58	-16.11	-35.20	-9.409
	2000	-21.02	-20.18	-28.43	0.00	0.081
	4000	-27.83	-29.35	-47.04	0.00	0.012
Forklift	50	22.79	25.93	26.90	25.75	31.605

Noise Source	Distance (m)	Sound Level (dBA)				Total Sound Level (dBA)
		500 Hz	1000 Hz	2000 Hz	4000 Hz	
	100	16.75	19.83	20.56	18.47	25.153
	250	8.73	11.64	11.66	6.73	16.170
	500	2.61	5.22	4.06	-5.59	9.019
	1000	-3.60	-1.58	-5.11	-24.20	1.591
	2000	-10.02	-9.18	-17.43	0.00	0.929
	4000	-16.83	-18.35	-36.04	0.00	0.152

The total sound level during the construction phase is calculated using the following formula.

LT = Total sound level (dBA)

LT = 10log∑10Li / 10

Equivalent noise levels, assuming that all machines in the field preparation works simultaneously, are given below (see Table 65).

Table 65: Clear Sound Levels of Noise Sources Depending on Distance in Site Preparation and Earth and Civil Works

Distance (m)	L(day,evening,night) (dBA)
50	48.12
100	41.67
250	32.71
500	25.64
1000	19.31
2000	17.83
4000	17.12

Building and Foundation Works

The sound power level of each noise source was calculated by distributing it to 4-octave bands (see Table 66). Total sound power level, 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz octave band sound power level calculations are used in the following formula. In the calculations, it is assumed that the total sound power levels are equally distributed on 4-octave bands.

Lw (i) = 10 * log (10 (Lw / 10) / 4)

Lw = Sound power level of the source (dB)

Table 66: Distribution of Noise Sources Sound Power Levels in Octave Bands in Building and Foundation Works

Noise Sources	Total	Sound Power Level (dB)			
		500 Hz	1000 Hz	2000 Hz	4000 Hz
Platform Lorry	80	74	74	74	74
Concrete Pump Truck	79	73	73	73	73
Concrete Delivery Truck	80	74	74	74	74
Piling Machine	89	83	83	83	83
Diesel Generator	74	68	68	68	68
Truck	66	60	60	60	60
Forklift	77	71	71	71	71

Sound pressure levels of each sources based on 4-octave bands are given in Table 67.

Table 67: Sound Pressure Levels of Noise Sources in Building and Foundation Works

Noise Source	Distance (m)	Sound Pressure Level (dB)			
		500 Hz	1000 Hz	2000 Hz	4000 Hz
Platform Lorry	50	29.01	29.01	29.01	29.01
	100	22.99	22.99	22.99	22.99
	250	15.03	15.03	15.03	15.03
	500	9.01	9.01	9.01	9.01
	1000	2.99	2.99	2.99	2.99
	2000	-3.03	-3.03	-3.03	-3.03
	4000	-9.05	-9.05	-9.05	-9.05
Concrete Pump Truck	50	28.01	28.01	28.01	28.01
	100	21.99	21.99	21.99	21.99
	250	14.03	14.03	14.03	14.03
	500	8.01	8.01	8.01	8.01
	1000	1.99	1.99	1.99	1.99
	2000	-4.03	-4.03	-4.03	-4.03
	4000	-10.05	-10.05	-10.05	-10.05
Concrete Delivery Truck	50	29.01	29.01	29.01	29.01
	100	22.99	22.99	22.99	22.99
	250	15.03	15.03	15.03	15.03
	500	9.01	9.01	9.01	9.01

Noise Source	Distance (m)	Sound Pressure Level (dB)			
		500 Hz	1000 Hz	2000 Hz	4000 Hz
	1000	2.99	2.99	2.99	2.99
	2000	-3.03	-3.03	-3.03	-3.03
	4000	-9.05	-9.05	-9.05	-9.05
	50	38.01	38.01	38.01	38.01
	100	31.99	31.99	31.99	31.99
	250	24.03	24.03	24.03	24.03
Piling Machine	500	18.01	18.01	18.01	18.01
	1000	11.99	11.99	11.99	11.99
	2000	5.97	5.97	5.97	5.97
	4000	-0.05	-0.05	-0.05	-0.05
	50	23.01	23.01	23.01	23.01
	100	16.99	16.99	16.99	16.99
	250	9.03	9.03	9.03	9.03
Diesel Generator	500	3.01	3.01	3.01	3.01
	1000	-3.01	-3.01	-3.01	-3.01
	2000	-9.03	-9.03	-9.03	-9.03
	4000	-15.05	-15.05	-15.05	-15.05
	50	15.01	15.01	15.01	15.01
	100	8.99	8.99	8.99	8.99
	250	1.03	1.03	1.03	1.03
Truck	500	-4.99	-4.99	-4.99	-4.99
	1000	-11.01	-11.01	-11.01	-11.01
	2000	-17.03	-17.03	-17.03	-17.03
	4000	-23.05	-23.05	-23.05	-23.05
	50	26.01	26.01	26.01	26.01
	100	19.99	19.99	19.99	19.99
	250	12.03	12.03	12.03	12.03
Forklift	500	6.01	6.01	6.01	6.01
	1000	-0.01	-0.01	-0.01	-0.01
	2000	-6.03	-6.03	-6.03	-6.03
	4000	-12.05	-12.05	-12.05	-12.05

As a result of the calculation with the correction factors, the sound levels of the 4-octave bands of each noise source were calculated (see Table 68).

Table 68: Sound Pressure Levels of Corrected Noise Sources in Building and Foundation Works

Noise Source	Distance (m)	Sound Power Level (dB)			
		500 Hz	1000 Hz	2000 Hz	4000 Hz
Platform Lorry	50	25.81	29.01	30.21	30.01
	100	19.79	22.99	24.19	23.99
	250	11.83	15.03	16.23	16.03
	500	5.81	9.01	10.21	10.01
	1000	-0.21	2.99	4.19	3.99
	2000	-6.23	-3.03	-1.83	-2.03
	4000	-12.25	-9.05	-7.85	-8.05
Concrete Pump Truck	50	24.81	28.01	29.21	29.01
	100	18.79	21.99	23.19	22.99
	250	10.83	14.03	15.23	15.03
	500	4.81	8.01	9.21	9.01
	1000	-1.21	1.99	3.19	2.99
	2000	-7.23	-4.03	-2.83	-3.03
	4000	-13.25	-10.05	-8.85	-9.05
Concrete Delivery Truck	50	25.81	29.01	30.21	30.01
	100	19.79	22.99	24.19	23.99
	250	11.83	15.03	16.23	16.03
	500	5.81	9.01	10.21	10.01
	1000	-0.21	2.99	4.19	3.99
	2000	-6.23	-3.03	-1.83	-2.03
	4000	-12.25	-9.05	-7.85	-8.05
Piling Machine	50	34.81	38.01	39.21	39.01
	100	28.79	31.99	33.19	32.99
	250	20.83	24.03	25.23	25.03
	500	14.81	18.01	19.21	19.01
	1000	8.79	11.99	13.19	12.99
	2000	2.77	5.97	7.17	6.97
	4000	-3.25	-0.05	1.15	0.95
Diesel Generator	50	19.81	23.01	24.21	24.01
	100	13.79	16.99	18.19	17.99
	250	5.83	9.03	10.23	10.03
	500	-0.19	3.01	4.21	4.01

Noise Source	Distance (m)	Sound Power Level (dB)			
		500 Hz	1000 Hz	2000 Hz	4000 Hz
	1000	-6.21	-3.01	-1.81	-2.01
	2000	-12.23	-9.03	-7.83	-8.03
	4000	-18.25	-15.05	-13.85	-14.05
Truck	50	11.81	15.01	16.21	16.01
	100	5.79	8.99	10.19	9.99
	250	-2.17	1.03	2.23	2.03
	500	-8.19	-4.99	-3.79	-3.99
	1000	-14.21	-11.01	-9.81	-10.01
	2000	-20.23	-17.03	-15.83	-16.03
	4000	-26.25	-23.05	-21.85	-22.05
Forklift	50	22.81	26.01	27.21	27.01
	100	16.79	19.99	21.19	20.99
	250	8.83	12.03	13.23	13.03
	500	2.81	6.01	7.21	7.01
	1000	-3.21	-0.01	1.19	0.99
	2000	-9.23	-6.03	-4.83	-5.03
	4000	-15.25	-12.05	-10.85	-11.05

Atmospheric absorption values at specific distances for each frequency were calculated using the following formula and calculated values are given in Table 69.

Waste (Atmospheric Swallow) = 7.4 * 10-8 (f2 * r / H) dB

f = frequency of noise source / center frequency of frequency band (Hz)

r = Distance from source (m)

H = Relative humidity of air (%) (According to the data recorded in Termez Meteorological Station for the years 2018, 2019 and 2020, 47% is taken.)

Table 69: Atmospheric Absorption Values Calculated Based on Distance

Frequency (Hz)	Distance (m)	Atmospheric Swallow
500	50	0.020
500	100	0.039
500	250	0.098
500	500	0.197
500	1000	0.394
500	2000	0.787

Frequency (Hz)	Distance (m)	Atmospheric Swallow
500	4000	1.574
1000	50	0.079
1000	100	0.157
1000	250	0.394
1000	500	0.787
1000	1000	1.574
1000	2000	3.149
1000	4000	6.298
2000	50	0.315
2000	100	0.630
2000	250	1.574
2000	500	3.149
2000	1000	6.298
2000	2000	12.596
2000	4000	25.191
4000	50	1.260
4000	100	2.519
4000	250	6.298
4000	500	12.596
4000	1000	25.191
4000	2000	50.383
4000	4000	100.766

After deducting the atmospheric absorption values, the net sound levels of the 4-octave bands of each noise source were calculated using the formula LP = LPort - Aatm (see Table 70).

Table 70: Clear Sound Levels of Noise Source Based on Distance in Building and Foundation Works

Noise Source	Distance (m)	Sound Level (dBA)				Total Sound Level (dBA)
		500 Hz	1000 Hz	2000 Hz	4000 Hz	
Platform Lorry	50	25.79	28.93	29.90	28.75	34.605
	100	19.75	22.83	23.56	21.47	28.153
	250	11.73	14.64	14.66	9.73	19.170
	500	5.61	8.22	7.06	0.00	12.140
	1000	0.00	1.42	0.00	0.00	6.420
	2000	0.00	0.00	0.00	0.00	6.021

Noise Source	Distance (m)	Sound Level (dBA)				Total Sound Level (dBA)
		500 Hz	1000 Hz	2000 Hz	4000 Hz	
	4000	0.00	0.00	0.00	0.00	6.021
Concrete Pump Truck	50	24.79	27.93	28.90	27.75	33.605
	100	18.75	21.83	22.56	20.47	27.153
	250	10.73	13.64	13.66	8.73	18.170
	500	4.61	7.22	6.06	0.00	11.208
	1000	0.00	0.42	0.00	0.00	6.128
	2000	0.00	0.00	0.00	0.00	6.021
	4000	0.00	0.00	0.00	0.00	6.021
Concrete Delivery Truck	50	25.79	28.93	29.90	28.75	34.605
	100	19.75	22.83	23.56	21.47	28.153
	250	11.73	14.64	14.66	9.73	19.170
	500	5.61	8.22	7.06	0.00	12.140
	1000	0.00	1.42	0.00	0.00	6.420
	2000	0.00	0.00	0.00	0.00	6.021
	4000	0.00	0.00	0.00	0.00	6.021
Piling Machine	50	34.79	37.93	38.90	37.75	43.605
	100	28.75	31.83	32.56	30.47	37.153
	250	20.73	23.64	23.66	18.73	28.170
	500	14.61	17.22	16.06	6.41	21.019
	1000	8.40	10.42	6.89	-12.20	13.591
	2000	1.98	2.82	-5.43	0.00	6.793
	4000	-4.83	-6.35	-24.04	0.00	1.945
Diesel Generator	50	19.79	22.93	23.90	22.75	28.605
	100	13.75	16.83	17.56	15.47	22.153
	250	5.73	8.64	8.66	3.73	13.170
	500	-0.39	2.22	1.06	-8.59	6.019
	1000	-6.60	-4.58	-8.11	-27.20	-1.409
	2000	-13.02	-12.18	-20.43	0.00	0.490
	4000	-19.83	-21.35	0.00	0.00	3.049

Noise Source	Distance (m)	Sound Level (dBA)				Total Sound Level (dBA)
		500 Hz	1000 Hz	2000 Hz	4000 Hz	
Truck	50	11.79	14.93	16.21	14.75	20.714
	100	5.75	8.83	10.19	7.47	14.383
	250	-2.27	0.64	2.23	-4.27	5.794
	500	-8.39	-5.78	-3.79	-16.59	-0.710
	1000	-14.60	-12.58	-9.81	-35.20	-7.110
	2000	-21.02	-20.18	-15.83	0.00	0.185
	4000	-27.83	-29.35	-21.85	0.00	0.040
Forklift	50	22.79	25.93	26.90	25.75	31.605
	100	16.75	19.83	20.56	18.47	25.153
	250	8.73	11.64	11.66	6.73	16.170
	500	2.61	5.22	4.06	-5.59	9.019
	1000	-3.60	-1.58	-5.11	-24.20	1.591
	2000	-10.02	-9.18	-17.43	0.00	0.929
	4000	-16.83	-18.35	-36.04	0.00	0.152

The total sound level during the construction phase is calculated using the following formula.

LT = Total sound level (dBA)

$LT = 10\log\sum 10Li / 10$

Equivalent noise levels, assuming that all machines in building and foundation works simultaneously, are given below (see Table 71).

Table 71: Clear Sound Levels of Noise Sources Depending on Distance in Building and Foundation Works

Distance (m)	L(day, evening, night) (dBA)
50	50.84
100	44.39
250	35.40
500	28.28
1000	21.37
2000	18.03
4000	17.10

Mechanical and Installation Works

The sound power level of each noise source was calculated by distributing it to 4-octave bands (see Table 72). Total sound power level, 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz octave band sound power level calculations are used in the following formula. In the calculations, it is assumed that the total sound power levels are equally distributed on 4-octave bands.

Lw (i) = 10 * log (10 (Lw / 10) / 4)

Lw = Sound power level of the source (dB)

Table 72: Distribution of Noise Sources Sound Power Levels in Octave Bands in Mechanical and Installation Works

Noise Sources	Total	Sound Power Level (dB)			
		500 Hz	1000 Hz	2000 Hz	4000 Hz
750t, 250t and 150t Crawling Crane	75	69	69	69	69
Hydraulic Lifting Device and Lifting Frame	67	61	61	61	61
50t Crawling Crane	71	65	65	65	65
50t Truck Crane	67	61	61	61	61
Gantry Crane	75	69	69	69	69
Electric Welding Machine	73	67	67	67	67
Tower and Vehicle Crane	76	70	70	70	70
Vehicle Crane	71	65	65	65	65
Diesel Generator	74	68	68	68	68
Truck	66	60	60	60	60
Forklift	77	71	71	71	71

Sound pressure levels of each sources based on 4-octave bands are given in Table 73.

Table 73: Sound Pressure Levels of Noise Sources in Mechanical and Installation Works

Noise Source	Distance (m)	Sound Pressure Level (dB)			
		500 Hz	1000 Hz	2000 Hz	4000 Hz
750t, 250t and 150t Crawling Crane	50	24.01	24.01	24.01	24.01
	100	17.99	17.99	17.99	17.99
	250	10.03	10.03	10.03	10.03
	500	4.01	4.01	4.01	4.01
	1000	-2.01	-2.01	-2.01	-2.01
	2000	-8.03	-8.03	-8.03	-8.03
	4000	-14.05	-14.05	-14.05	-14.05
Hydraulic Lifting Device and Lifting Frame	50	16.01	16.01	16.01	16.01
	100	9.99	9.99	9.99	9.99
	250	2.03	2.03	2.03	2.03
	500	-3.99	-3.99	-3.99	-3.99

Noise Source	Distance (m)	Sound Pressure Level (dB)			
		500 Hz	1000 Hz	2000 Hz	4000 Hz
	1000	-10.01	-10.01	-10.01	-10.01
	2000	-16.03	-16.03	-16.03	-16.03
	4000	-22.05	-22.05	-22.05	-22.05
50t Crawling Crane	50	20.01	20.01	20.01	20.01
	100	13.99	13.99	13.99	13.99
	250	6.03	6.03	6.03	6.03
	500	0.01	0.01	0.01	0.01
	1000	-6.01	-6.01	-6.01	-6.01
	2000	-12.03	-12.03	-12.03	-12.03
	4000	-18.05	-18.05	-18.05	-18.05
50t Truck Crane	50	16.01	16.01	16.01	16.01
	100	9.99	9.99	9.99	9.99
	250	2.03	2.03	2.03	2.03
	500	-3.99	-3.99	-3.99	-3.99
	1000	-10.01	-10.01	-10.01	-10.01
	2000	-16.03	-16.03	-16.03	-16.03
	4000	-22.05	-22.05	-22.05	-22.05
Gantry Crane	50	24.01	24.01	24.01	24.01
	100	17.99	17.99	17.99	17.99
	250	10.03	10.03	10.03	10.03
	500	4.01	4.01	4.01	4.01
	1000	-2.01	-2.01	-2.01	-2.01
	2000	-8.03	-8.03	-8.03	-8.03
	4000	-14.05	-14.05	-14.05	-14.05
Electric Welding Machine	50	22.01	22.01	22.01	22.01
	100	15.99	15.99	15.99	15.99
	250	8.03	8.03	8.03	8.03
	500	2.01	2.01	2.01	2.01
	1000	-4.01	-4.01	-4.01	-4.01
	2000	-10.03	-10.03	-10.03	-10.03
	4000	-16.05	-16.05	-16.05	-16.05
Tower and Vehicle Crane	50	25.01	25.01	25.01	25.01
	100	18.99	18.99	18.99	18.99
	250	11.03	11.03	11.03	11.03
	500	5.01	5.01	5.01	5.01
	1000	-1.01	-1.01	-1.01	-1.01
	2000	-7.03	-7.03	-7.03	-7.03
	4000	-13.05	-13.05	-13.05	-13.05
Vehicle Crane	50	20.01	20.01	20.01	20.01
	100	13.99	13.99	13.99	13.99
	250	6.03	6.03	6.03	6.03
	500	0.01	0.01	0.01	0.01
	1000	-6.01	-6.01	-6.01	-6.01

Noise Source	Distance (m)	Sound Pressure Level (dB)			
		500 Hz	1000 Hz	2000 Hz	4000 Hz
	2000	-12.03	-12.03	-12.03	-12.03
	4000	-18.05	-18.05	-18.05	-18.05
Diesel Generator	50	23.01	23.01	23.01	23.01
	100	16.99	16.99	16.99	16.99
	250	9.03	9.03	9.03	9.03
	500	3.01	3.01	3.01	3.01
	1000	-3.01	-3.01	-3.01	-3.01
	2000	-9.03	-9.03	-9.03	-9.03
	4000	-15.05	-15.05	-15.05	-15.05
Truck	50	15.01	15.01	15.01	15.01
	100	8.99	8.99	8.99	8.99
	250	1.03	1.03	1.03	1.03
	500	-4.99	-4.99	-4.99	-4.99
	1000	-11.01	-11.01	-11.01	-11.01
	2000	-17.03	-17.03	-17.03	-17.03
	4000	-23.05	-23.05	-23.05	-23.05
Forklift	50	26.01	26.01	26.01	26.01
	100	19.99	19.99	19.99	19.99
	250	12.03	12.03	12.03	12.03
	500	6.01	6.01	6.01	6.01
	1000	-0.01	-0.01	-0.01	-0.01
	2000	-6.03	-6.03	-6.03	-6.03
	4000	-12.05	-12.05	-12.05	-12.05

As a result of the calculation with the correction factors, the sound levels of the 4-octave bands of each noise source were calculated (see Table 74).

Table 74: Sound Pressure Levels of Corrected Noise Sources in Mechanical and Installation Works

Noise Source	Distance (m)	Sound Power Level (dB)			
		500 Hz	1000 Hz	2000 Hz	4000 Hz
750t, 250t and 150t Crawling Crane	50	20.81	24.01	25.21	25.01
	100	14.79	17.99	19.19	18.99
	250	6.83	10.03	11.23	11.03
	500	0.81	4.01	5.21	5.01
	1000	-5.21	-2.01	-0.81	-1.01
	2000	-11.23	-8.03	-6.83	-7.03
	4000	-17.25	-14.05	-12.85	-13.05
Hydraulic Lifting Device and Lifting Frame	50	12.81	16.01	17.21	17.01
	100	6.79	9.99	11.19	10.99
	250	-1.17	2.03	3.23	3.03

Noise Source	Distance (m)	Sound Power Level (dB)			
		500 Hz	1000 Hz	2000 Hz	4000 Hz
	500	-7.19	-3.99	-2.79	-2.99
	1000	-13.21	-10.01	-8.81	-9.01
	2000	-19.23	-16.03	-14.83	-15.03
	4000	-25.25	-22.05	-20.85	-21.05
50t Crawling Crane	50	16.81	20.01	21.21	21.01
	100	10.79	13.99	15.19	14.99
	250	2.83	6.03	7.23	7.03
	500	-3.19	0.01	1.21	1.01
	1000	-9.21	-6.01	-4.81	-5.01
	2000	-15.23	-12.03	-10.83	-11.03
	4000	-21.25	-18.05	-16.85	-17.05
50t Truck Crane	50	12.81	16.01	17.21	17.01
	100	6.79	9.99	11.19	10.99
	250	-1.17	2.03	3.23	3.03
	500	-7.19	-3.99	-2.79	-2.99
	1000	-13.21	-10.01	-8.81	-9.01
	2000	-19.23	-16.03	-14.83	-15.03
	4000	-25.25	-22.05	-20.85	-21.05
Gantry Crane	50	20.81	24.01	25.21	25.01
	100	14.79	17.99	19.19	18.99
	250	6.83	10.03	11.23	11.03
	500	0.81	4.01	5.21	5.01
	1000	-5.21	-2.01	-0.81	-1.01
	2000	-11.23	-8.03	-6.83	-7.03
	4000	-17.25	-14.05	-12.85	-13.05
Electric Welding Machine	50	18.81	22.01	23.21	23.01
	100	12.79	15.99	17.19	16.99
	250	4.83	8.03	9.23	9.03
	500	-1.19	2.01	3.21	3.01
	1000	-7.21	-4.01	-2.81	-3.01
	2000	-13.23	-10.03	-8.83	-9.03
	4000	-19.25	-16.05	-14.85	-15.05

Noise Source	Distance (m)	Sound Power Level (dB)			
		500 Hz	1000 Hz	2000 Hz	4000 Hz
Tower and Vehicle Crane	50	21.81	25.01	26.21	26.01
	100	15.79	18.99	20.19	19.99
	250	7.83	11.03	12.23	12.03
	500	1.81	5.01	6.21	6.01
	1000	-4.21	-1.01	0.19	-0.01
	2000	-10.23	-7.03	-5.83	-6.03
	4000	-16.25	-13.05	-11.85	-12.05
Vehicle Crane	50	16.81	20.01	21.21	21.01
	100	10.79	13.99	15.19	14.99
	250	2.83	6.03	7.23	7.03
	500	-3.19	0.01	1.21	1.01
	1000	-9.21	-6.01	-4.81	-5.01
	2000	-15.23	-12.03	-10.83	-11.03
	4000	-21.25	-18.05	-16.85	-17.05
Diesel Generator	50	19.81	23.01	24.21	24.01
	100	13.79	16.99	18.19	17.99
	250	5.83	9.03	10.23	10.03
	500	-0.19	3.01	4.21	4.01
	1000	-6.21	-3.01	-1.81	-2.01
	2000	-12.23	-9.03	-7.83	-8.03
	4000	-18.25	-15.05	-13.85	-14.05
Truck	50	11.81	15.01	16.21	16.01
	100	5.79	8.99	10.19	9.99
	250	-2.17	1.03	2.23	2.03
	500	-8.19	-4.99	-3.79	-3.99
	1000	-14.21	-11.01	-9.81	-10.01
	2000	-20.23	-17.03	-15.83	-16.03
	4000	-26.25	-23.05	-21.85	-22.05
Forklift	50	22.81	26.01	27.21	27.01
	100	16.79	19.99	21.19	20.99
	250	8.83	12.03	13.23	13.03
	500	2.81	6.01	7.21	7.01
	1000	-3.21	-0.01	1.19	0.99

Noise Source	Distance (m)	Sound Power Level (dB)			
		500 Hz	1000 Hz	2000 Hz	4000 Hz
	2000	-9.23	-6.03	-4.83	-5.03
	4000	-15.25	-12.05	-10.85	-11.05

Atmospheric absorption values at specific distances for each frequency were calculated using the following formula and calculated values are given in Table 75.

Waste (Atmospheric Swallow) = 7.4 * 10-8 (f2 * r / H) dB

f = frequency of noise source / center frequency of frequency band (Hz)

r = Distance from source (m)

H = Relative humidity of air (%) (According to the data recorded in Temez Meteorological Station for the years 2018, 2019 and 2020, 47% is taken.)

Table 75: Atmospheric Absorption Values Calculated Based on Distance

Frequency (Hz)	Distance (m)	Atmospheric Swallow
500	50	0.020
500	100	0.039
500	250	0.098
500	500	0.197
500	1000	0.394
500	2000	0.787
500	4000	1.574
1000	50	0.079
1000	100	0.157
1000	250	0.394
1000	500	0.787
1000	1000	1.574
1000	2000	3.149
1000	4000	6.298
2000	50	0.315
2000	100	0.630
2000	250	1.574
2000	500	3.149
2000	1000	6.298
2000	2000	12.596
2000	4000	25.191

Frequency (Hz)	Distance (m)	Atmospheric Swallow
4000	50	1.260
4000	100	2.519
4000	250	6.298
4000	500	12.596
4000	1000	25.191
4000	2000	50.383
4000	4000	100.766

After deducting the atmospheric absorption values, the net sound levels of the 4-octave bands of each noise source were calculated using the formula LP = LPort - Aatm (see Table 76).

Table 76: Clear Sound Levels of Noise Source Based on Distance in Mechanical and Installation Works

Noise Source	Distance (m)	Sound Level (dBA)				Total Sound Level (dBA)
		500 Hz	1000 Hz	2000 Hz	4000 Hz	
750t, 250t and 150t Crawling Crane	50	20.79	23.93	24.90	23.75	29.605
	100	14.75	17.83	18.56	16.47	23.153
	250	6.73	9.64	9.66	4.73	14.170
	500	0.61	3.22	2.06	0.00	7.679
	1000	0.00	0.00	0.00	0.00	6.021
	2000	0.00	0.00	0.00	0.00	6.021
	4000	0.00	0.00	0.00	0.00	6.021
Hydraulic Lifting Device and Lifting Frame	50	12.79	15.93	16.90	15.75	21.605
	100	6.75	9.83	10.56	8.47	15.153
	250	0.00	1.64	1.66	0.00	6.922
	500	0.00	0.00	0.00	0.00	6.021
	1000	0.00	0.00	0.00	0.00	6.021
	2000	0.00	0.00	0.00	0.00	6.021
	4000	0.00	0.00	0.00	0.00	6.021
50t Crawling Crane	50	16.79	19.93	20.90	19.75	25.605
	100	10.75	13.83	14.56	12.47	19.153
	250	2.73	5.64	5.66	0.73	10.170
	500	0.00	0.00	0.00	0.00	6.021
	1000	0.00	0.00	0.00	0.00	6.021
	2000	0.00	0.00	0.00	0.00	6.021

Noise Source	Distance (m)	Sound Level (dBA)				Total Sound Level (dBA)
		500 Hz	1000 Hz	2000 Hz	4000 Hz	
	4000	0.00	0.00	0.00	0.00	6.021
	50	12.79	15.93	16.90	15.75	21.605
	100	6.75	9.83	10.56	8.47	15.153
	250	-1.27	1.64	1.66	-3.27	6.170
50t Truck Crane	500	-7.39	-4.78	-5.94	-15.59	-0.981
	1000	-13.60	-11.58	-15.11	-34.20	-8.409
	2000	-20.02	-19.18	-27.43	0.00	0.102
	4000	-26.83	-28.35	-46.04	0.00	0.015
	50	20.79	23.93	24.90	23.75	29.605
	100	14.75	17.83	18.56	16.47	23.153
	250	6.73	9.64	9.66	4.73	14.170
Gantry Crane	500	0.61	3.22	2.06	-7.59	7.019
	1000	-5.60	-3.58	-7.11	-26.20	-0.409
	2000	-12.02	-11.18	-19.43	0.00	0.609
	4000	-18.83	-20.35	0.00	0.00	3.059
	50	18.79	21.93	23.21	21.75	27.714
	100	12.75	15.83	17.19	14.47	21.383
	250	4.73	7.64	9.23	2.73	12.794
Electric Welding Machine	500	-1.39	1.22	3.21	-9.59	6.290
	1000	-7.60	-5.58	-2.81	-28.20	-0.110
	2000	-14.02	-13.18	-8.83	0.00	0.859
	4000	-20.83	-22.35	-14.85	0.00	0.199
	50	21.79	24.93	25.90	24.75	30.605
	100	15.75	18.83	19.56	17.47	24.153
	250	7.73	10.64	10.66	5.73	15.170
Tower and Vehicle Crane	500	1.61	4.22	3.06	-6.59	8.019
	1000	-4.60	-2.58	-6.11	-25.20	0.591
	2000	-11.02	-10.18	-18.43	0.00	0.753
	4000	-17.83	-19.35	-37.04	0.00	0.121
	50	16.79	19.93	20.90	19.75	25.605
Vehicle Crane	100	10.75	13.83	14.56	12.47	19.153
	250	2.73	5.64	5.66	0.73	10.170

Noise Source	Distance (m)	Sound Level (dBA)				Total Sound Level (dBA)
		500 Hz	1000 Hz	2000 Hz	4000 Hz	
	500	-3.39	-0.78	-1.94	-11.59	3.019
	1000	-9.60	-7.58	-11.11	-30.20	-4.409
	2000	-16.02	-15.18	-23.43	0.00	0.253
	4000	-22.83	-24.35	-42.04	0.00	0.039
	50	19.79	22.93	23.90	22.75	0.000
	100	13.75	16.83	17.56	15.47	0.000
	250	5.73	8.64	8.66	3.73	0.000
Diesel Generator	500	-0.39	2.22	1.06	-8.59	0.000
	1000	-6.60	-4.58	-8.11	-27.20	0.000
	2000	-13.02	-12.18	-20.43	0.00	0.000
	4000	-19.83	-21.35	0.00	0.00	0.000
	50	11.79	14.99	16.19	15.99	-0.02
	100	5.75	8.95	10.15	9.95	-0.04
	250	-2.27	0.93	2.13	1.93	-0.10
Truck	500	-8.39	-5.19	-3.99	-4.19	-0.20
	1000	-14.60	-11.40	-10.20	-10.40	-0.39
	2000	-21.02	-17.82	-16.62	-16.82	-0.79
	4000	-27.83	-24.63	-23.43	-23.63	-1.57
	50	22.79	25.99	27.19	26.99	-0.02
	100	16.75	19.95	21.15	20.95	-0.04
	250	8.73	11.93	13.13	12.93	-0.10
Forklift	500	2.61	5.81	7.01	6.81	-0.20
	1000	-3.60	-0.40	0.80	0.60	-0.39
	2000	-10.02	-6.82	-5.62	-5.82	-0.79
	4000	-16.83	-13.63	-12.43	-12.63	-1.57

The total sound level during the construction phase is calculated using the following formula.

LT = Total sound level (dBA)

$LT = 10\log\Sigma 10Li / 10$

Equivalent noise levels, assuming that all machines in mechanical and installation works simultaneously at the same place, are given below (see Table 77).

Table 77: Clear Sound Levels of Noise Sources Depending on Distance in Mechanical and Installation Works

Distance (m)	L(day,evening,night,) (dBA)
50	55.48
100	49.03
250	40.05
500	32.92
1000	25.72
2000	25.60
4000	25.34

Summary of noise levels caused from activities in construction phase, average of the background noise measurements and national and international limits are given in Table 78.

Table 78: Summary of Noise Levels Caused from Activities in Construction Phase, Average of the Background Noise Measurements and National and International Limits

Receptor	Distance to Border of the Project Area (m)	Background Noise Measurements (dBA)		Noise Caused by Construction Activities (dBA)			Noise Levels at Receptors				National Noise Level Standard (SanPİN No. 0267-09) (30 min LAeq (dB(A))		IFC/WBG General EHS Guidelines (2007), Table 1.7.1. (One-hour LAeq (dB(A))	
		Daytime (07:00 to 22:00)	Nighttime (22:00 to 07:00)	Site Preparation and Earth and Civil Works	Building and Foundation Works	Mechanical and Installation Works	Daytime (07:00 to 22:00)	Noise Difference	Nighttime (22:00 to 07:00)	Noise Difference	Daytime (07:00 to 23:00)	Nighttime (23:00 to 07:00)	Daytime (07:00 to 22:00)	Nighttime (22:00 to 07:00)
Noise-1	**250**	46.00	41.75	32.71	35.40	40.05	46.98	0.98	43.99	2.24	55	45	55	45
Noise-2	**990**	44.70	44.20	19.30	21.36	25.71	44.75	0.05	44.26	0.06				
Noise-3	**1,690**	52.25	43.85	18.84	19.71	25.63	52.26	0.01	43.91	0.06				
Noise-4	**2,980**	44.70	43.55	17.56	17.83	25.49	44.75	0.05	43.62	0.07				
Noise-5	**-**	38.60	44.20	48.12	50.84	55.48	55.57	16.97	55.84	11.64	70	70	70	70

As seen form Table 78, noise levels during construction phase of the project are under the limit values specified for the day and night time in both national and international limits.

In addition to this, it is stated in IFC's EHS Guidelines that noise levels should not exceed the levels presented in Table 78, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site. The baseline noise level measurement results and the noise level calculations are given in Table 78 and there is not any increase in background levels of 3 dB(A) off-site.

The noise levels at Noise-5 location, which is inside of the Project Area, were calculated with the worse case scenario assumption of all machines in mechanical and installation working simultaneously at the same place. The results are quite below the limitations at the boundary of an industrial property which is 70 dB.

Vehicular Noise

The addition of temporary construction vehicles on local roads and within the site will likely result in temporary increases in traffic which will consequently result in an increase to noise levels at off-site receptors within close proximity to the Project boundary and close to the site access road and along key routes. Impacts due to vehicular noise will vary due to the phasing of works and the timing of vehicular movements, which affect both vehicles flow and the percentage of heavy vehicles.

The flow of vehicles in the local area is not constant, but the main road to the north of the Project site has a very low but continuous flow. The construction phase will result in the presence of larger vehicles and other more specialized equipment. As a major Project in the local area requiring hundreds of construction staff, associated equipment and deliveries, there will be a noticeable increase in vehicles at the site and along key access routes. This will influence noise levels and impacts to receptors in the adjacent corridors along these roads, in addition to existing impacts from existing vehicle flows. It is noted that such impacts will be limited to the construction phase only and may be more prevalent during certain period so construction, which require more vehicle trips.

Internal site roads will generate a new noise source from the movement of construction vehicles. Such noises will be predominantly experienced by the Project construction workers and workers of in nearby facility. It is noted that much of this movement of vehicles has been captured by the predictions for construction equipment as above.

Vibration

There will be no blasting during construction activities; therefore, vibration effect will not be of concern on the environment and human health. Nevertheless, there will be vibration due to heavy machinery. Vibrations resulted from the machines or buildings including machinery emerge from the dynamic force from the moving parts of the machines. Different parts of the machines generally make different frequency and vibration. Vibrations cause mechanical weathering in time. Generally, most important factor of a machine malfunction is vibration. Therefore, necessary maintenance shall be performed for the construction machines and equipment.

Noise Impacts to Site Workers

Site workers will be exposed to varying levels of noise depending on their specific roles and activities being conducted. This may relate to exposure to noise in areas that are considered 'high' (e.g. above occupational health and safety guidelines), Without mitigation, noise impacts to the workforce could results in health impacts, for example hearing damage.

Noise Impacts at Accommodation Facilities Located on Site

Some of the EPC construction workers will live in accommodation facilities located at the Project site. This will potentially expose the workers to construction phase noise levels especially in the event that workers are required to work in shifts (day and night). Currently, the exact location of the accommodation facilities has not been determined, so if the impacts are higher than regulatory limit values, the EPC Contractor will be required to implement appropriate mitigation and management measures.

7.3.1.1 Assessment of Impacts and Mitigation Measures

By using impact assessment significance criteria approach, key potential impacts and countermeasures on air quality for the construction phase are presented in Table 80.

Table 79: Impacts Significance of the Noise and Vibration during – Construction Phase

Potential Impacts	Receptor	Sensitivity of the Receptor	Magnitude of Impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Construction Site Noise – Noise generated from general construction activities	Waste Processing Facility	Medium	Medium	Moderate	Consideration of noise fences for non-mobile equipment such as generators or at boundaries for key receptors that may have higher assessed impacts. The EPC Contractor will, at all times, carry out all work in such a manner as to keep any disturbance from noise to a minimum (by phasing noisy works). Acoustic covers on machine engines will be remain closed at all times as applicable. Where practical, electrically powered machines will be preferred to mechanically powered alternatives. All mechanically powered plant, diesel engine vehicles and compression equipment will be fitted with noise control equipment (exhaust silencers, mufflers) as available from the manufacturer. Where possible, the highest noise emitting activities will be undertaken in a central site area, or within an enclosed structure. Where practical, additional noise barriers/attenuation should be employed to ensure that the maximum noise level at 1m distance outside of the plant fence when all equipment is running do not exceed 70dB(A) and maximum noise level at 1m from open air installations do not exceed 85dB(A). Items of plant on site operating intermittently will be shut down in the intervening periods between use. Night time construction works will be avoided as much as practicable to prevent noise impact at the sub contactor camp. Where unavoidable, night work permits (if applicable) will be obtained from the relevant authorities. The impacted receptors will have access to a grievance mechanism in accordance with the Project SEP in order to make any complaints regarding noise during the construction phase.	Minor
	Residential Areas	Medium	Medium	Moderate		Minor

Potential Impacts	Receptor	Sensitivity of the Receptor	Magnitude of Impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Vehicular Noise- Noise from movement of Vehicles	Waste Processing Facility & Residential Areas	Medium	Medium	Moderate	Delivery vehicles will be prohibited from waiting outside the site with their engines running (consideration of driver waiting room with heating/AC). Ensure any applicable permits are in place for deliveries to the site and for any works performed outside normal working hours. Review vendor specifications and accept site plant & vehicles, in particular heavy vehicles, based on noise generation (as far as practical). The movement of heavy vehicles during the night will be avoided wherever practical. Where available in country, audible reversing alarms with broadband noise (white noise) should be preferred over tone alarms (beeping), to limit external disturbance to communities. Where construction vehicles will be operating in close proximity to the accommodation camps, the need for trucks to reverse will be minimized as far as practicable. This is so as to reduce the frequency at which disturbing but necessary reverse warnings sirens will be used. Speed limits established in the Traffic Management Plan will be adhered to.	Minor
Construction vibration impacts (including vehicle vibration)	Waste Processing Facility & Residential Areas	Medium	Medium	Moderate	The Contractors will, at all times, carry out all works in such a manner to keep any disturbance from vibration to a minimum. Wherever practical, all vibratory generating equipment and activities shall be sited away from the Project boundary. Vibrating equipment/machinery will be switched off when not in use.	Minor

Potential Impacts	Receptor	Sensitivity of the Receptor	Magnitude of Impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Impacts to Construction Workers & Accommodation Areas Located at the Project site	Site Workers	High	Medium	Major	Where noise levels exceed 80dB(A) noise protection devices will be provided to personnel on-site and the area marked as a high-noise zone where ear protection is mandatory. Note: 80dB(A) is aligned with Uzbekistan noise standards. Operators of vibrating hand-held machinery (if any) will be provided with appropriate PPE (e.g. protective gloves and ear muffs/plugs) and be given suitable breaks from using such equipment to reduce the impacts of vibration. Workers potentially exposed to high noise and vibration shall be provided with appropriate PPE with respect to the occupational H&S risk assessment conducted for that activity. Workers potentially exposed to high noise and vibration shall be trained to identify situation when PPE is required to be worn and how to effectively utilise the PPE. These mitigation measures shall be incorporated to the applicable occupational H&S plan being developed by the EPC Contractor and implemented on-site. The Occupational H&S Plan shall include measures to reduce the risk of potential sleep disturbance to workers (who may work both day and night shifts). Where practical the benchmark for noise in the sleeping areas shall be taken against the WHO Guidelines for Community Noise (2011) of 30dB (LAeq,8h). Worker accommodation facilities should be located further away from the construction areas and facilities such as canteens and laundry rooms positioned in a way that creates a buffer zone between the sleeping areas and construction areas. Where applicable, the worker accommodation facilities at the Project site should be constructed with walls and windows that reduce noise (such as double-glazed windows, noise cancelling shutters or blinds, etc.). If necessary, solid walls (rather than wire fences) may be required to fence the accommodation area. Where noisy activities are located in close proximity to the EPC accommodation facilities, stockpiling of materials could be considered between the source of noise and the camp so as to provide acoustic screening.	Moderate

7.3.2 Operational Phase

In scope of the project, 2 Gas Turbines + 2 Heat Recovery Steam Generators + 1 Steam turbines will be operated. Under consideration of an unabsorbing inner lining, the following room averaged sound pressure levels will be expected during normal operation: (excluding offices and recreation rooms):

- Turbine building 90 dB(A),
- Circulating water pump area 90 dB(A),
- Building for water treatment plant 85 dB(A).

Additionally, IFC/WBG General EHS Guidelines indicate that "Limits for vibration and action values, (i.e. the level of exposure at which remediation should be initiated) are provided by the American Conference of Governmental Industrial Hygienists. Exposure levels should be checked on the basis of daily exposure time and data provided by equipment manufacturers."

Moreover, the Project commits that the following room average sound pressure levels will not be exceeded inside the Plant in rooms which are provided for or which require the constant presence of staff:

- Main control room and offices 50 dB(A),
- Local control rooms 70 dB(A),
- Areas of computers 75 dB(A),
- Workshop and stores 85 dB(A).

The contribution of noise caused by the inventory in these rooms, e.g., workshop machines, as well as that caused by the staff is not taken into consideration.

The sound power level of each noise source was calculated by distributing it to 4-octave bands (see Table 80). Total sound power level, 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz octave band sound power level calculations are used in the following formula. In the calculations, it is assumed that the total sound power levels are equally distributed on 4-octave bands.

Lw (i) = 10 * log (10 (Lw / 10) / 4)

Lw = Sound power level of the source (dB)

Table 80: Distribution of Noise Sources Sound Power Levels in Octave Bands in Operation Phase

Noise Sources	Total	Sound Power Level (dB)			
		500 Hz	1000 Hz	2000 Hz	4000 Hz
Turbine Building	90	84	84	84	84
Circulating Water Pomp Area	90	84	84	84	84
Building for Treatment Plants	85	79	79	79	79

Sound pressure levels of each sources based on 4-octave bands are given in Table 81.

.

Table 81: Sound Pressure Levels of Noise Sources in Operation Phase

Noise Source	Distance (m)	Sound Pressure Level (dB)			
		500 Hz	1000 Hz	2000 Hz	4000 Hz
Turbine Building	50	39.01	39.01	39.01	39.01
	100	32.99	32.99	32.99	32.99
	250	25.03	25.03	25.03	25.03
	500	19.01	19.01	19.01	19.01
	1000	12.99	12.99	12.99	12.99
	2000	6.97	6.97	6.97	6.97
	4000	0.95	0.95	0.95	0.95
Circulating Water Pomp Area	50	39.01	39.01	39.01	39.01
	100	32.99	32.99	32.99	32.99
	250	25.03	25.03	25.03	25.03
	500	19.01	19.01	19.01	19.01
	1000	12.99	12.99	12.99	12.99
	2000	6.97	6.97	6.97	6.97
	4000	0.95	0.95	0.95	0.95
Building for Treatment Plants	50	34.01	34.01	34.01	34.01
	100	27.99	27.99	27.99	27.99
	250	20.03	20.03	20.03	20.03
	500	14.01	14.01	14.01	14.01
	1000	7.99	7.99	7.99	7.99
	2000	1.97	1.97	1.97	1.97
	4000	-4.05	-4.05	-4.05	-4.05

As a result of the calculation with the correction factors, the sound levels of the 4-octave bands of each noise source were calculated (see Table 82).

Table 82: Sound Pressure Levels of Corrected Noise Sources in Operation Phase

Noise Source	Distance (m)	Sound Power Level (dB)			
		500 Hz	1000 Hz	2000 Hz	4000 Hz
Turbine Building	50	35.81	39.01	40.21	40.01
	100	29.79	32.99	34.19	33.99
	250	21.83	25.03	26.23	26.03
	500	15.81	19.01	20.21	20.01
	1000	9.79	12.99	14.19	13.99

Noise Source	Distance (m)	Sound Power Level (dB)			
		500 Hz	1000 Hz	2000 Hz	4000 Hz
	2000	3.77	6.97	8.17	7.97
	4000	-2.25	0.95	2.15	1.95
Circulating Water Pomp Area	50	35.81	39.01	40.21	40.01
	100	29.79	32.99	34.19	33.99
	250	21.83	25.03	26.23	26.03
	500	15.81	19.01	20.21	20.01
	1000	9.79	12.99	14.19	13.99
	2000	3.77	6.97	8.17	7.97
	4000	-2.25	0.95	2.15	1.95
Building for Treatment Plants	50	30.81	34.01	35.21	35.01
	100	24.79	27.99	29.19	28.99
	250	16.83	20.03	21.23	21.03
	500	10.81	14.01	15.21	15.01
	1000	4.79	7.99	9.19	8.99
	2000	-1.23	1.97	3.17	2.97
	4000	-7.25	-4.05	-2.85	-3.05

Atmospheric absorption values at specific distances for each frequency were calculated using the following formula and calculated values are given in Table 83.

Waste (Atmospheric Swallow) = 7.4 * 10-8 (f2 * r / H) dB

f = frequency of noise source / center frequency of frequency band (Hz)

r = Distance from source (m)

H = Relative humidity of air (%) (According to the data recorded in Termez Meteorological Station for the years 2018, 2019 and 2020, 47% is taken)

Table 83: Atmospheric Absorption Values Calculated Based on Distance

Frequency (Hz)	Distance (m)	Atmospheric Swallow
500	50	0.020
500	100	0.039
500	250	0.098
500	500	0.197
500	1000	0.394
500	2000	0.787
500	4000	1.574
1000	50	0.079

Frequency (Hz)	Distance (m)	Atmospheric Swallow
1000	100	0.157
1000	250	0.394
1000	500	0.787
1000	1000	1.574
1000	2000	3.149
1000	4000	6.298
2000	50	0.315
2000	100	0.630
2000	250	1.574
2000	500	3.149
2000	1000	6.298
2000	2000	12.596
2000	4000	25.191
4000	50	1.260
4000	100	2.519
4000	250	6.298
4000	500	12.596
4000	1000	25.191
4000	2000	50.383
4000	4000	100.766

After deducting the atmospheric absorption values, the net sound levels of the 4-octave bands of each noise source were calculated using the formula LP = LPort - Aatm (see Table 84).

Table 84: Clear Sound Levels of Noise Source Based on Distance in Operation Phase

Noise Source	Distance (m)	Sound Level (dBA)				Total Sound Level (dBA)
		500 Hz	1000 Hz	2000 Hz	4000 Hz	
Turbine Building	50	35.79	38.93	39.90	38.75	44.605
	100	29.75	32.83	33.56	31.47	38.153
	250	21.73	24.64	24.66	19.73	29.170
	500	15.61	18.22	17.06	7.41	22.019
	1000	9.40	11.42	7.89	0.00	14.729
	2000	2.98	3.82	0.00	0.00	8.060
	4000	0.00	0.00	0.00	0.00	6.021
Circulating Water Pomp Area	50	40.79	43.93	44.90	43.75	44.605
	100	34.75	37.83	38.56	36.47	38.153

Noise Source	Distance (m)	Sound Level (dBA)				Total Sound Level (dBA)
		500 Hz	1000 Hz	2000 Hz	4000 Hz	
	250	26.73	29.64	29.66	24.73	29.170
	500	20.61	23.22	22.06	12.41	22.019
	1000	14.40	16.42	12.89	0.00	14.729
	2000	7.98	8.82	0.57	0.00	8.060
	4000	1.17	0.00	0.00	0.00	6.021
Building for Treatment Plants	50	35.79	38.93	39.90	38.75	39.605
	100	29.75	32.83	33.56	31.47	33.153
	250	21.73	24.64	24.66	19.73	24.170
	500	15.61	18.22	17.06	7.41	17.019
	1000	9.40	11.42	7.89	0.00	10.034
	2000	2.98	3.82	0.00	0.00	6.021
	4000	0.00	0.00	0.00	0.00	6.021

The total sound level during the construction phase is calculated using the following formula.

LT = Total sound level (dBA)

$LT = 10\log\Sigma 10Li / 10$

Equivalent noise levels, assuming that all machines in operation phase are given below (see Table 85).

Table 85: Clear Sound Levels of Noise Sources Depending on Distance in Operation Phase

Distance (m)	L (day, evening, night) (dBA)
50	48.25
100	41.80
250	32.82
500	25.67
1000	18.42
2000	12.25
4000	10.79

For the operation phase, summary of average of the background noise levels at the measurement points, noise level caused from operational activities and national and international standards are given in Table 86.

Table 86: Summary of Noise Levels Caused from Operation Phase, Background Noise Measurements and National and International Limits

Receptor	Distance to border of the Project Area (m) (m)	Background Noise Measurements (dBA)		Noise Caused By Operation Activities (dBA)	Noise Levels at Receptors				National Noise Level Standard (SanPİN No. 0267-09) (30 min LAeq (dB(A))		IFC/WBG General EHS Guidelines (2007), Table 1.7.1. (One-hour LAeq (dB(A))	
		Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)		Daytime (07:00 to 23:00)	Noise Difference	Night-time (23:00 to 07:00)	Noise Difference	Daytime (07:00 to 23:00)	Night-time (23:00 to 07:00)	Daytime (07:00 to 22:00)	Night-time (22:00 to 07:00)
Noise-1	250	**46.00**	**41.75**	32.82	**46.20**	**0.20**	**42.27**	0.52	55	45	55	45
Noise-2	990	**44.70**	**44.20**	18.42	**44.71**	**0.01**	**44.21**	0.01				
Noise-3	1,690	**52.25**	**43.85**	15.33	**52.25**	**0.00**	**43.86**	0.01				
Noise-4	2,980	**44.70**	**43.55**	11.52	**44.70**	**0.00**	**43.55**	0.00				
Noise-5	-	**38.60**	**44.20**	41.80	**41.50**	**2.90**	**46.17**	1.97			70	70

As seen in Table 86, noise levels during operation phase of the project are under the limit values specified for the day and night time in both national and international limits.

In addition to this, it is stated in IFC's EHS Guidelines that noise levels should not exceed the levels presented in Table 86, or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site. The baseline noise level measurement results and the noise level calculations are given in Table 86 and there is not any increase in background levels of 3 dB off-site. The noise levels at Noise-5 location, which is inside of the Project Area, the results are quite below the limitations at the boundary of an industrial property which is 70 dB.

Therefore, no additional noise level reduction mitigations (such as establishment of noise barriers, etc.) are foreseen for the operation phase. Besides, as can be seen from the project layout (see Figure 10) the project components are not adjacent to the main road and any other receptors.

Vibration

Vibration associated with the operation of the CCGT plant is anticipated to be minimal. Minimal vibrations associated with the standard operation of the plant or machinery dissipate rapidly as they spread due to losses of energy radiating 360 degrees from the source and are only anticipated to have a negligible impact at Waste Processing Facility receptor.

Noise Impacts to Site Workers

Site workers will be exposed to varying levels of noise depending on their specific roles and activities being conducted. This may relate to exposure to noise in areas that are considered 'high' (e.g. above occupational health and safety guidelines), Without mitigation, noise impacts to the workforce could results in health impacts, for example hearing damage.

7.3.2.1 Assessment of Impacts and Mitigation Measures

By using impact assessment significance criteria approach, key potential impacts and countermeasures on noise levels for the operation phase are presented in Table 87.

Table 87: Impacts Significance of the Noise and Vibration during – Operation Phase

Potential Impacts	Receptor	Sensitivity of the Receptor	Magnitude of Impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Operational Noise – Noise from CCGT, control rooms, machine rooms, etc.	Waste Processing Facility & Residential Areas	Medium	Medium	Moderate	Cooling fans could be installed with inlet and exhaust mufflers. A digital billboard in front of the plant gate could be established which will present the result of noise level at the boundary of the plant.	Minor
Impacts to Workers	Site Workers	High	Medium	Major	The design of the project will include selection of state-of-art technologies to have low noise level equipment to prioritise the reduction of noise at the source. Where noise levels exceed 80dB(A), additional mitigation measures will be taken to reduce noise at source. Additionally, noise protection devices will be provided to personnel on-site and the area marked as a high-noise zone where ear protection is mandatory. Note: 80dB(A) is aligned with Uzbekistan noise standards. Operators of vibrating hand-held machinery (if any) will be provided with appropriate PPE (e.g. protective gloves and ear muffs/plugs) and be given suitable breaks from using such equipment to reduce the impacts of vibration. Workers potentially exposed to high noise and vibration shall be provided with appropriate PPE with respect to the occupational H&S risk assessment conducted for that activity. Workers potentially exposed to high noise and vibration shall be trained to identify situation when PPE is required to be worn and how to effectively utilize the PPE. These mitigation measures shall be incorporated to the applicable occupational H&S plan being developed by the Project Company and implemented on-site.	Minor

7.4 Cumulative Impacts

The purpose of a cumulative impact assessment is to determine how the potential impacts of a proposed development might combine cumulatively, with the potential impacts of other projects or human activities as well as natural stressors such as droughts or extreme climatic events. Summary of Cumulative Impacts of Noise & Vibration is presented in Table 88.

Table 88: Summary of Cumulative Impacts of Noise & Vibration

Environmental & Social Aspects	Construction	Operation
Noise & Vibration		
Cumulative Impacts	No cumulative impact is expected if construction periods do not coincide. If construction period coincide, cumulative impact will occur at receptors within the area of influence which is defined as 10 km in this ESIA. Receptors within the area of influence may be temporarily impacted by the cumulative impact from the increase in ambient noise due to operation of construction machinery and equipment.	The cumulative Project and ambient noise levels do not increase the existing noise levels by more than 3dB(A), which aligns with the WBG EHS Guidelines where existing baseline is in excess of the applicable standard.

7.5 Monitoring

The EPC Contractor and the Project owner will need to undertake noise monitoring on a periodic basis during both the construction, commissioning and operational phases of the project respectively. The minimum expected requirements for the noise monitoring are outlined in Table 89.

Table 89: Monitoring Requirements of Noise

Source	Parameters	Duration	Location	Responsibility
Construction and Commissioning Phase				
Day Time Noise	Leq (A)	Monthly and if there is complaint for 10-15 minutes periods at each location	Nearest residential area and at the origin of the complaint.	EPC Contractor
Night Time Noise	Leq (A)			
Operation Phase				
Day & night noise	Leq (A)	Quarterly and if there is complaint for 10-15-minute periods at each location	Nearest residential area and at the origin of the complaint.	Contractor of The Project Company

In the event of a recorded exceedance during noise monitoring a process to investigate and take appropriate corrective actions will be outlined in the overarching 'Environmental Monitoring Plan'.

Occupational Health and Safety Monitoring

Where noise or hearing related grievances are received form the workforce, these shall be further investigated and as applicable hearing tests to applicable workers will be necessary.

8. WATER RESOURCES AND WATER ENVIRONMENT

8.1 Standards and Regulatory Requirements

8.1.1 National Regulations

The relevant legislation on the water resources and water environment in Uzbekistan is given below:

- Law "On Water and Water Use", No. 837-XII dated May 06, 1993 (as amended on April 21, 2021);
- Resolution of the Cabinet of Ministers of the RUz" On Approval of the Regulation on Water Protection Zones Sanitary Protection Zones of Water Bodies in The Territory of the RUz" No. 981 dated December 11, 2019.

Main objectives of the Law "On Water and Water Use", are to ensure the rational use of water for the needs of the population and economic sectors, protect water from pollution, contamination and depletion, prevent and eliminate the harmful effects of water, improve the condition of water bodies, as well as protect the rights and legitimate interests of enterprises, institutions, organizations, farms, dekhkan farms and citizens in the field of water relations.

Resolution of the Cabinet of Ministers of the RUz No.981, determines the procedure for establishing water protection zones and sanitary protection zones for water bodies on the territory of the RUz, as well as the regime for carrying out economic activities in these zones to prevent pollution, clogging, and depletion of water resources, effective use of water bodies and rational management of water resources.

In related with the project, the regulation sets a water protection zone around water canals and lake for the protection of the water bodies from industrial activities or construction works. It is understood that a water protection zone of 150 m is applicable for the Uchkizil Reservoir according to the article 18 based on a water volume in the lake of ≈0.2 billion m^3 (see Figure 30).

For drinking, domestic water supply, as well as for other needs of the population, water bodies are provided, the water quality of which meets the established sanitary and hygienic requirements and state standards. Ambient water quality is regulated through sanitary norm and standard in Uzbekistan which are given below:

- SanPiN RUz No. 0318-15 "Hygienic and anti-epidemic requirements for the protection of water in reservoirs on the territory of the RUz."
- SanPiN RUz No. 0173-04 "Sanitary and hygienic requirements for the protection of groundwater from pollution in the specific conditions of Uzbekistan."
- SanPiN No. 0255-08 "The main criteria for hygienic assessment of the degree of pollution of water and water bodies in terms of danger to public health in Uzbekistan."
- SanPİN No. 0202-06 "The procedure for issuing permits for special water use, development and approval of projects of maximum Permissible discharges (MPD) of substances entering with wastewater into water bodies and on the terrain."
- List of Maximum permissible concentration (MPC) of pollutants in water by categories of watercourse use.

- State standard O'z DSt 951:2011 "Sources of centralized household water supply. Hygienic, technical requirements and classification code"
- State standard O'z DSt 950:2011 "Drinking water. Hygienic requirements and quality control"

Subject to the purpose of use, watercourses could be categorized as for domestic use (could be used as a source for drinking water after treatment), cultural & service and fishery, communal use in Uzbekistan. Uzbekistan general effluent standards into the water bodies are classified by type of use and presented in Table 90.

Table 90: General Water Standards

Indicators	Purpose of water use			
	Domestic use	Cultural and service	Fishery needs Highest and first category	Second category
Suspended solids	Compared with the natural conditions the content of suspended solids at wastewater discharge shall not be increased by more than 0.25 mg/dm^3	0.75 mg/dm^3	0.25 mg/dm^3	0.75 mg/dm^3 For reservoirs and watercourses containing at low water above 30 mg/dm^3 suspended solids, there may be an increase to 5%. Suspensions with fallout rate of more than 0.4 mm/s for watercourses and more than 0.2 mm/s for discharge lake are prohibited
Floating matter	There shall not be a film of oil products and concentrations of other contaminants on the water surface			
Color	Shall not be detected in the column of height 20 sm	10 sm	There shall be no foreign colour	
Smell and test	Intensity of more than 1 point is not permitted		Water must not give extraneous odours and flavours to fish meat	
Temperature	Temperature of water at the discharge point must not exceed 3ºC in comparing with average monthly temperature of the hottest month		Temperature of water at the discharge point must not exceed 5ºC in comparing average monthly temperature of the hottest month. Increasing of temperature more than 28 ºC in summer and till 8ºC in winter is not allowed	
Hydrogen exponent (pH)	Shall not beyond 6.5	8.5 pH	Shall not beyond 6.5	8.5 pH

Indicators	Purpose of water use			
	Domestic use	Cultural and service	Fishery needs Highest and first category	Second category
Mineralization	Shall not exceed by dry residue 1000 mg/dm^3, including chlorides - 350mg/dm^3 and sulphates - 500 mg/dm^3		Rated according to water bodies intoxications	
Dissolved oxygen	No less than 4 mg/dm^3 in any period of the year in a sample taken by 12 a.m. on the same day		In winter shall be no less than 6 mg/dm^3 No less than 6 mg/dm^3 in any period of the year in a sample taken by 12 a.m. on the same day	
BOD	At 20ºC must not exceed 3.0 mg/dm^3	6.0 mg/dm^3	At 20 º C shall not exceed 3.0 mg/dm^3 if in winter the dissolved oxygen content in the water of the first* category fishing water bodies fell to 6.0 mg/dm^3, and in the second** – to 4 mg/dm^3, then discharge in them is only permitted to wastewater that does not change the BOD	
COD	Shall not exceed 15.0 mg/dm^3	30.0 mg/dm^3	-	-
Causative agent (of a disease)	Not allowed			
Chemicals (pollutants)**	Shall not be contained in concentrations exceeding the MAC			

** The first category includes water bodies, where valuable fish species highly sensitive to oxygen are kept and reproduced in.*

*** The second group includes water bodies used for other aquatic economy needs.*

The List of MPC of pollutants in water by categories of watercourse use (see Table 91) is a document of Centre for Specialized Analytical Control in the Field of Environmental Protection. This list establishes the national water quality standards depends on the purpose of the usage water body. Since Uchkizil Reservoir has aquatic life in it, it is accepted as fishery reservoir according to the regulation.

Table 91: Maximum Permissible Concentration (MPC) Of Pollutants in Water by Categories of Watercourse Use, mg / l

Parameter	Category of the watercourse			
	Fishery	Cultural and household	Potable	Irrigation
COD	15	40	30	40
BOD20, mgO / l	3	3-6	3-7	10
pH	6.5-8.5	6.5-8.5	6.5-8.5	6.5-8.5
Suspended particles	15	30	30	50
Mineralization, including:	1000	1000	1000-1500	1000
Sulfates (SO4)	100	500	400-500	-
Chlorides	300	350	400-500	-
Ammonium nitrogen (NH4)	0.5	2.0	0.5	1.5
Nitrite nitrogen (NO2)	0.02	0.5	3	0.5
Nitrite nitrogen (NO3)	9.1	25	45	25
Nitrite	0.08	3.3	3	-
Nitrates	40	45	45	-
Phosphates (PO43)	0.3	1	3.5	1
Ether-soluble	0.05	0.8	0.8	0.8
Petroleum products	0.05	0.3	0.1	0.3
SPAV	0.1	0.5	0.5	0.5
Phenol	0.001	0.001	0.001-0.1	0.001
Fluorine (F)	0.05	1.5	0.7	1
Arsenic (As)	0.05	0.05	0.05	0.1
Iron (Fe)	0.05	0.5	0.3-3	5
Chromium (Cr6)	0.001	0.1	0.05	0.1
Copper (Cu)	0.001	1	1	1
Zinc (Zn)	0.01	1	3	5
Cyanide	0.05	0.1	-	-
Lead (Pb)	0.03	0.1	0.03	0.2
Nickel (Ni)	0.01	0.1	0.1	-
Cadmium (Cd)	0.005	0.01	-	-
Cobalt (Co)	0.1	1	-	-

Parameter	Category of the watercourse			
	Fishery	Cultural and household	Potable	Irrigation
Molybdenum (Mo)	**0.0012**	**0.5**	**0.25**	**-**
Strontium (Sr2)	**-**	**2**	**7**	**-**
Saline (Se)	**0.001**	**-**	**0.01**	**-**
Rodanids	**0.1**	**-**	**-**	**-**
Mercury (Hg)	**-**	**0.005**	**0.0005**	**-**
Coloration	**20 cm.**	**-**	**10 cm.**	**-**
Smells	**The water should not acquire odors with an intensity of more than 2 points, detected by:**			
	directly or with subsequent chlorination	**-**	**directly**	**-**
Floating impurities	**Films of oil products, oils, fats and the accumulation of other impurities should not be found on the surface of the water**			
Temperature	**Summer water temperature as a result of wastewater discharge should not be exceeded by more than 3ºC, compared to the average monthly water temperature of the hottest month of the year over the past 10 years**			

According to SanPİN No. 0202-06, "The norms of maximum permissible discharges of harmful substances are established for each source of pollution, based on the conditions of inadmissibility of exceeding the maximum permissible concentrations of harmful substances in water bodies and its intended use. These limits are established and approved by the State Committee Ecology and Environmental Protection.

In all cases, the MPC will consider the existing background natural water quality for the body of water into which effluents will be discharged and the water quality objectives for the classification applied to the waterbody, which is Uchkizil Reservoir for this Project.

In no case will the MPCbe set below the current background natural water quality value (in the case of polluted water bodies) or lower than the MPC set for category of water to be discharged into (for non-polluted water courses).

Moreover, in terms of compliance with the requirements of the resolution of the Cabinet of Ministers of the RUz, the enterprise will ensure the implementation of appropriate measures to ensure the protection of waters from pollution, clogging and depletion, as well as improve the state and regime of water use in Uchkizil Reservoir. In particular, in the water protection zone with a width of at least 150 meters from industrial buildings and structures to the water edge of Lake Uchkizil, tree and shrub plantations will be planted with the exception of any economic and other activities.

In the water protection zone, it is prohibited:

- the use and burial of any types of poisonous chemical agents used to combat plant pests and diseases, weeds;

- construction of warehouses for storage of poisonous chemical agents, pesticides, herbicides and mineral fertilizers, sites for refueling equipment of poisonous chemical agents, arrangement of runways for air-chemical works;
- construction of new residential and tourist complexes without centralized sewage networks;
- construction of sewage treatment facilities and various types of tanks (storages) of wastewater;
- placement of new cemeteries and burial of new corpses in existing ones;
- construction of livestock and poultry farms, burial sites for animals, livestock, birds and fish;
- placement of garbage dumps, including chemical and radioactive waste, as well as the use of liquid manure for irrigation;
- arrangement of parking lots, refueling points for fuel and lubricants, maintenance, repair and washing places for vehicles and other equipment;
- application of fertilizers on snow cover, use of untreated manure-containing wastewater as fertilizers, as well as discharge of untreated industrial and domestic wastewater;
- Unnormal grazing, especially on the elements of gully and ravine network, grassing of pastures;
- cutting of trees and bushes, except forest maintenance and sanitary cutting;
- construction, dredging, bank protection and blasting works, extraction of minerals and aquatic plants, their processing, laying of pipeline networks and cable communications, drilling, agricultural and other works in water protection zones of reservoirs and other water bodies, rivers and non-drying sais, as well as territories of underground fresh water formation that influence water conditions shall be performed only with the permission of local executive authorities in coordination with environmental and nature protection authorities, state sanitary.

Therefore, as per water protection zone requirements, any type of Project buildings, temporary/permanent waste storage area, equipment storage area, parking area etc. shall not be placed in the 150 m water protection zone.

In addition to these requirements, as stated in the State Environmental Review Conclusion (see Attachment A), "Permit for special water use" will be obtained. This permit will be obtained to withdraw water from the Uchkizil Reservoir and discharge water into the reservoir from the Basin Irrigation Systems Department prior to commissioning phase.

8.1.2 Lender Requirements

8.1.2.1 International Finance Corporation (IFC)

The IFI's applicable water use and discharge standards for the Project are given below:

- Guidance values for drinking water quality established by the World Health Organization (WHO, 2011) - IFC General EHS Guidelines
- IFC Environmental, Health, and Safety Guidelines for Thermal Power Plants
- EU BAT Reference (BREF) Note - Large Combustion Plant (LCP)

IFC PS3 for Resource Efficiency and Pollution Prevention, state that "recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels". Specifically, for water consumption, PS3 requires that the client (in addition to applying resource efficiency measures) shall adopt measures that avoid or reduce water

usage so that the Project's water consumption does not have a significant adverse impact on others. These measures include, but are not limited to, the use of additional technically feasible water conservation measures within the client's operations, the use of alternative water supplies, water consumption offsets to reduce total demand for water resources to within the available supply, and evaluation of alternative project locations.'

According to Environmental Water Quality, all kinds of drinking water sources should always be protected to meet or not exceed applicable national regulations. In the absence of national restrictions, the current WHO Guidelines for Drinking-Water Quality should be consulted. The quality of the water should comply with national standards even when the project is transmitted to the community or to the users of the project infrastructure where water can be used for drinking, cooking, washing and bathing.

The IFC, a member of the World Bank Group, has produced General EHS Guidelines that apply to investment projects in various industry sectors. Also, Project will be required to meet EU Best Available Techniques (BAT) and related emission and discharge standards, regardless of location. The relevant limit values for Thermal Power Plants wastewater are given in Table 92 with EU BAT Reference (BREF) Note.

General EHS Guidelines state that "If sewage from the industrial facility is to be discharged to surface water, treatment to meet national or local standards for sanitary wastewater discharges or, in their absence, the indicative guideline values applicable to sanitary wastewater discharges shown in Table 92.

Since, National regulatory limits are stricker than IFC EHS Guidelines Thermal Power Plant and EUBAT Conclusions, National regulatory limits, which are set for fisheries shall be applied as Project Discharge Limits during all phases of the Project.

Table 92: Effluent Discharge Requirements

Parameter	IFC EHS Guidelines Thermal Power Plant (Table 5 – effluent guidelines)[9] mg/l, except pH and temperature (unless stated)/General EHS Guidelines	EUBAT Conclusions/ BAT-AEL mg/l (daily average) unless stated
pH	**6-9**	
TSS	**50**	**10-30**
Oil and Grease	**10**	**-**
Total Chlorine Residual	**0.2**	**-**
Fluoride	**-**	**10-25**
(Total)Chromium (Cr)	**0.5**	**10-50 µg/l**
Copper (Cu)	**0.5**	**10-50 µg/l**
Iron (Fe)	**1.0**	**-**

[9] To be applicable at relevant wastewater stream: e.g. from FGD system, wet ash transport, washing boiler, air preheater and precipitator, boiler acid washing, regeneration of demineralisers and condensate polishers, oil-separated water, site drainage, coal pile runoff and cooling water

Parameter	IFC EHS Guidelines Thermal Power Plant (Table 5 – effluent guidelines)[9] mg/l, except pH and temperature (unless stated)/General EHS Guidelines	EUBAT Conclusions/ BAT-AEL mg/l (daily average) unless stated
Zinc (Zn)	**1.0**	**10-20 µg/l**
Lead (Pb)	**0.5**	**10-20 µg/l**
Cadmium (Cd)	**0.1**	**2-5 µg/l**
Nickel (Ni)	**-**	**10-50 µg/l**
Mercury (Hg)	**0.005**	**0.2 – 3 µg/l**
Arsenic (As)	**0.5**	**10 to 50**
Phosphorous	**0.5**	
Salinity (dry residue)	**-**	**20-50**
Chemical consumption oxygen	**-**	**60-150**
Temperature increase by thermal discharge from cooling system	**3 degrees[10]**	

Table 93: Treated Sanitary Waste Water Discharge Requirements

Pollutants	IFC/WBG General EHS Guidelines (2007), Table 1.3.1 Indicative Values for Treated Sanitary Sewage Discharges mg/l
pH	6-9
BOD	30
COD	125
Total nitrogen	10
Total phosphorus/ Tricresyl phosphate (UZB)	2
Oil and Grease	10
Total Solids Suspended	50

[10] The effluent will be result in a temperature change of no more than 3°C at the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use, potential receptors, and assimilative capacity. The EA for a specific project may specify a more stringent temperature change guideline

8.2 National Context

Water resources in Uzbekistan consist of the surface runoff of Amudarya and Surkhandarya rivers (55%), small rivers (33%), underground water (approximately 10%) and collector/drainage waters (2%). All watercourses in Uzbekistan are attributed to the Aral Sea basin. The Surkhandarya is a primary right tributary of the Amudarya in Uzbekistan. It is formed at the confluence of the rivers Karatag and To'polondaryo near the city Denov. It flows into the Amudarya in the city Termez. The river is 175 kilometers long (287 km including its source river Karatag) and has a basin area of 13,500 km^2.

The construction site of the SCE-1600 MW power plant is located on the shore of the Uchkizil reservoir.

The Uchkizil reservoir is located on the lower reaches of the Surkhandarya (Surkhan River), 14 km northwest of the city of Termez.

The Uchkizil reservoir is located in a natural horseshoe-shaped basin. There is no natural waterway to the reservoir: the lake is supplied with water via constructed canals, mainly the Zang Canal, from Surkhandarya (Surkhan River).

The Uchkizil reservoir is a seasonally filled impoundment with a total volume of 160 million m^3 ,80 million m^3 of which is usable, and is used to impound the autumn-winter runoff of the Surkhandarya River via Zang canal. The reservoir does not have an outlet stream and planned to supply irrigation water to the Termez and Angora.

8.2.1 Basin Water Organisation of Amudarya (Amu Darya)

In 1992, BWO Amudarya became the executive body of Interstate Coordination Water Commission of Central Asia (ICWC) under the Almaty agreement signed by five countries - Republic of Kazakhstan, Kyrgyz Republic, Republic of Tajikistan, Turkmenistan and the Republic of Uzbekistan.

The Amudarya Basin Water Organization has 7 sub-organizations located in three countries (Tajikistan, Turkmenistan and Uzbekistan). The BWO manages and monitors the functions for the interstate distribution of Amudarya's water resources among the three riparian countries. It was created to assess and improve the management of water resources in the basin and to develop solutions to problems of water management of the Amudarya River and its main tributaries: The Pyanj River, the Vakhsh River and the Kafirnigan River. The location of Surkhandarya (Surkhan River) and relation to Amudarya (Amu Darya River) can be seen in Figure 53.

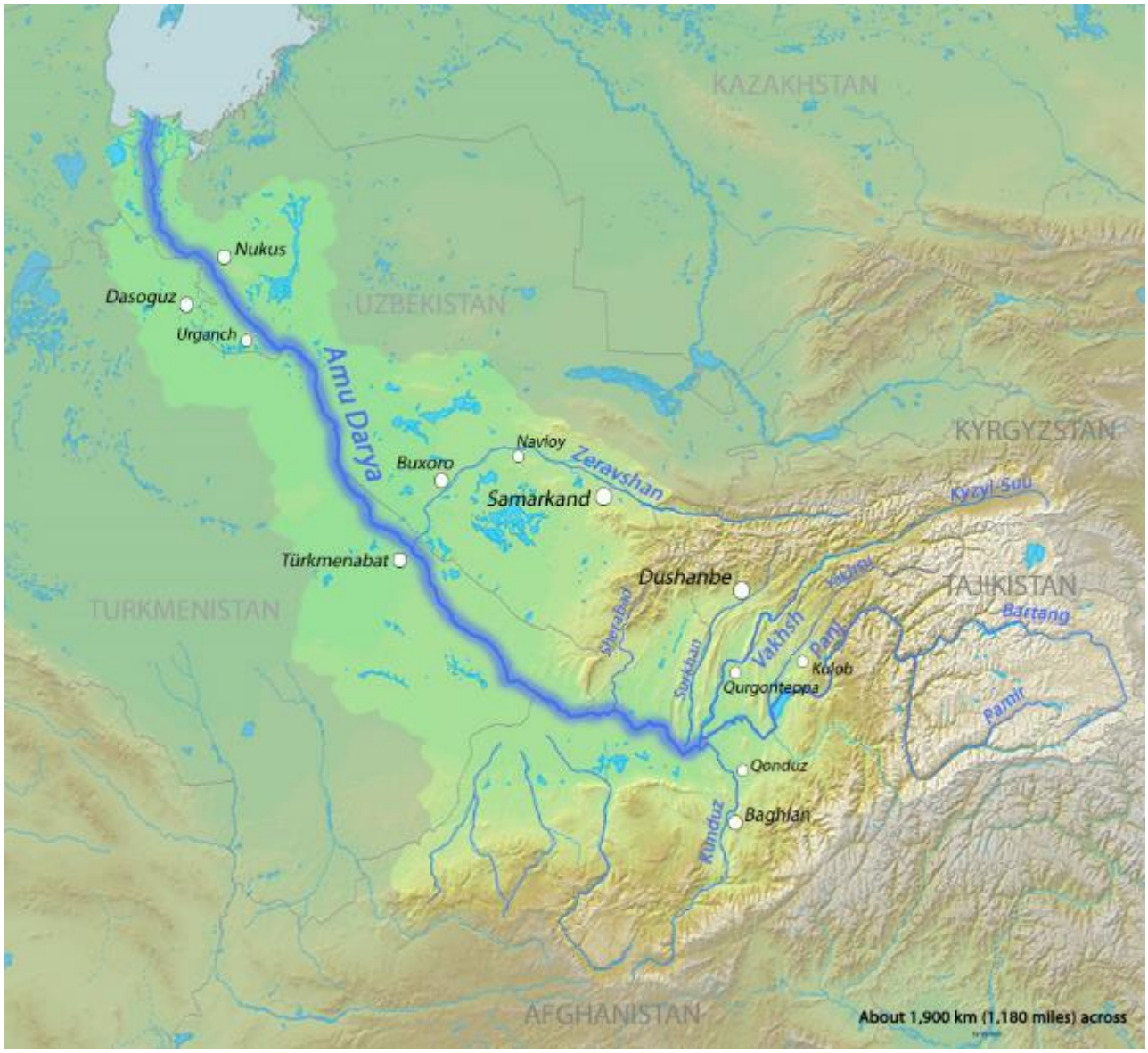


Figure 53: Amudarya River Basin

8.2.2 Existing Water Management Issues

8.2.2.1 Water Usage

The Amudarya River, the main river in the basin is a snow and glacier-fed river. The main volume of its flow originates from melting glaciers (44%), high-mountain snow and snowdrifts (37%). Rainwater runoff accounts for 1-2% and groundwater 16-18%.

The maximum flow rate of the Amudarya varies from 2800 to 6900 m^3/s (with an average maximum of 4450 m^3/s), with minimum values varying from 130 to 600, with an average minimum of about 325 m^3/s.

The Surkhandarya is one of the large tributaries of the Amudarya. The Surkhandarya basin is bounded by the Gissar Range to the north, by its south-western spurs to the west, and by the Babatag Mountains to the east; in the south it merges imperceptibly with the Amudarya Valley. The river is 200 km long and is formed by the confluence of the Karatag and Tupolang, the largest rivers in the basin. The annual flow of these rivers is 20 and 46%, respectively, of the total flow of the Surkhandarya. According to an FAO report, as of 2010 water used from Amu River is mostly for irrigation and agricultural purposes. Average Annual Water use by country of the Amu River can be seen in Table 94.

Table 94: Average Annual Water Use

Riparian Country	Average Annual Water Use in million m3	Share of Total Average Annual Water Use in %
Tajikistan	**7500**	**11**
Afghanistan	**500**	**7**
Uzbekistan	**33000**	**47**
Kyrgyzstan	**1500**	**2**
Turkmenistan	**23000**	**33**
Total	**70000**	**100**

**Ref: FAO Report [96]*

The surveys show that livelihoods in the vicinity of the project site are primarily based on irrigated agriculture. Since Uchkizil Reservoir is fed by Surkhandarya via Zang Canal, the lake is expected to be highly loaded with macronutrients such as nitrogen and phosphorus, which come from surface runoff due to the use of fertilizers on agricultural land.

8.3 Local Context

There is no natural waterway to the irrigation reservoir: the lake is supplied with water via constructed canals, mainly the Zang Canal, from Surkhandarya (Surkhan River). The water collected in the lake is used for irrigation purposes in the dry seasons. The water collected in the lake is used for the irrigation of fields in Talashkan, Chinabad, Navshahar, Uchkizil and Kaftarhana towns. The lake is a seasonally filled reservoir with a total volume of 160 million m^3, of which 80 million m^3 is usable[11], and is used to store the autumn-winter runoff of the Surkhandarya River. It is fed from the Zang main channel via the Zang lower distributary channel and the feeder channel.

8.3.1 Water Resources Near the Project Site

The most readily available water source in the project area is Uchkizil irrigation reservoir which is fed from Surkhandarya River via Zang Canal. The main natural water resource in the area is the Surkhandarya River which is 200 km long is formed by the confluence of the basin's largest rivers Karatag and Tupalang. The annual total flow of Karatag and Tupalang Rivers are 20% and 46% of the

[11] http://www.cawater-info.net/bk/1-1-1-1-3-uz.htm

total runoff of the Surkhandarya River, respectively. Their catchment areas, located on the southern slopes of the Gissar Ridge, are 634 to 2,200 km^2. On the right side, the Surkhandarya River receives two tributaries with constant inflow: Sangardak and Hodzhaipak, with catchment areas of 901 and 762 km, respectively. The tributaries are fed by snow and glacier. After they leave the mountains, they are used for irrigation and runoff reaches the main river only during floods. The Surkhandarya River is also partially replenished with discharge collector water, small rivers and thinning in the river and its tributaries.[97]

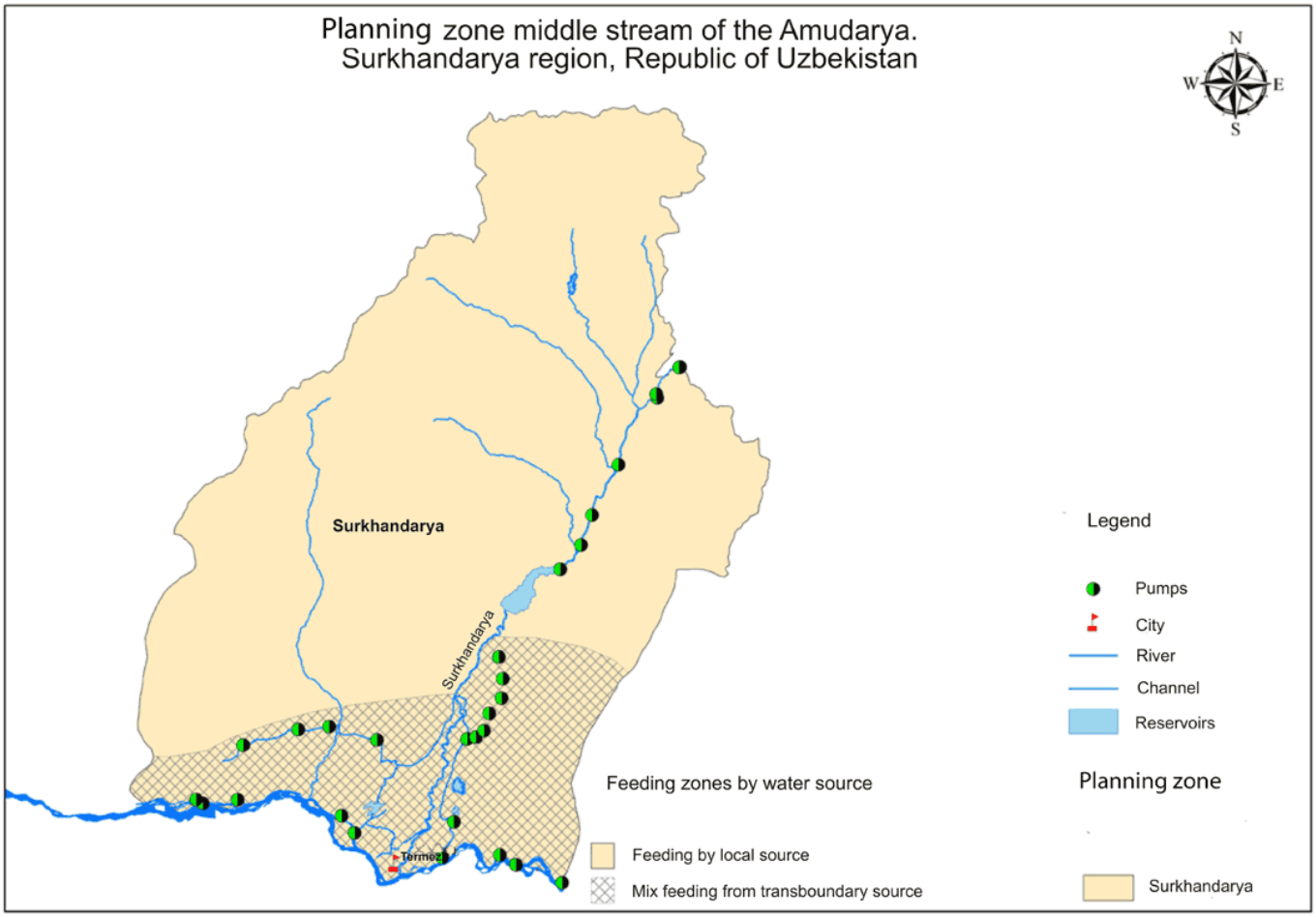


Figure 54: Irrigation System of Surkhandarya Province [15]

8.4 Baseline Studies

8.4.1 Water Quality

The main waterway of the Surkhandarya region is the Surkhandarya river, its length is 200 km, the basin area is 13,500 km^2, and the average water flow rate is 703 m^3/ s. Formed at the confluence of the Karatag and Tupalangdarya rivers the total surface inflow from the mountainous area of Surkhandarya river is equal to 128 m^3/s. In the upper reaches, the waters of the Surkhandarya River are carbonate rich, with a mineralization of 0.188 g/dm^3, in the middle and lower reaches, sulfate-hydrocarbonate, with a mineralization of 0.432-0.610 g/dm^3, average turbidity 850 g/dm^3, at the

confluence with the Amudarya - 2700 g/dm^3. Floods last from April to August, the low water period - from September to February.

In the southern foothills part there are temporary streams that arise in the winter-spring period, which are fed by snow, snow-rain and spring. All of these belong to the Surkhandarya river basin. The rivers are small, 5-25 m wide, up to 1 m deep and have rocky, sandy and pebbly bottoms. Steep banks sometimes alternate with more gentle slopes. River floodplains are narrow, sometimes absent altogether.

The Uchkizil Reservoir was built on the territory of the Project. The off-channel (i.e. constructed away from the main channel of the river) Uchkizil Reservoir of seasonal regulation is located in the lower reaches of the Surkhandarya river, 14 km north-west of the city of Termez in the Angora district of the Surkhandarya region of the Republic of Uzbekistan. The Uchkizil reservoir was designed by the institutes of Sredazgiprovodkhlopok, Uzgiprovodkhoz and Hydroproject JSC. It was built in 1953-1957 and commenced with operations on December 29, 1957. The reservoir has been in operation for 64 years.

The Uchkizil reservoir stores the accumulation of the autumn-winter runoff of the Surkhandarya River and is intended to increase the water supply of the existing irrigated lands by 15,200 hectares and of new lands in the Termez and Angora districts by 6000 hectares. In addition, if necessary, the Termez Canal system can be replenished by the reservoir. The reservoir does not have an outlet stream.

The area of the reservoir is 10 km^2, length 5.5 km^2, maximum width 3.5 km, maximum depth 37 m, average depth 16.0 m [16]. The reservoir is connected to the Surkhandarya River through a supply canal.

Maximum water temperature at the surface of the reservoir is 27.8ºC (June) and up to 25ºC at the bottom, the temperature difference reaches 10ºC or more. The minimum is 6.3ºC (February). At the same time, the temperature difference between the surface and natural water layers does not exceed 0.3ºC. In spring, summer and autumn, there is direct stratification throughout the reservoir, without noticeable formation of a temperature thermocline. [17].

The surface water and sediment samples were taken at 2 (two) observation points (SW-01, SW-02) between July 9-16, 2021.

SW-01 sample was taken from the reservoir, located 10 m from the shore, a composite water sample was collected from a water column and at the same point sediment sample was also collected to represent whole water column system at this point.

SW-02 sample is collected from tributary of Zang canal which feeds the Uchkizil Reservoir, water and sediment sample is collected from the same point.

Table 95 shows the coordinates and location of sampling points for surface water (see Figure 55).

Table 95: Coordinates and Location of Sampling Points for Surface Water

Number of monitoring station	Station location	Sampling points coordinates, deg/min/sec
SW-01	Uchkizil reservoir	N = 37°22’26,7" E = 67°14’48,2"
SW-02	Zang Canal	N = 37°22’40,2" E = 67°14’32,0"

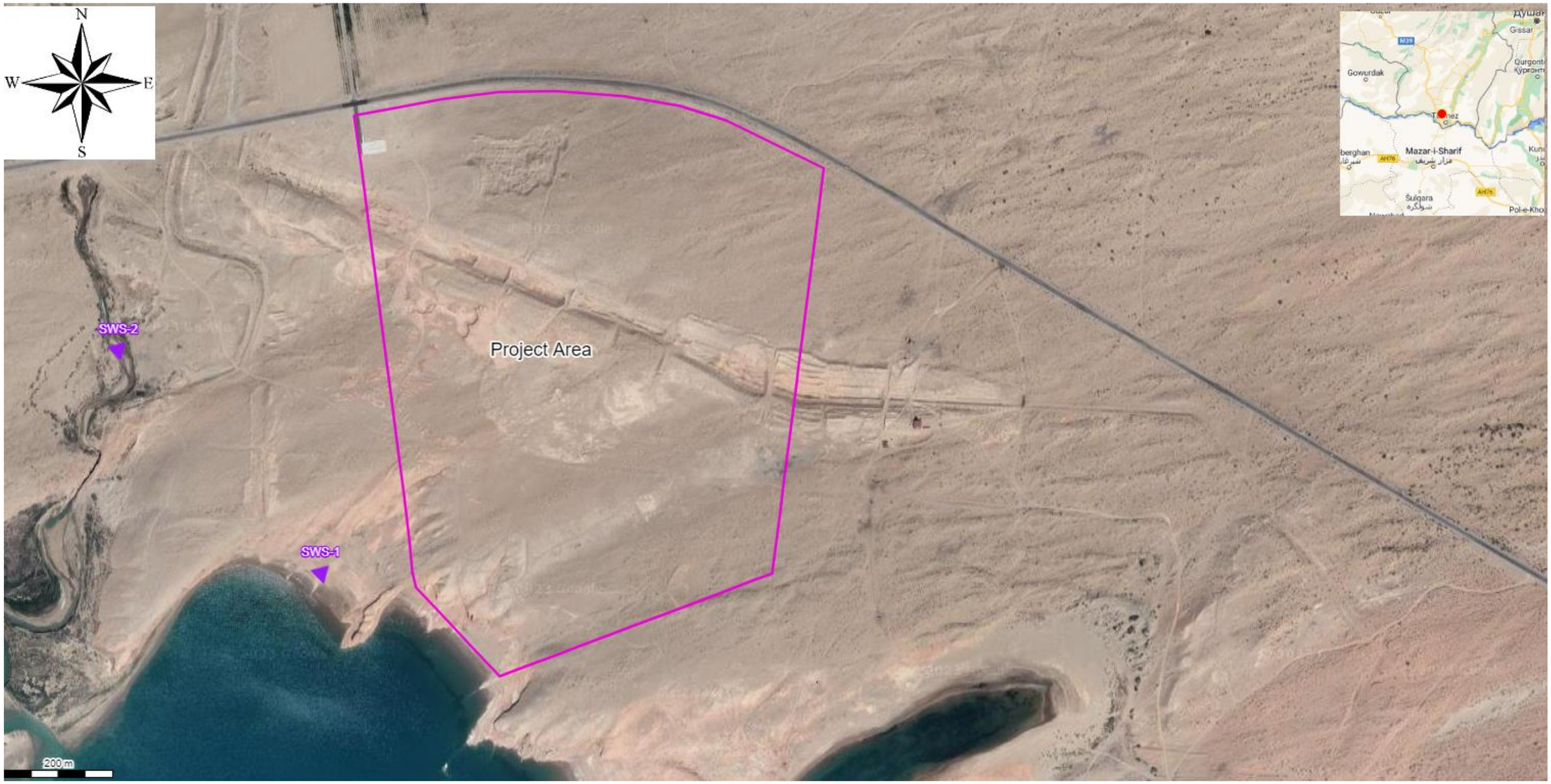


Figure 55: Location of Surface Water Sampling Points

Sampling and analysis were carried out in accordance with the established state standards according to the regulatory, methodological and instructive documents. Surface water Measurement were taken in accordance with GOST 31861-2012 "Water. General requirements for sampling".

Samples of surface water, groundwater, as well as bottom sediments were drawn up in accordance with the relevant Sampling Acts and delivered to the Center of Testing Laboratories Complex which is accredited in compliance with the requirements of the national accreditation system of the Republic of Uzbekistan O'z DSt ISO/IEC17025 for competence and independence.

The pH parameter is measured in-situ. The sampling activities are presented Figure 56 and Figure 57.

Figure 56: Sampling of Surface Water from The Uchkizil Reservoir at Observation Station SW-01

Figure 57: Sampling of Surface Water from the Zang Canal SW-02

Analysis methods consisted of:

- Photometric-based on the chemical transformation of harmful substances (ammonium nitrogen, nitrite nitrogen, nitrate nitrogen, phenols, phosphates, synthetic surfactants, hydrogen sulfide, aluminum, barium, cyanides, chromium (+6), COD) into color-intensive compounds when interacting with appropriate reagents, with subsequent measurement of the

density of colored compounds at a certain wavelength and allowing quick measurements with a sufficiently high accuracy;

- Titrimetric - a method of quantitative / mass analysis (chlorides, sulfates, hydrocarbons, dissolved oxygen, BOD), based on measuring the volume of a reagent solution of a precisely known concentration being consumed for the reaction with the substance being determined;
- Gravimetric - a method of quantitative chemical analysis (mineralization, suspended matter), based on an accurate measurement of the mass of a substance;
- Complexometric - titrimetric method of determination (calcium, hardness), based on the formation reactions of complex compounds of metal ions with ethylenediaminetetraacetic acid, also known as complexone III and Trilon B;
- Atomic absorption - an instrumental method of quantitative elemental analysis by atomic absorption (absorption) spectra to determine the concentration of metals (cadmium, potassium, sodium, manganese, copper, nickel, mercury, lead, zinc, chromium (+3)) in surface water and ground waters.

Analyses were carried out in accordance with certified methods that passed metrological certification and registration in the agency "Uzstandart".

The assessment of the qualitative composition of water was carried out in accordance with the document "The Generalized List of Maximum Permissible Concentrations (MPC) and Approximately Safe Exposure Levels (TSEL) of Harmful Substances for Water in Fishery Water Bodies for Surface Water", as well as certified methods for measuring pollutants (MVI - O'zO'U), which reflect the values of maximum permissible concentrations (MPC) used for analytical control in the water of reservoirs of fishery importance.

Table 96 provides a list of the methods of determination used.

Table 96: List of Substances in Water and Methods for Their Determination

Parameter	Method of determination	Used Books
Hydrogen exponent (pH)	The method is based on measuring the potential difference arising at the boundaries between the outer surface of the glass membrane of the electrode and the test solution.	O'zO'U 0556: 2012
Sulfates	Methods for measuring the mass concentration of sulfate ions in natural and waste waters by the complexometric method The essence of the method is based on the precipitation of sulfate ions by barium chloride.	O'z O'U 07.0676: 2015
Chlorides	The essence of the method is based on titrimetric precipitation of chloride ion at pH = 7-10 with silver nitrate.	O'z O'U 0418: 2009
Mineralization	The method is based on the gravimetric determination of mineral and partially organic substances dissolved in water at 600 ^{0} C.	O'z O'U 07.0495: 2010
Ammonium ion	The photometric method is based on the formation of a yellow color of iodide in an alkaline medium.	O'z O'U 07.0682: 2015
Nitrite	The photometric method is based on the formation of an intensely colored diazo compound	O'z O'U 07.0265: 2005

Parameter	Method of determination	Used Books
	with sulfanilic acid and alphanaphthylamine (Griss reagent)	
Nitrates	The determination is based on the reaction of nitrates with sodium salicylate in an acidic medium with the formation of a yellow salt of nitrosalicylic acid.	O'z O'U 0705: 2016
Mercury & Lead	Atomic absorption spectrometry (AAS). The method is based on the absorption of ultraviolet radiation by gas atoms.	O'z O'U 0422 : 2009 O'zO'U 0482: 2009
COD	Method for measuring the mass concentration of chemical oxygen demand (COD) in natural and waste waters by the photocolorimetric method	O'z O'U 07.0147: 2000
Metals (copper, zinc, nickel, chromium, iron, manganese, cobalt)	Methods for measuring the mass fraction of metals (copper, zinc, nickel, chromium, iron, manganese, cobalt) in water by the atomic absorption method	O'z O'U 0744: 2016
Chromium (VI and III valence)	Method for measuring the mass concentration of total, VI and III valence chromium in natural and waste waters by the photocolorimetric method	O'z O'U 0522: 2011
BOD_5	Technique for measuring the mass concentration of biochemical oxygen demand before and after n- days of incubation (BOD full) in natural, waste and treated waste waters	O'z O'U 0746: 2016
Suspended substances	Methodology for measuring the mass concentration of suspended solids in natural and waste waters by the gravimetric method	O'z O'U 0696: 2015
Aluminum	Method for measuring the mass concentration of aluminum in natural and waste waters by the photocolorimetric method	O'z O'U 0413: 2009

The results of the physicochemical analysis of the surface of the site are presented in Table 97 .

Zang Canal water condition (SW-02): The channel is located to the west of the site.

- Mineralization levels of surface water of the river goes up to 0.532 g/dm^3.
- The concentrations of the following parameters exceed the MPC:
  - Suspended solids (25.2 times of MPC),
  - Sulfates (1.33 times of MPC),
  - COD value (1.6 times of MPC),
  - Cadmium (2.75 times of MPC),
  - Potassium (1.3 times of MPC),
  - Iron (2.88 times of MPC),
  - Lead (1.03 times of MPC)
  - Chromium (+6) (MPC level)
- Hydrogen sulphide concentration is analysed as the presence of hydrogen sulfide up to 0.0022 mg/dm^3
- The concentrations of nitrite nitrogen, nitrate nitrogen, BOD, sodium, manganese, nickel, and zinc are below the MPC.

- The pH of the waters is within the normal range (i.e. 8.33).
- Ammonium nitrogen, phosphates, cyanides, aluminum, barium, vanadium and mercury were not detected.

The concentrations of nitrite nitrogen, nitrate nitrogen, BOD, sodium, manganese, nickel, chromium (+6) and zinc are below the MPC. The pH of the waters is within the normal range up to 8.33. Ammonium nitrogen, phosphates, cyanides, aluminum, barium, vanadium and mercury were not detected in these waters.

Surface water condition in Uchkizil Reservoir (SW -01):

- Mineralization levels of surface waters of the lake goes up to1.16 g/dm^3.
- The concentrations of the following parameters exceed the MPC:
  - Suspended solids (11.4 times of MPC),
  - Sulfates (2.9 times of MPC),
  - COD (10.6 times of MPC),
  - BOD (4.8 times of MPC),
  - Cadmium (3.6 times of MPC),
  - Potassium (1.5times of MPC),
  - Sodium (1.16 times of MPC),
  - Iron (1.9 times of MPC),
  - Copper (2.1 times of MPC)
  - Lead (1.09 times of MPC)
- Hydrogen sulphide concentrations is analysed as 0.0058 mg/dm^3.
- The concentrations of nitrite nitrogen, aluminum, manganese, nickel and zinc are below the MPC.
- The pH of the waters is measured in normal range (i.e. 8.44).
- Ammonium nitrogen, nitrate nitrogen, phosphates, cyanides, barium, chromium (+6), vanadium and mercury were not detected.

As Zang Canal and Uchkizil reservoir are a part of the irrigation system and Uchkizil reservoir is fed by Surkhandarya River via Zang Canal, the water in both samples (SW-01 and SW-02) contain macronutrients such as phosphorus, which likely come from surface runoff due to utilization of fertilizers on agricultural lands. Additionally, COD and BOD exceedances indicate anthropogenic impact on the canal and reservoir by agricultural activities.

Table 97: Results of physicochemical analysis of surface waters of the site

Parameter name	Place of selection and content	
	River in the west from the site (SW-02)	Uchkizil reservoir (SW-01)
pH	8.33	8.44
Suspended substances, mg/dm ^{3}	378.6	172.0
Ammonium nitrogen, mg/dm ^{3}	<0.2	<0.2
Nitrite nitrogen, mg/dm ^{3}	0.012	0.012
Nitrate nitrogen, mg/dm ^{3}	1.36	<0.09
Chlorides, mg/dm ^{3}	85.96	361.0
Sulfates, mg/dm ^{3}	133.0	290.0
Phosphates, mg/dm ^{3}	<0.01	<0.01
Mineralization, mg/dm ^{3}	532.0	1160.0
Cyanides, mg/dm ^{3}	<0.03	<0.03
Hydrogen sulfide, mg/dm ^{3}	0.0022	0.0058
COD, mg/dm ^{3}	24.0	160.0
BOD $_5$, mg/dm ^{3}	2.16	14.4
Aluminum mg/dm ^{3}	<0.02	0.01
Barium, mg/dm ^{3}	<1.0	<1.0
Vanadium, mg/dm ^{3}	<0.005	<0.005
Cadmium, mg/dm ^{3}	0.00275	0.00361
Iron, mg/dm ^{3}	0.144	0.0954
Manganese, mg/dm ^{3}	0.0213	0.00421
Copper, mg/dm ^{3}	0.00296	0.00206
Sodium, mg/dm ^{3}	105.50	140.85
Potassium, mg/dm ^{3}	65.20	76.73
Nickel, mg/dm ^{3}	0.0043	0.0076
Mercury, mg/dm ^{3}	<0. 000005	<0. 000005
Lead, mg/dm ^{3}	0.0103	0.0109
Chromium (+3), mg/dm ^{3}	0.00128	0.00071
Chromium (+6), mg/dm ^{3}	0.001	< 0.0005
Zinc, mg/dm ^{3}	0.0092	0.0088

8.4.2 Sensitive Receptors

Along the project area sensitive receptors defined. List of sensitive receptors can be found in Table 98.

Table 98: List of Sensitive Receptors – Water

Receptor	Sensitivity	Justification
Water and Sediment Quality	Medium	Any impact caused by construction and operation on water quality is expected to be time limited.
Reservoir Fauna	High	Impacts during the construction phase of the Project from dewatering and construction of the intake and outfall have the potential to have significant impacts in case management and mitigation measures are not implemented. Project area and the habitat is modified. In addition, the operational phase of the Project will only include discharge of blowdown water, service water and storm water.
Fishes **Luciobarbus conocephalus** **Sabanejewia aurata aralensis**	Medium	*Sabanejewia aurata aralensis* is a near threatened species according to Red book of Ruz. Not listed in CITES or IUCN. In addition, Luciobarbus conocephalus is VU according to Red Book of the RUz.
Reservoir's water users (fishermen, farmers, recreational users)	Medium	Reservoir water users found downstream will be particularly vulnerable to any changes in reservoir water quantities and quality as a result of Project construction and operation.

8.5 Potential Impacts, Mitigation, Management & Residual Impact

8.5.1 Construction Phase

During construction, the main activities that could negatively impact the aquatic life and water quality can be listed as follows:

- Laying of the outfall and water intake pipelines to the reservoir;
- Water usage for construction and domestic purposes
- Groundwater dewatering discharge on the reservoir banks from the construction activities on site (discussed under the soil and groundwater Section of this ESIA (Section 9));
- Habitat fragmentation as a result of construction of the intake and outfall.
- Discharge of wastewater due to construction activities.
- Erosion due to soil movement in case unappropriated management of top soil, surplus soil, dumpsites and borrow pits.

8.5.1.1 Water Consumption and Wastewater Generation

At the construction stage of the Plant, water is mainly needed to prepare mortars, as well as for water spray for dust control at the construction site. In addition, household and drinking water needs will consist of drinking needs, showers, and cooking. The water needs during construction phase will be

supplied from the nearby districts via trucks. The drinking water will be supplied by bottled water from the market.

Therefore, no water is planned to be supplied from both Uchkizil reservoir or groundwater during the construction phase of the Project. On the other hand, the water will be supplied from the Uchkizil Reservoir during the commissioning phase.

The water consumption during construction and commissioning phases are calculated in the following text.

During the construction, the daily water consumption rate was determined according to KMK 2.04.01.98, which assumes that workers will consume 25 liters/personnel.day, and engineering personnel will consume 12 liters/personnel.day.

Calculations of water consumption for production needs during construction

At the construction phase, water will be required for the preparation of concrete, cement, as well as for watering the territory in order to reduce dust emission, etc. Water consumption during construction works is determined by their volumes, and this water consumption will be an irretrievable loss.

Preparation of concrete and cement during construction.

For the preparation of 1 m^3 concrete, approximately 180 liter water is needed and for the preparation of 1 m^3 cement, approximately 165 liter water is needed. Therefore, the water consumption for the preparation of concrete (about 10,000 m^3) and cement (about 8500 m^3) will be:

Q1 = 180 x 10000/1000 = 1800 m^3/year = 4.931 m^3/day

Q2 = 165 x 8500/1000 = 1402.5 m^3/year = 3.842 m^3/day.

Total 3202.5 m^3/year = 8.773 m^3/day

Water consumption during dust emissions reduction

The water consumption for reducing dust is calculated by the following formula:

$Q3 = nr \times Sp \times dp / 106$

Where;

Sp is the area to be watered in order to reduce dusting

nr is the rate of water consumption for irrigation of the territory in order to reduce dusting, 2.0 L/m^2

dp is the number of waterings per year = 100

The watering area is assumed as 10% of the total construction area and is determined as follows:

$Sp = S \times 0.1$

Where;

S is the total allocated area S = 73.4 ha =r 734,000 m^2

Sp = 734,000 × 0.1 = 73,400 m^2

Then, the water consumption for reducing dust is calculated as:

Q3 = 2.0 × 73,400 × 100/106 = 14,680 m³/year

Q3 =14,680 × 103/100 = 146.8 m³/day.

Calculations of water consumption for household needs during the construction phase

Approximately 2054 workers will be employed during commissioning phase, of which 134 are engineering and management of Client personnel and 1920 are subcontractor workers. Engineering personnel will work in one shift, while workers will work in three shifts, 8 hours/day.

According to Uzbekistan Environmental Performance Rewiews – Third Review Report of the United Nations (2020), Uzbekistan Government estimates household water usage as 124.9 L/capita/day in 2018. With this data water to be consumed for domestic purposes and household needs during the construction phase by 2054 workers can be calculated as 256.5 m^3/day and 93,638.78 m^3/year.

Table 99: Water Consumption - Commissioning phase

Process	Total Volume(m^3)
Steam flushing	60 000
Acid Cleaning	18 000
Hydraulic tests (mainly boilers and tanks)	15 000
Total	**93 000**

The total water consumption during the construction is calculated as 412.073 m³/day (111,521.28 m³/year), of which for; production needs - 8.773 m³/day. or 3202.5 m³/year; household and drinking needs - 256.5 m^3/day (93,638.78 m^3/year), irrigation of the territory - 146.8 m³/day (53,582 m³/year).

Total water consumption for commissioning phase is approximately 93,000 m^3 in total.

The total water discharge (effluent) of domestic wastewater during the construction phase will be: 256.5 m^3/day = 93,638.78 m^3/year m³/year.

Domestic wastewater generated during construction is planned to be directed to a temporarily installed storage tank (a waterproof cesspool) with subsequent removal to the nearest treatment facilities in the city of Termez.

Termez wastewater treatment plant has a capacity of 25,000 m³/ day as of 2020. Domestic wastewater emerged from the construction phase of Project will only occupy 1% of Termez Wastewater treatment capacity.

Summary of water consumption and wastewater generation during construction and commissioning phase and their source/disposal is given in Table 100.

Table 100: Water Consumption and Wastewater Generation During Construction and Commissioning Phases

Type	Amount	Source/Disposal
Water Consumption – Construction Phase		
Construction	8.773 m³/day	From nearby districts via trucks
Household and Drinking	256.5 m³/day	Household - from nearby districts Drinking – from bottled water (market)
Irrigation of the Territory	146.8 m³/day	From nearby districts via trucks
Water Consumption – Commissioning		
Commissioning	93,000 m³	From Uchkizil Reservoir
Wastewater Generation		
Domestic Wastewater	256.5 m³/day	Deposition -waterproof septic tank Discharge - Wastewater treatment plant in Termez

During the site surveys, a meeting was performed with the competent authority regarding the amount of water used for irrigation purposes. The competent authority has stated that the water usage allowance is based on the agricultural product for each hectare. It is also mentioned that amount of irrigation water is calculated for 8-months period. The competent authority has mentioned that the Uchkizil reservoir is fed by the Zang Channel depending on the water consumption. The total irrigation water amount for different kind of agricultural product for each hectare is given below:

- Cotton: 6,600 m3/ha
- Wheat and rice: 2,700 m3/ha
- Vegetables: 11,900 m3/ha
- Fruit gardens: 6,400 m3/ha

The competent authority has mentioned that Uchkizil Reservoir can provide up to 220 million m3[12] water. As indicated in Table 100, the annual amount of water required during the construction stage is negligible and will not be provided from the Uchkizil Reservoir. Therefore, it is not expected to have adverse impact on Uchkizil reservoir and the irrigation system during construction phase. The water use consumption during commissioning phase accounts for 93,000 m3 (see Table 100). Considering the usable capacity of the Uchkizil Reservoir, the adverse impact on the reservoir and the irrigation system during commissioning phase is negligible.

[12] According to the desk review information, the lake is a seasonally filled reservoir with a total volume of 160 million m3, of which 80 million m3 is usable (http://www.cawater-info.net/bk/1-1-1-1-3-uz.htm).

8.5.1.2 Construction of water inlet and outlet structures

Regarding onshore construction activities as seen in the project layout presented in Attachment B, there will be no structure within Uchkizil reservoir and its water protection zone other than the water intake and discharge structures and water pretreatment structure (fine and coarse screens). The letter dated 29 September 2021 from the State Committee on Ecology and Environmental Protection mentioned that;

- to develop and obtain a "Permit for special water use" (PSWU) for the intake of water from a surface watercourse - Lake "Uchkizil" in the manner prescribed by law;
- to provide a water protection zone with a distance of at least 70 meters from the production sites to the water edge of Lake Uchkizil with the planting of trees and shrubs in compliance with the conditions of shore protection structures in the coastal strip of Lake Uchkizil.
- In the water protection zone of Lake Uchkizil (70 meters distance from production sites to the water edge of Lake Uchkizil), any economic activity is prohibited, including the placement of: sewage treatment facilities and various types of containers (accumulators) for waste water; livestock and poultry farms; landfills for production and consumption waste; parking lots, filling stations of fuels and lubricants, places of technical maintenance, repair and washing of vehicles and other equipment; felling of tree and shrub plantations, with the exception of felling for forest maintenance and sanitary felling.

It should be noted that as seen in Attachment B, the boundary wall of the plant is approximately 100 m away from the water protection zone of Uchkizil reservoir, in total 250 m away from the bank of Uchkizil reservoir.

Although the final design for water intake/discharge structure is not yet finalized, it is anticipated that the diameter of the pipeline for water intake and discharge will be maximum DN 500. During the construction of the pipeline, a trench will be opened and the intake and discharge pipelines will be laid in parallel in compliance with the permissions to be obtained from relevant authorities. There are no trees within the project area and hence the construction of the pipeline will not require cut of any trees but may require clearance of the shrubs. Once the pipelines are laid, the excavated material along the water intake / discharge pipeline will be assessed to be used if it is available for backfilling material. The EPC Contractor will ensure that necessary mitigative actions such as installation of sheeting walls, etc. are taken in trench regarding OHS issues. The route of the water intake / discharge pipeline will be restored following the completion of construction activities. The water intake/discharge pipelines will be constructed under the access road (see Attachment B) to minimize the disturbance within the water protection zone.

In respect to the construction activities on Uchkizil Reservoir, the discharge point will be at a sufficient distance from the shore to promote mixing with the main water body. Following the detailed design together with performing a bathymetry, hydraulic and nearshore topography survey, the exact locations will be determined and necessary relevant permits will be obtained from the national authorities.

Excavation of the reservoir banks for inlet and outlet construction will alter the Uchkizil Reservoir shore, including the potential temporary loss of associated fauna and localized impacts to water chemistry associated with an increase in suspended sediment. An increase in suspended sediment results in turbidity, which can reduce light penetration in the water column and lead to a reduction in photosynthetic activity of aquatic life in the reservoir. Turbid conditions in the water column could negatively impact the production and growth of organisms present. Measures like silt curtain and

coffer dam for mitigating such negative impacts will be implemented during the works near the reservoir banks and in the lake.

Once excavation is completed, turbidity levels are expected to return to background levels as suspended sediment settles. This can be achieved practically by not disposing of excavated material into the reservoir and by using effective silt fences. Construction impacts will be limited in size and scope because they are, by definition and design, confined to the narrow corridor of the outlet pipe and inlet channel.

Following the completion of water intake/discharge pipelines, the area within the water protections zone will be planted in close cooperation with the competent authority by selecting appropriate shrub species for the region.

8.5.1.3 Waste Water

The Project will involve construction near Uchkizil reservoir. The project also will require storage, handling and use of dangerous hazardous materials such as hydrocarbons, hazardous chemicals, paints, thinner etc. Also waste water during construction phase is expected to derive from several processes. These processes are mainly expected to be followings;

- Sanitary domestic wastewater from construction site
- Waste water from carwash and vehicle maintenance
- Concrete waste water from concrete production/ batching plant
- Storm water which might has oil and silt
- Accidental hazardous material spills

Domestic wastewater generated during construction is planned to be directed to a temporarily installed storage tank (a waterproof cesspool) with subsequent removal to the nearest treatment facilities in the city of Termez. It is planned that there will not be any accommodation facilities within the construction area. Based on the previous experiences in similar projects, it is expected the EPC contractor will arrange accommodation off-site and will use the existing housing compounds located in Termez city. Thus, it is expected that sewage will be discharged into the existing sewerage system.

The washing of equipment and vehicles, as well as dirty water run-off from different Project components has the potential to contaminate surface- and groundwater resources if not managed appropriately.

Waste water from car wash and vehicle maintenance activities at the other end expected to has high content of TSS, oil and grease. Appropriate silt and oil trap structures will be constructed on car wash areas prior to discharge on the reservoir to avoid future damage on water quality and aquatic life.

The waste water and sludge from concrete production shall be treated. Waste water from concrete batch plant is expected to has high pH values and high amount of TSS.

Mitigation measures to reduce impacts on water quality for construction phase are given below and summarized in Table 101.

- The Project will consult with the Uchkizil Reservoir to confirm the need and applicability for water discharge permits/licenses necessary for the successful construction of the Project. Such discharge permits/licenses will be associated with effluent discharges (including stormwater). The Special Terms and Conditions associated with each Water Use Permit will be followed, and adherence to such will be monitored and confirmed through routine inspections and/or audits;

- Method Statements detailing spill emergency response and clean-up procedures for spills will be developed including process, responsibilities, training and drill needs.
- Training regarding proper methods for transporting, transferring and handling hazardous substances that have the potential to impact surface and groundwater resources will be undertaken.
- Areas where spillage of soil contaminants occurs will be excavated (to the depth of contamination) and suitably rehabilitated. If any other minor spillage occurs, the spillage will be cleaned immediately and the contaminated area will be rehabilitated. All contaminated material will be suitably disposed of.
- The washing of Project vehicles in and aroud any surface water bodies will be prohibited. All Project vehicles will be washed at designated wash bays on site. These wash bays should include oil/grease and sediment traps for grey water.
- The ad hoc maintenance of vehicles in and around the contruction area will be prevented. All vehicles will be maintained at a designated workshop. The workshop should include containment berms and an oil/grease trap.
- All construction areas and associated facilities will be maintained in a good and tidy condition; debris and wastes will be contained in such a way that they cannot become entrained in surface run off during periods of heavy rain.
- Where practical, exposed surfaces and friable materials will be covered / sheeted.
- Construction activities will be conducted > 150 m away from water bodies as defined in "Regulation on procedure of establishing water protection zones and sanitary protection zones for water bodies".
- In the water protection zone (i.e. 150m), there will be no plant clearance and no permanent or temporary project related structures like storage buildings or area including fuel and chemical storages, vehicle or equipment washing station, vehicle park area, toilet, waste disposal area etc.
- Sufficient toilets at active work areas will be provided for site staff and workers and these will be serviced regularly by a competent and suitably qualified person.
- Domestic wastewater generated during construction is planned to be directed to a temporarily installed storage tank (a waterproof cesspool) with subsequent removal to the nearest treatment facilities in the city of Termez.
- All wastewater which may be contaminated with oily substances will be managed in accordance with an approved Waste Management Plan, and no hydrocarbon-contaminated water will be released into the environment.
- Fixed fuel storage infrastructure will be minimum 250 m away from Uchkizil Reservoir, on flat, impermeable surface and surrounded by a bond with a volume of 110 percent of the volume of the storage tank(s), and fuel transfer at fixed stations will be performed on a concrete surface draining to a mechanical oil separator.
- Chemicals storage and dispensing areas will be located minimum 250 m from Uchkizil Reservoir, and in no instance should they be located drained on an irrigation channel. Storage will be on flat, impermeable surface and surrounded by a bund or enclosed storage. To avoid siltation, soil stockpile will be located minimum 250 m away from surface water bodies.

Table 101: Impacts Significance of the Water Resources and Water Enviroment - Construction Phase

Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Water Intake Structure Construction	Reservoir's aquatic life, Water and Sediment Quality	High	Low	Moderate	The Contractor's HSE department shall oversee the impacts caused by clearance of vegetation on reservoir banks before any excavation Fauna shouldn't be damaged during excavation and proper escape path should remain during excavation in case any nest of animal find.. Any animal mortality will be recorded in incident log and corrective actions should be taken for future incidents to minimize the occurrence. Even if the impact is short term, silt curtain/ coffer dam should be in place to avoid siltation and suspended soilds to the water bodies. Silt curtain should has concrete block attachment to avoid them floating. Disposal of any kind of concrete, soil or chemical will not be done nearby the reservoir. Surplus soil should be stored at least 250 meters away from the reservoir to avoid erosion impacts on the reservoir. Even after construction of the structure completei silt curtain should be in place to allow complete settlement of Total suspended solids. The curtain should be removed after the water TSS level reduced to the threshold limits identified in Uzbek and International regulations whichever is more stringent. The Project should consult with the authority to confirm the need and applicability for water discharge permits/licenses necessary for the successful construction of the Project.	Minor
Environmental Emergencies (Spills, Mismanagement of HAZMAT)	Reservoir's aquatic life Water and Sediment Quality	High	Medium	Major	Method Statements detailing spill emergency response and clean-up procedures for spills should be developed. Training regarding proper methods for transporting, transferring and handling hazardous substances that have the potential to impact surface and groundwater resources should be undertaken. Areas where spillage of soil contaminants occurs should be excavated (to the depth of contamination) and suitably rehabilitated. If any other minor spillage occurs the spillage should be cleaned immediately and the contaminated area should be rehabilitated. All contaminated material should be suitably disposed of. The washing of Project vehicles in any surface water bodies in and around the reservoir should be prohibited. All Project vehicles should be washed at designated wash bays on site. These wash bays should include oil/grease and sediment traps for grey water. All construction areas and associated facilities should be maintained in a good and tidy condition; debris and wastes should be contained in such a way that they cannot become entrained in surface run off during periods of heavy rain. To the furtherest extent practicably possible, construction activities should be conducted > 150 m, further of sanitary buffer zone, away from water bodies (in conformance to the requirements of the Uzbekistan legal requirements),. All wastewater which may be contaminated with oily substances should be managed in accordance with an approved Waste Management Plan, and no hydrocarbon-contaminated water should be released into the environment. **Fixed fuel storage infrastructure will be minimum 250 m away from Uchkizil Reservoir, on flat, impermeable surface and surrounded by a bond with a volume of 110 percent of the volume of the storage tank(s), and fuel transfer at fixed stations will be performed on a concrete surface draining to a mechanical oil separator** **Chemicals storage and dispensing areas will be located minimum 250 m from Uchkizil Reservoir, and in no instance should they be located drained on an irrigation channel. Storage will be on flat, impermeable surface and surrounded by a bund or enclosed storage. To avoid siltation, soil stockpile will be located minimum 250 m away from surface water bodies**	Moderate

Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Sanitary wastewater from construction site	Reservoir's aquatic life Water and Sediment Quality	High	Medium	Moderate (M)	Domestic wastewater generated will be directed to a temporarily installed storage tank (a waterproof cesspool) with subsequent removal to the nearest treatment facilities in the city of Termez.	Minor
Test and Commissioning Wastewater	Reservoir's aquatic life Water and Sediment Quality	High	Medium	Moderate (M)	To minimize usage in test and commissioning phase, recycling and reuse of water should be assessed. Hydro testing water can be resued in same testing procedure until this phase of testing is completed and the water is no longer usable in the process.	Moderate

8.5.2 Operational Phase

Water is a key resource required for the operation of the Power Plant. It will be used in several processes and will be sourced from the Uchkizil reservoir.

The water intake structure will be at a sufficient depth below minimum water level to avoid collisions with boats and intake of warm surface water and at sufficient distance from the bed of the reservoir to avoid the intake of sediments and sludge. The water intake velocity will be limited with 0.15 m/s [18] and a bubble curtain shall be applied to prevent fish and fauna to enter the intake.

The discharge point will be at a sufficient distance from the shore to promote mixing with the main water body. Following the detailed design together with performing a bathymetry, hydraulic and nearshore topography survey, the exact locations will be determined and necessary relevant permits will be obtained from the national authorities.

Water balance diagram for the Project is given in Attachment B. In accordance with the water balance diagram;

- Below listed three main systems are merged and discharged to the receiving environment (Uchkizil Reservoir) through one discharge pipeline:
    - Storm water collection network: Collected storm water will be discharged to the Uchkizil reservoir after oil-separation unit.
    - Service water network: Water collected from the service water network will be discharged to the Uchkizil reservoir after oil-separation unit.
    - Blow- down water system: Water collected from the blow-down water system will be sent to the neutralization system (industrial wastewater treatment system). After neutralization, the collected water will be discharged to the Uchkizil reservoir.
- Domestic wastewater will be treated by sanitary water treatment system and treated water will be sent to the irrigation water storage tank, for watering the green belt.
- Since close loop cooling system will be used in the plant, there will be no cooling water discharge to the Uchkizil reservoir.

The main function of the Wastewater System is to collect, temporary store and deliver for treatment and final disposal the aqueous effluents derived from the Power Plant operation.

The wastewater system shall comply with the Laws and the guidelines for liquid emissions of the plant in operation for the combined effluent stream and for the sanitary effluent stream.

The Wastewater Treatment System (WWTS) consists of the following sub-systems:

- Industrial Wastewater Treatment System (IWWTS) to treat:
    - Chemical wastewater, including laboratory wastes, regeneration wastes, and Heat recovery steam generator (HRSG) continuous and intermittent blowdown and drains.
    - Clean (non-oily) floor and equipment drains.
    - Treated oily wastewater from the Plant Oily Water Treatment System (POWTS).
- Plant Oily Water Treatment System (POWTS) to treat oily water from floor and equipment drains.

- Other Chemical wastes like from the regeneration of the Polishing Plant resins. These effluents are stored for off-site disposal by trucks.

In the Industrial Wastewater Treatment System (IWWTS) incoming categories of wastewater streams shall be routed to the IWWTS Waste Neutralization Basin.

In the IWWTS wastewater is mixed, pH is adjusted using acid and caustic dosing in the basins as needed for final discharge.

The Plant Oily Water Treatment System (POWTS) removes the oil from potentially oil contaminated plant floor and equipment drains such that the treated wastewater meets the allowed discharge limit for Oil and Grease prior to being further processed by the IWWTS.

The Oily Water Separators provide oil removal to the environmental limit requirements after which the treated wastewater is forwarded to the IWWTS Waste Neutralisation basin.

All treated Industrial Wastewater shall be discharged to the Uchkizil water reserve terminal point.

Recovered oil from the packaged oil water separators of the Plant Oily Water Treatment System (POWTS) will be disposed off-site by trucks.

8.5.2.1 Water Consumption and Wastewater Generation

The source of water supply for the facility will be Uchkizil Reservoir.

Water consumption for industrial needs is the sum of the water consumption:

- to feed the circulating cooling system of auxiliary equipment;
- to make up the steam-water cycle;
- for the need for additional water of the chemical water treatment system.

A closed-loop cooling system will be used to cool the auxiliary equipment. Demineralized water will be used as a cooling medium in a closed loop.

The make-up water consumption consists of the losses of water treatment, the circulating cooling system of auxiliary equipment, the water consumption for blowing the boilers, as well as the intake of the make-up water into the chemical water treatment system.

Calculations of industrial water consumption:

Total hourly amount of water consumption will be 15.75 m3. The breakdown is given below.

- 18.5 m3/h of the extracted water (2.75 m3/h of which comes from Sludge Treatment System) will be sent to Raw Water Pretreatment System to supply water for industrial needs.
- 16.644 m3/h of total extracted amount (18.5 m3/h) is diverted to Clarified Water Pond.
- 24.674 m3/h of the water (8.03 m3/h of which comes from Blow Down Pit) is diverted to Gravel Filter Recovery (~98%).

Adjustment of water consumption rates will be carried out after determining all the characteristics of the equipment before putting the Project into operation.

Wastewater disposal

All effluent from the wastewater treatment plant, sample racks, laboratory wastewater, etc. will be collected and pumped out into the neutralization system. The rinse water for the gas turbine is collected in the GT rinse water reservoir and is separately discharged to the Uchkizil water reserve terminal point.

Industrial wastewater will be sent for treatment to a neutralization tank, a coagulation tank and further to a clarifier. Purified water enters the storage tank. In the case of extreme wastewater parameters, the treated wastewater from the holding tank can be redirected to the inlet of the wastewater treatment plant. Temperature and pH levels are continuously monitored and recorded. Alarm levels will be present for operator actions.

Wastewater treatment of waste heat boilers

The waste heat boiler blowdown water will be partially cooled by water quenching and transferred to the waste heat boiler blowdown water cooling pond. Chilled purge water (temperature approximately 80 ° C) is further cooled to acceptable limits using a jet aerator prior to neutralization. The cooled and neutralized water is directed to the Uchkizil water reserve terminal point.

Oily water separation

The oily water separation system will be sufficient to purify all oily water from the territory of the combined cycle power plant (diverted from the transformer area, the floor of the gas turbine, and so on). Waste water from oily water collected in the sump will be pumped into the buffer tank of the oily water separation system.

CPI Oil Separator (Pleated Plate Interceptor) is used to separate oil from water. The oil rising to the surface flows through the overflow of the skimmer, which is adjustable at a fixed height. The separated oil sludge will be directed by gravity into the oil sludge mine. Periodically, oil sludge should be transferred for disposal to a specialized organization.

Domestic waste water from the entire combined cycle power plant is transferred to a biological treatment plant, where it will be purified from organic matter with the formation of a stable sludge. The cleaning process is carried out as follows. Untreated wastewater from every building (toilets, showers, sinks, etc.) flows into modular septic tanks where solids are separated from liquids. Heavy solids settle to the bottom of the tank, the remaining liquids flow out of the tank into a wastewater sump, from which they are pumped to an aeration tank equipped with an extended aeration device. The aeration tank makes it possible to clean the effluent by oxidizing organic pollutants of both liquid and solid phases under aerobic conditions (oxygen saturation occurs). The wastewater is then sent to a sump where the liquid is separated from the sludge.

In the secondary sludge zone, the return of sludge to the primary sump is organized. The return of the sludge is made forcibly by an air lift. Surface liquids from the sump are disinfected in the chlorine contact chamber by dosing a hypo-chlorite solution before draining.

The total daily volume of wastewater to be discharged from the plant is 2.55 m3/h of which 0.32 m3/h from the Sanitary Wastewater Treatment System, 0.25 m3/h from the Oil Waste Water Treatment System, 0.05 m3/h from the Turbine Hall Floor Washing Water, and the remaining 1.93 m3/h from Unpredictable Water (Contingency).

There will be rainwater collection system which is also connected wastewater discharge unit following the oil water separation.

Therefore, 15.75 m3/h (378 m3/day) accounts for total water use within the Project's scope based on the latest water balance diagram presented in Attachment B of this document and amount of this water will be extracted from Uchkizil Reservoir.

The total annual water extraction of the power plant will be approximately with 137,970 m3 which is around 0.17 % of the Uchkizil reservoir volume (80 million m3).

The competent authority has mentioned that Uchkizil Reservoir can provide up to 220 million m3 water. Therefore, it is not expected to have adverse impact on Uchkizil reservoir and on the irrigation system during operation phase.

8.5.2.2 Industrial Wastewater Treatment System (IWWTS)

The IWWTS consists mainly of the following sub-systems and equipment:

- *HRSG Effluents and Auxiliary Boiler Collection Subsystem*: This subsystem, comprising all the necessary components including accessories, instrumentation and control devices to collect effluents
- Collection and Neutralization subsystem including:
    - Two (2) x 100% air blowers (common for each compartment) and one air distribution system for each basin compartment;
    - Neutralization Subsystem of the including:
        - Neutralization basin (divided in two compartments, one compartment filling and one controlling the PH and discharging);
        - One (1) pumping station equipped with two (2) 100% pumps for wastewater recirculation and, if possible, discharge to the wastewater collection and equalization basin;
        - Two (2) mechanical agitator;
        - Dosing equipment of chemical products for pH adjustment in the neutralization basins;
        - Instruments for continuous flow, pH and conductivity measurement
        - A water fogging system to cool down the effluents and one service water distribution system to cool down the effluents directly in the basin in case the system fogging is not enough to comply with the maximum temperature discharge;
        - Instruments for continuous flow, pressure, temperature, pH, turbidity and conductivity measurement.
    - Instruments for continuous flow, pressure, temperature, pH, turbidity and conductivity measurement to ensure effluent meets project discharge standards (see Section 8.1.1).
- The necessary electrical control panels and junction boxes;
- Power, control and instrumentation cables inside the Wastewater Treatment Package Plant;
- One (1) PLC with communication with the Distributed Control System (DCS);
- Complete control system design, including operation philosophy, logic diagrams, process displays and wiring diagrams;
- Necessary instrumentation for the automatic and continuous operation of the WWTP.

8.5.2.3 Plant Oily Water Treatment System (POWTS)

The Plant Oily Water Treatment System (POWTS) removes oil from potentially oil-contaminated plant floor and equipment runoff so that the treated effluent meets the allowable discharge limit for oil and grease before it is further processed by the IWWTS.

8.5.2.4 POWTS Collection System

The POWTS Collection System collects and conveys facility effluent with the potential for oil contamination by gravity. The POWTS collects the oily wastewater from each area in local oil separators (lamella separators) from which the treated water is pumped to the IWWTS and the oil sludge is trucked off-site for disposal.

8.5.2.5 Sanitary Waste System

The sanitary waste water collection system collects and treats all sanitary waste produced within the Facility.

The sanitary drains shall provide discharge from all lavatories, showers, sinks and similar facilities. The drains shall be plumbed from the various buildings.

Wastewater from the sanitary wastewater collection system is further transferred to irrigation water tank.

8.5.2.6 Final Effluents Discharge

The final treated wastewater shall be discharged towards the Uchkizil water reservoir.

As per the National legislation, in all cases, the MPC will be considered the existing background natural water quality for the body of water into which effluents will be discharged and the water quality objectives for the classification applied to the waterbody, which is Uchkizil Reservoir for this Project.

In no case, the MPC will set below the current background natural water quality value (in the case of polluted water bodies) or lower than the MPC set for category of water to be discharged into (for non-polluted water courses). Therefore, in order to protect Uchkizil reservoir water quality, Project discharge limits will be in line for the limit values set for fishery.

Mitigation measures to reduce impacts on water quality for construction phase are given below and summarized in Table 103.

- SCE employees will be trained on how to minimize water consumption and ensure they have an understanding of the water issues in the Project area.
- Mechanisms and management practices to further reduce the volume of water required in the plant (e.g. increased reuse rates of treated effluent) will be considered, as this would help decrease freshwater consumptions.
- Limit water intake velocity with 0.15 m/s according to IFC EHS Guideline for Thermal Power Plants at the entrance of inlet structure.
- A bubble curtain shall be installed across the entrance of the intake channel to prevent fish and other fauna from going through the intake channel.
- Periodic monitoring of intakes will be undertaken during the first year of operation to record the effectiveness and ensure that there is no injury to the vulnerable fish species.

- Brief visual observation of the intake channel will be undertaken daily to check that reptiles and large fish are not within the channel.
- Maintenance program and competent teams will be on board. Capacity of the team shall be appropriate to handle maintenance and emergencies.
- Fuel and hazardous storage facilities will be more than 150 meters from water bodies.
- Facility management shall be informed about possible negative impacts related with water use and wastewater treatment and awareness program for entire facility team shall be on place.
- Oily wastewater will be treated via an oil/water separator. A specialist contractor will remove the recovered oil for recycling. Any residual sludge will be taken to a Municipality approved hazardous waste landfill.
- Wastewater collection systems and oil water separators shall be inspected frequently, to ensure that no blockages could result in overflowing.
- Water temperature control system will be installed to the neutralization pond to ensure that the discharge temperature is within the Project discharge limit which is less than 3 degrees from the temperature of lake water (see Table 92).
- Sludge from all treatment systems will be disposed in accordance with national, and IFC regulations for the hazardous wastes.
- Provisions for the containment of the first flush of storm water will be considered to ensure that the initial runoff from rainfall events does not lead to contamination of the receiving canal waters.

It is proposed to consider the need to undertake Hydrodynamic, initial dilution and dispersion modelling to define monitoring obligations to confirm no significant impact during the operation phase and if necessary define any additional design mitigation requirements. The objectives of the modelling study would be to:

- Understand near-field and far-field dilutions and dispersion of the rejected cooling water effluent.
- To assess possible recirculation issues at the intake location (if relevant when final design is determined) as well as to determine increases in water temperature and pollutant concentrations above ambient in the vicinity of the outfall location.

Monitoring obligations to confirm the findings of the assessment are proposed as follows:

- Intake velocity will be in accordance with IFC guidance of < 0.15 m3.
- A bubble curtain shall be installed across the entrance of the intake channel to prevent fish and other fauna from going through the intake channel.
- Periodic monitoring of intake will be undertaken during the first year of operation to record the effectiveness and ensure that there is no injury to the vulnerable fish species.
- Brief visual observation of the intake channel should be undertaken daily to check that reptiles and large fish are not within the channel.
- Survey for the presence of the Luciobarbus conocephalus and Sabanejewia aurata aralensis prior to start of construction and half yearly during construction within 500 m of intake and outfall locations.
- Survey for the presence of Luciobarbus conocephalus and Sabanejewia - Half yearly for first 3 years, within 500 m of intake and outfall locations.

During the operation stage, it is recommended following parameters shall be monitored at the discharge point.

Table 102: Monitoring Parameters at the Outfall of the Plant

Parameter	Frequency
pH, Temperature, Conductivity and Flow rate	Continuous
COD, oil, TSS, Nitrogen, Phosphorus	Bi-weekly
Suite of heavy metals	Quarterly

Table 103: Impacts Significance of the Water Resources and Water Environment during - Operation Phase

Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Water consumption during operations	Reservoir users	High	Medium	Moderate	SCE employees will be trained on how to minimise water consumption and ensure they have an understanding of the water issues in the Project area. Mechanisms and management practices to further reduce the volume of water required in the plant (e.g. increased reuse rates of treated effluent) will be considered, as this would help decrease freshwater consumptions. It is recommended that SCE will seek for innovative solutions to have rainwater harvest and use the collected water for irrigation purposes	Minor
Stormwater and Operation Wastewater	Reservoir water and sediment quality	High	High	Major	Maintenance program and competent teams should be on board. Capacity of the team shall be appropriate to handle maintenance and emergencies. Facility management shall be informed about possible negative impacts related with water use and wastewater treatment and awareness program for entire facility team shall be on place. Oily wastewater will be treated via an oil/water separator. A specialist contractor will remove the recovered oil for recycling. Any residual sludge will be taken to a Municipality approved hazardous waste landfill. Wastewater collection systems and oil water separators shall be inspected frequently, to ensure that no blockages could result in overflowing. Sludge from all treatment systems will be disposed in accordance with national, and IFC regulations for the hazardous wastes. Provisions for the containment of the first flush of storm water will be considered to ensure that the initial runoff from rainfall events does not lead to contamination of the receiving reservoir waters. All discharges into the reservoir will meet all the specific Project discharge requirements set by the State Committee on Ecology and Environmental Protection.	Moderate
Disturbance to aquatic life due to water intake	Reservoir fauna	High	Low	Moderate	To avoid any harm to the aquatic life, water Intake velocity of the water should be less than 0,15 m/s in compliance with “IFC EHS Guidelines for Thermal Power Plants” which allow any fish species to escape easily from the flow. Bubble curtain shall be installed at the entrance of water intak structure to avoid fish and other animals to go through intake channel Periodic monitoring of intake structure should be done to ensure that there is no injury to aquatic life. •Survey for the presence of the Luciobarbus conocephalus and Sabanejewia aurata aralensis prior to start of construction and half yearly during operation	Minor

8.6 Site-specific Flood Risk Assessment

This hydrological desktop study is performed to provide information regarding a site-specific hydrological analysis that is required or not for the assessment of the hydrologic conditions to identify flood risk from water courses generated from contributing catchments within the surrounding areas. In this aspect, the water courses having contributions to the catchments within the surrounding areas in the Project Site or its close vicinity and Termez Meteorological Station data are mainly considered in the study. This section summarizes the results of the Hydrological Analysis Report, which is presented in Attachment E.

The Project Site does not have a big catchment contribution. The site is dissected by mainstream beds and small dry channels. The downstream parts coinciding with the Uchkizil reservoir. Basins have different elevation values with a narrow range. Slopes are generally low and average in the sub-basins while relevant slopes are considerably low. The Project Site is shown in Figure 58 along with the catchment analysis results.

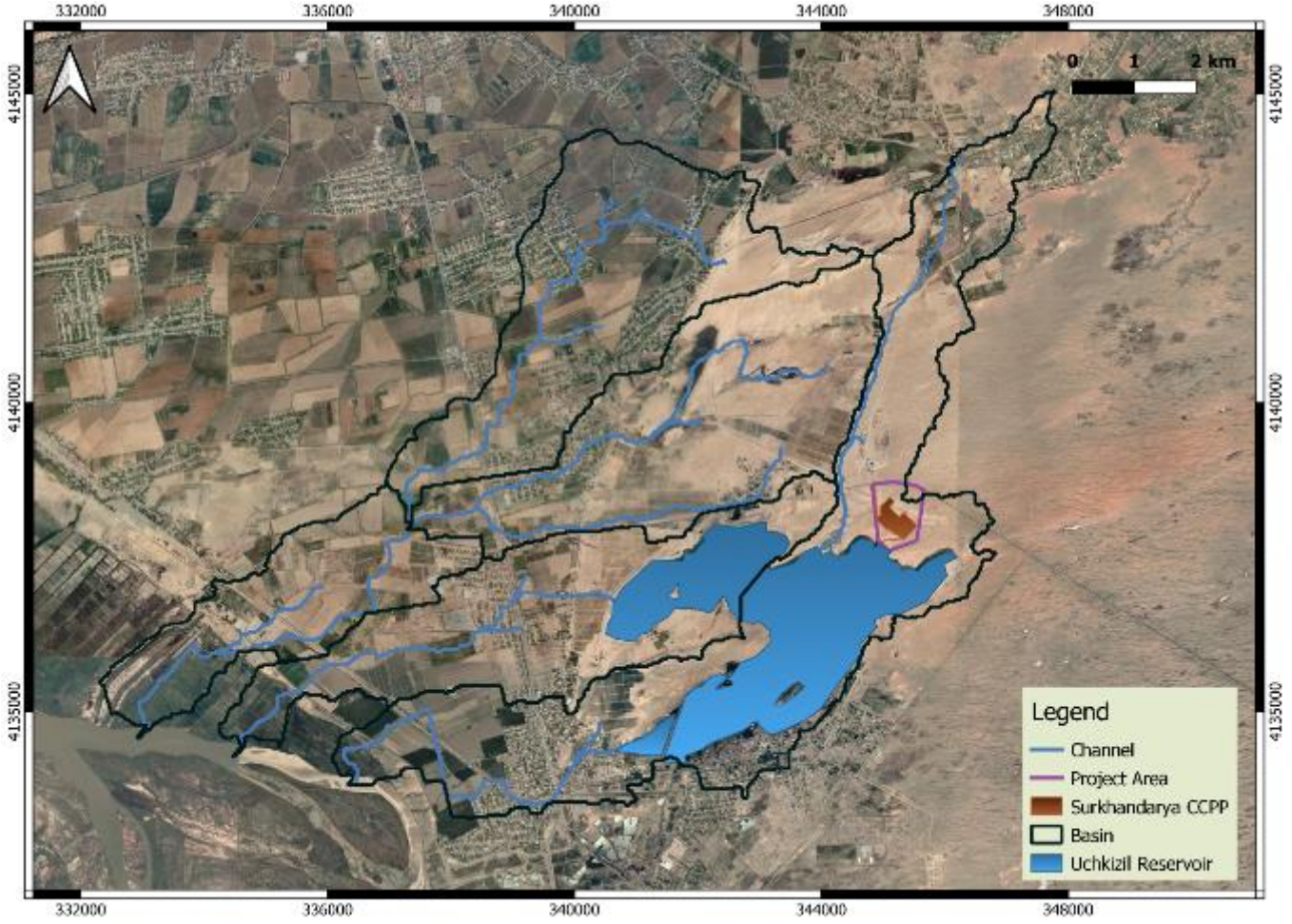


Figure 58: Project Site Delineation Including Seasonal and Main Rivers

Flood hazard analysis is performed to evaluate the possible effects of flooding at the Project Site. First, characteristics of the local rainfall regime are considered to assess the runoff potential in the proposed plant area. In addition, watershed (catchment) analysis is performed to figure out the basins, sub-

basins, and main drainage paths or networks within the Project Site and its vicinity. A preliminary flood modeling has been performed with HEC-RAS 2D software (USACE, 2016) [119], by using elevation data having a grid spacing of 12.5 m × 12.5 m with ALOS PALSAR DEM, and results are also compared with the model created by FABDEM[13] data which is quite utilizable for flood modeling.

The main aim of this hydraulic analysis with HEC-RAS 2D is to compare the results and validate the preliminary findings in the context of the preliminary hydrological survey. This analysis is run to obtain the water accumulation and velocity map for the Project Site for the calculations of 50-year and 100-year return periods.

A closer view of the Project Site is presented in Figure 59. The Project Site has an aerial coverage of 0.7 km^2. The basin and the sub-basins are obtained from the catchment analyses by using ALOS PALSAR Digital Elevation Model (DEM). The river channels and the sub-basins are presented in Figure 58.

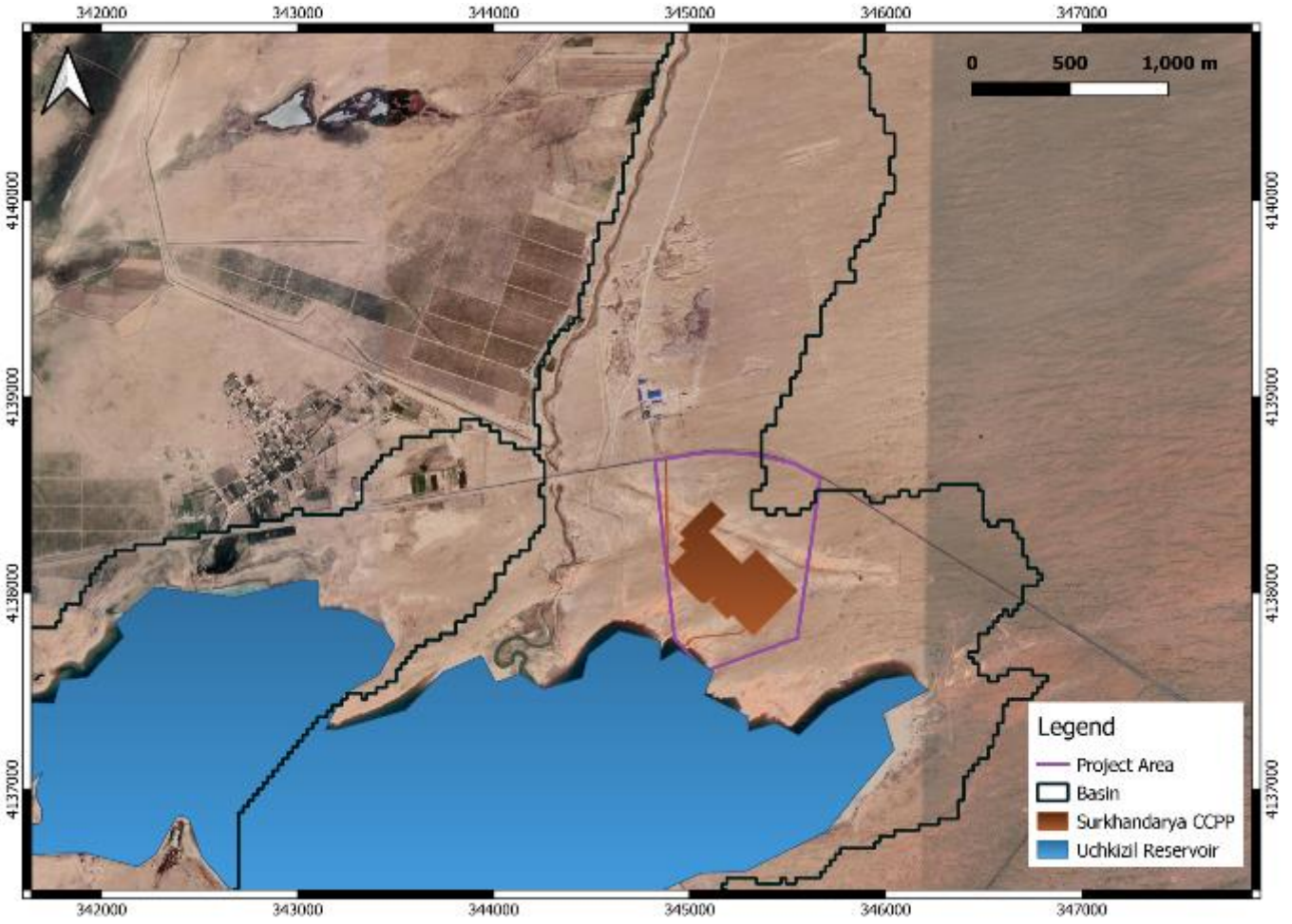


Figure 59: A Closer View of The Project Site

[13] https://data.bris.ac.uk/data/dataset/25wfy0f9ukoge2gs7a5mqpq2j7

The Project Site is located at the middle main sub-basin where the elevations of the relevant sub-basin are between 242 and 365 m as their maximum and minimum values.

For the Project Site, the available DEM Data (12.5 m × 12.5 m) is utilized to observe the effect of topographical features such as roads on the hydrological properties of the Site.

The drainage areas that are not covered by the provided ALOS PALSAR DEM, FABDEM data have been used to complete the stream network. After performing the catchment analysis, aerial coverage of the hydrological basin (the catchment area) in the Surkhandarya Project Site is obtained as 29.44 km2. The generated catchment area of the Project Site and its vicinity are shown in Figure 60. The maximum elevation in the sub-basin is around 365 m, and the minimum elevation downstream of the sub-basins is 242 m within the catchment area. Drainage lines and corresponding sub-basins are delineated with the help of ALOS PALSAR and FABDEM.

The threshold value for drainage line delineation is selected appropriately to depict the river network sufficiently at the study site. The longest flow paths, basin area, and slope of the longest flow paths are computed for each sub-basin.

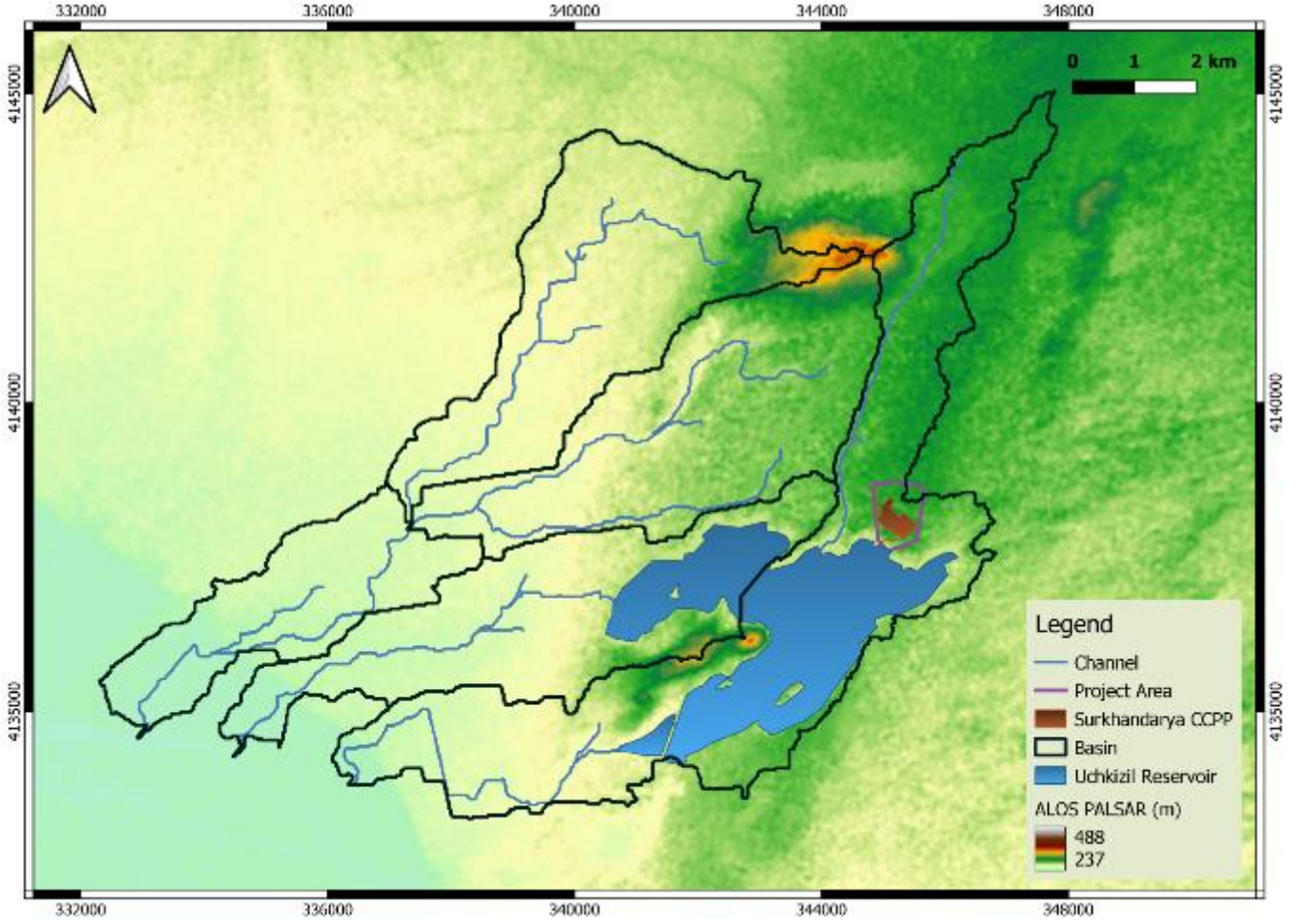


Figure 60: The sub-basins and the river network obtained from ALOS PALSAR DEM with the Project Site

For flood modeling analysis, maximum values are important. Thus, daily precipitation values observed at Termez Station are used and relevant analysis is implemented. The most suitable Probability

Distribution Function (PDF) is found as the Generalized Extreme Value (GEV) distribution according to Anderson-Darling and Cramer-von Mises tests. The goodness of fit test used has a 95% of confidential level and the estimation method is the maximum likelihood method. The effective rainfall duration is calculated by the time of concentrations. Each sub-basin has a different time of concentration according to its slopes, main channel lengths, topographies, etc. However, the study area does not have a direct contribution from neighboring dry channels which means local flash floods would be more hazardous. As a result, flash floods which can be resulted from intense 5-10-20 or 30-minute rainfall durations are also considered.

In addition, it is known that snow is observed in the winter months in the basin. The maximum snow depth of 22 cm was observed in December 2016. Snow is usually seen in December, January, and February. It is observed that maximum precipitation generally does not occur in these months. On the other hand, there are some coinciding time intervals for precipitation and snow. To analyze whether snow melting is a problem for the study area, MODIS snow cover product (MOD10A1.006 Terra Snow Cover Daily Global 500m [14]) is used. In this product, snow cover is scaled between 0-100. All available data between 2000 and 2022 is collected and the average is presented. It's seen that snow melting is not a problem for flooding in the study site. According to the mentioned reasons snow melting is not considered in the flood hydrograph determination.

The direct rainfall method (DRM) is employed in flood modeling. DRM involves directly applying rainfall to the hydrodynamic surface-flow model. Advantages of this approach include the facilitation of cross catchment flows, a high definition of flow behavior in catchments, and the approach can replace the requirement for hydrological models within the 2D model domain. One of the most utilizable advantages of the DRM method is to implement the infiltration of precipitation with relevant land cover and soil data for all meshes of the basin. In this study, the SCS Curve Number method is used to estimate the water depths and hydrographs for the study sites. The method requires the combination of soil and land cover infiltration which leads to estimating the Curve Numbers of layers. In this study, ESA WorldCover[15] 10 m product is used for land cover information. The product provides land cover information with 10 m spatial resolution based on Sentinel-1 and 2 data. For the soil information, Global Hydrologic Soil Groups (HYSOGs250m)16 is used. This dataset represents a globally gridded hydrologic soil group information with 250 m spatial resolution.

The water depth and velocity due to the 100-year storm and 50-year storm obtained for the study site are presented between Figure 61 and Figure 64Figure 63. Flood hazard maps for 100-year and 50-year storms are presented in Figure 65 and Figure 66Figure 64 and a closer view of the potential risky areas due to 100-year storm event is presented in Figure 67.

[14] https://nsidc.org/data/mod10a1/versions/6

[15] https://esa-worldcover.org/en

[16] https://daac.ornl.gov/SOILS/guides/Global_Hydrologic_Soil_Group.html

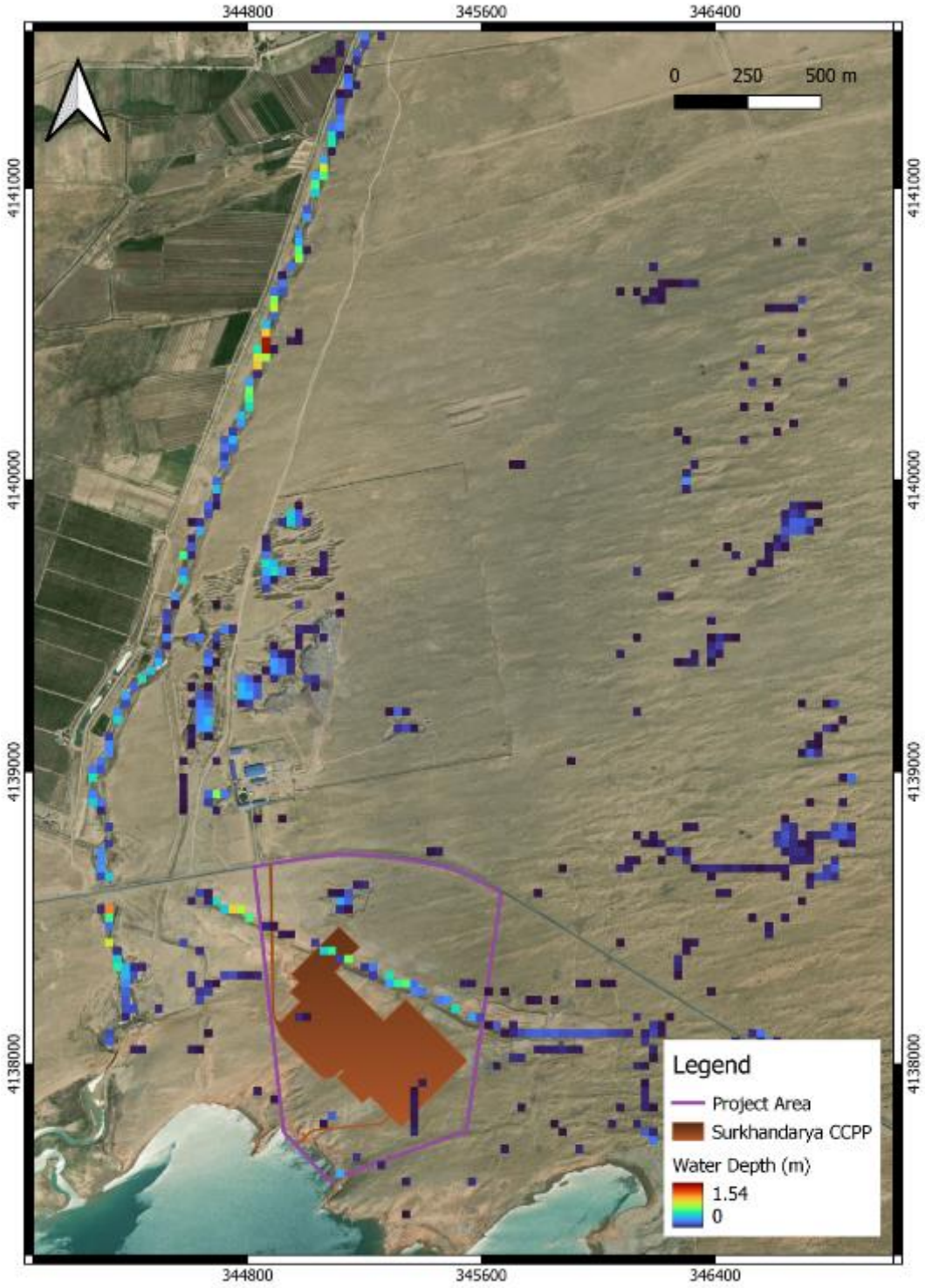


Figure 61: Flood Inundation Map of The 100-Year Storm for Project Site

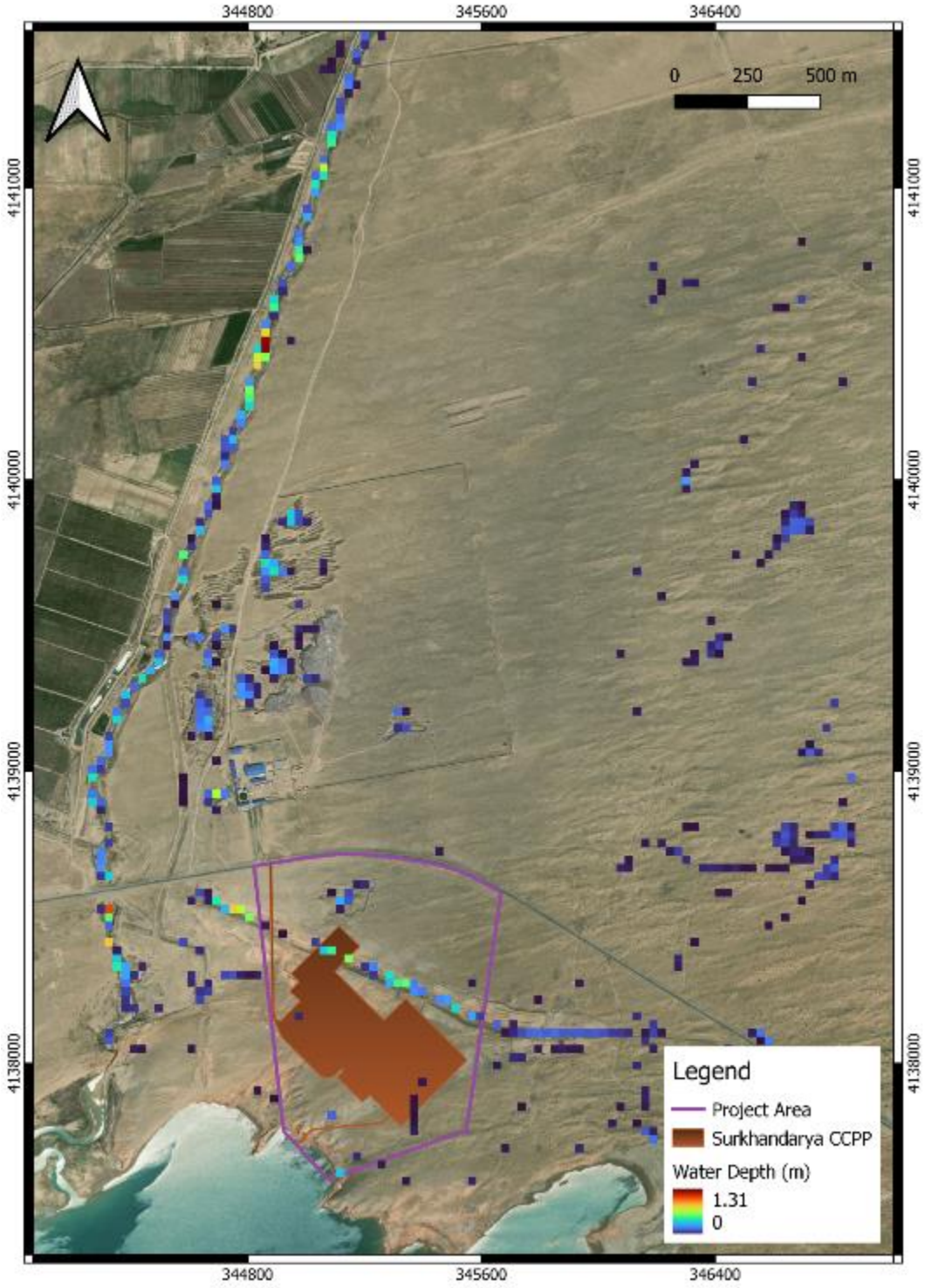


Figure 62: Flood inundation map of the 50-year Storm for Project Site

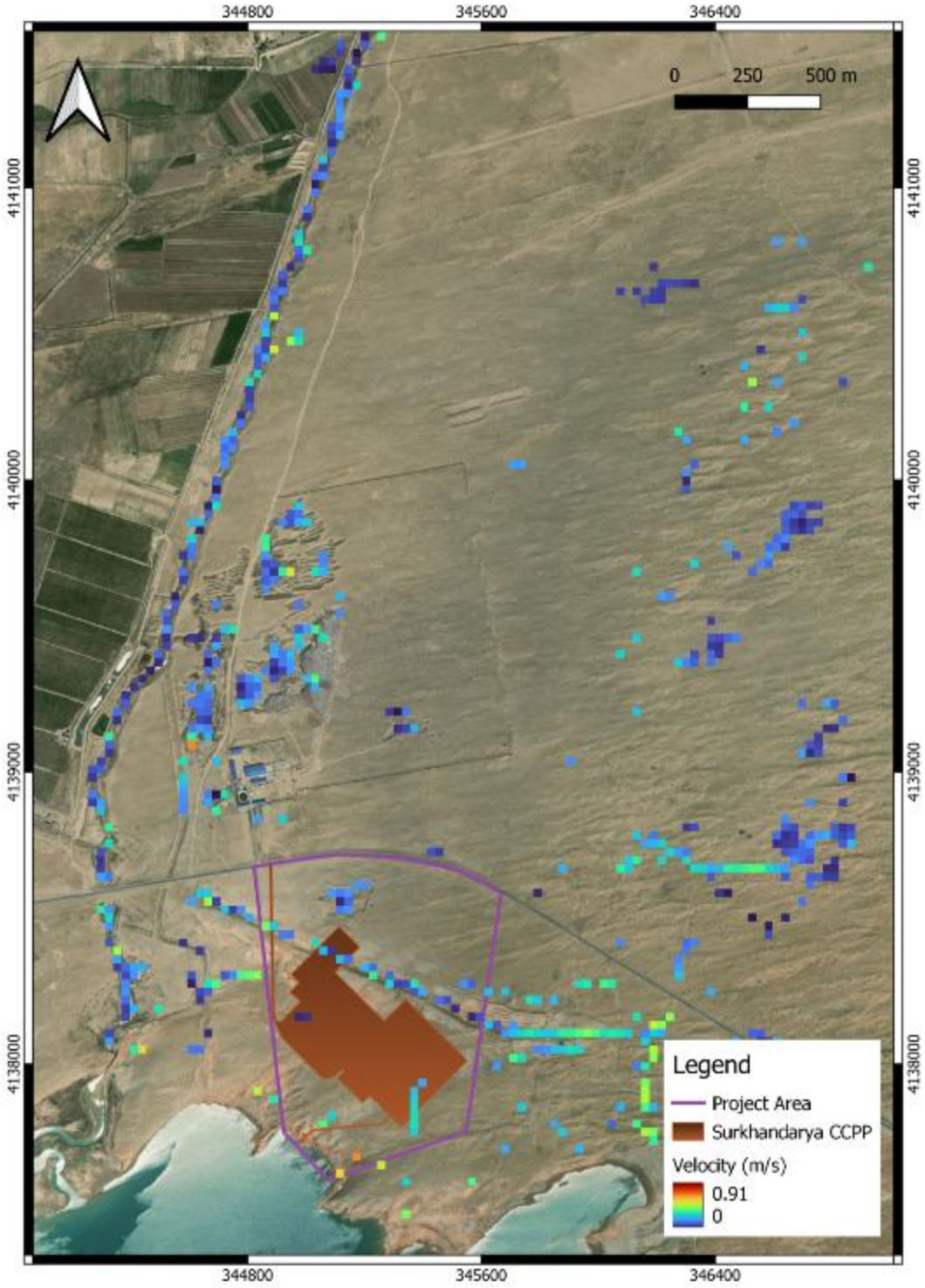


Figure 63: Velocity due to 100-year Storm for Project Site

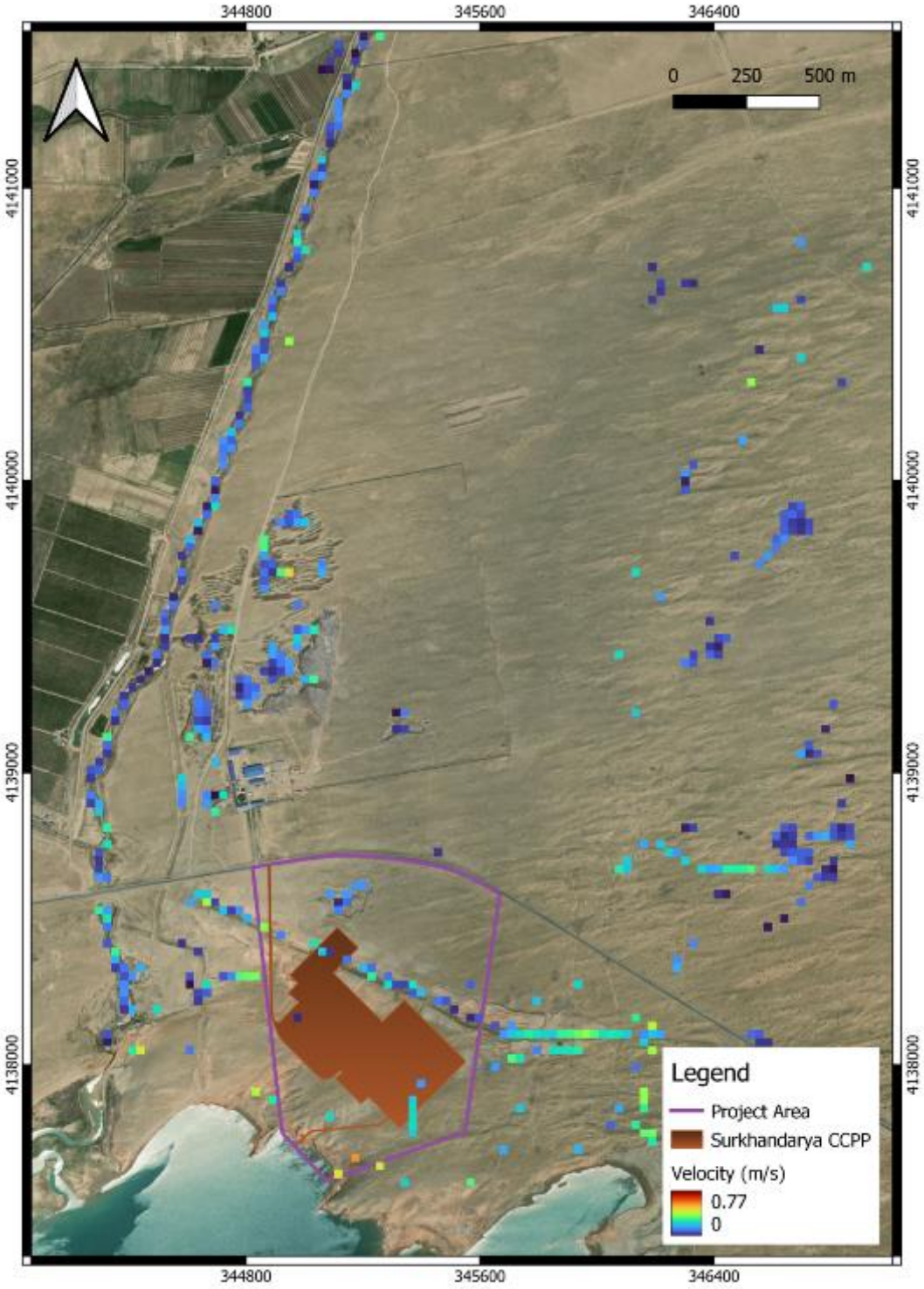


Figure 64. Velocity due to 50-year Storm for Project Site

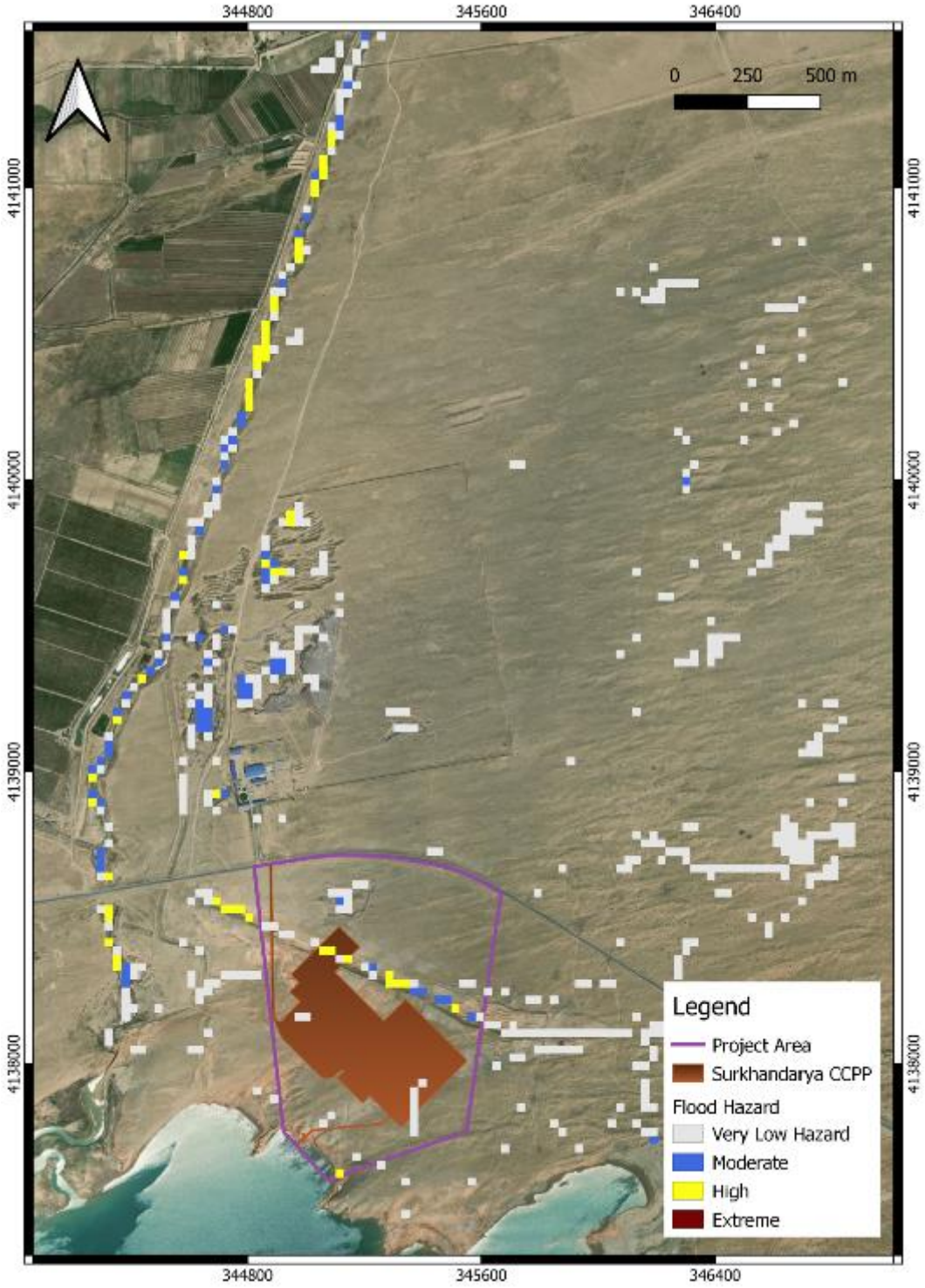


Figure 65: Flood Hazard Map of the 100-Year Storm for Project Site

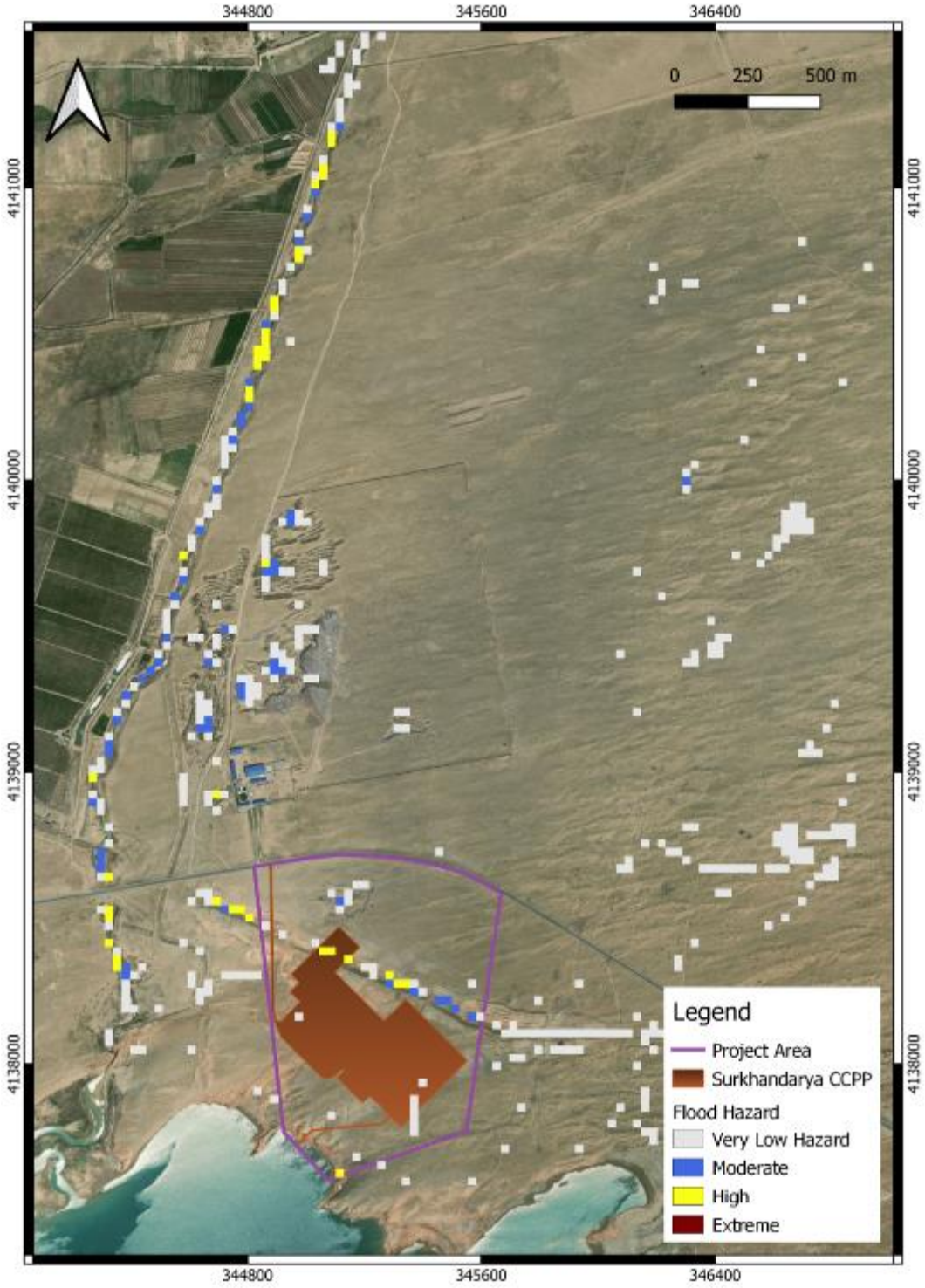


Figure 66: Flood Hazard Map of the 50-Year Storm for Project Site

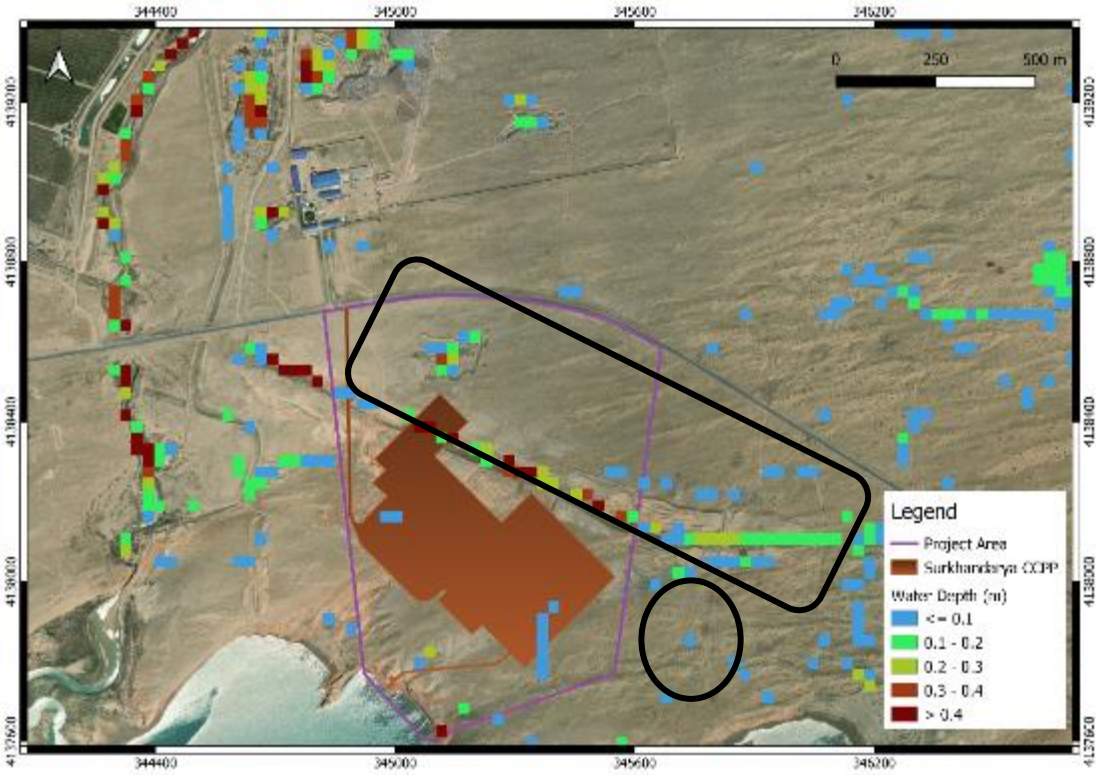


Figure 67. Potential Risky Areas (Depression Storage)

There are some depression storages in the area presented as a black rectangle in Figure 67 and these depressions are due to some pits existing in the Project Site (see Figure 68). These areas cause 70 cm of maximum water depth due to 100-year storm event in some locations. The water depth is limited to the accuracy of the DEM used in flood modeling.

Figure 68. Some Pits Within the Study Area

Secondly, a high flow area (black circle) with low water levels (less than 10 cm) gives a resultant flow hydrograph that is contributing to the downstream of the project site (aee Figure 69).

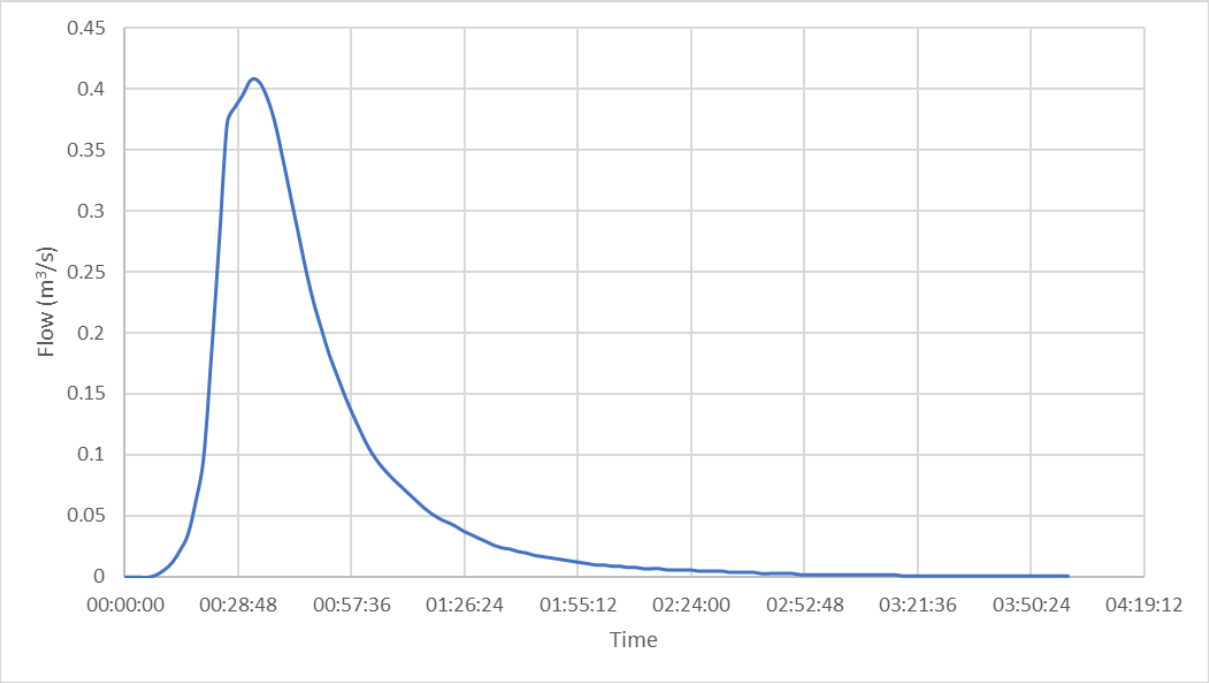


Figure 69. Indicated Hydrograph

As a conclusion it can be said that the Project area does not have any flood risk due to flood hazard classification for 50-year and 100-year return period storms. However, the pits in the area must be filled and some leveling must be performed to eliminate the depression storages within the Project Site.

8.7 Cumulative Impacts

The purpose of a cumulative impact assessment is to determine how the potential impacts of a proposed development might combine cumulatively, with the potential impacts of other projects or human activities as well as natural stressors such as droughts or extreme climatic events. The summary of cumulative impacts of water resources and water management is presented in Table 104.

Table 104:Summary of Cumulative Impacts of Water Resources and Water Management

Environmental and Social Aspects	Construction	Operation
Water Resources and Water Management		
Cumulative Impacts	Increasing in water consumption during construction and commissioning phase of the Project may potentially affect the users downstream. Discharge of dewatering if not properly managed could impact the water quality for downstream users and biological environment of the waterbody.	Additional water consumption from the Project may potentially affect the users downstream and the discharge could lead to slight changes in the water quality of the waterbody that may affect biological environment. The competent authority has mentioned that Uchkizil Reservoir can provide up to 220 million m3 water. Therefore, it is not expected to have adverse impact on Uchkizil reservoir and on the irrigation system. State Ecological Committee for Environment and Ecology Protection already gave positive consent regarding the water usage of the project during the local EIA process.

8.8 Monitoring

The Contractor and the Project Company will undertake canal monitoring during the construction, commissioning and operational phase of the Project. The minimum expected requirements for the monitoring are outlined in the Table 105. The final monitoring methodology with specific details (i.e. locations, frequencies, durations, parameters etc.) will be developed in a specific 'Environmental Monitoring Plan'.

Table 105: Monitoring Requirements of Water Resources and Water Environment

Source	Parameters	Duration	Location	Responsiblity
Construction Phase				
Fauna species	Species in the Uchkizil and its banks	Daily visual observations in the Uchkizil banks construction areas	All work areas at the Uchkizil	EPC Contractor
Ambient Water Quality	Total Suspended Solids, Turbidity	Water quality visual observation	Representative locations outside the silt curtains	EPC Contractor
	Range of parameters including physical heavy metals, bacteriological and hydrocarbons	Monthly sampling and laboratory analysis.		
Commissioning Phase				
Commissioning Discharge Monitoring	pH, temperature, conductivity and flow rate	Continuous	Discharge point	EPC Contractor
	Parameters of Project Discharge Standards	Bi-weekly		
	Suite of heavy metals	Quarterly		
Operation Phase				
Operational Discharge Monitoring	pH, temperature, conductivity and flow rate	Continuous	Outfall of the Plant and other points in and around the Uchhkizil Reservoir (see Figure 70)	Project Company
	Parameters of Project Discharge Standards	Bi-weekly		
	Suite of heavy metals	Quarterly		
Water & Sediment Quality	Uchkizil fauna species, water and sediment quality	Biannually	Discharge point	Project Company

Figure 70: Future Water Monitoring Points

9. ECOLOGY

9.1 Standards and Regulatory Requirements

9.1.1 National Regulations

The relevant legislation related with ecology and biodiversity in Uzbekistan are given below:

- Law "On Nature Protection", No.754-XII, dated December 09, 1992 (as amended on April 21, 2021)".
- Law "On Protected Natural Territories", No.13 dated January 08, 2018 (as amended on December 28, 2020).
- Law "On Ecological Expertise", No.73-II dated May 25, 2000 (as amended on April 29 2021)
- Law "On Protected Natural Reserves", No.710-II dated December 03, 2004 (as amended on September 30, 2020).
- Law "On Protection and Use of the Wildlife", No.545-I dated December 26, 1997 (as amended on September 19, 2016).
- Law "On Protection and Use of Flora (new edition)", No.409 dated September 21, 2016 (as amended on April 21, 2021).
- Law "On Protection and Use of Fauna (new edition)", No.408 dated September 19, 2016 (as amended on April 21, 2021).
- Law "On Plant Quarantine", No. 113-I dated August 31, 1995 (as amended on July 09, 2018).
- Decree of the Cabinet of Ministers of the RUz "On the Settlement of the Use of Biological Resources and the Procedure of Permission of the Resolving Procedures in the Field of Nature Use", No.290 dated October, 2014 (as amended on May 27, 2019).
- Decree of the Cabinet of Ministers of the RUz "On Measures to Improve the Public Administration System in the Sphere of Protected Natural Territories" No.4247 dated March 20, 2019.
- Decree of the Cabinet of Ministers of the RUz "On the Approval of the strategy for the preservation of biological diversity in the RUz for the period 2019-2028" No.484 dated June 11, 2019.
- Decree of the Cabinet of Ministers of Uzbekistan "About measures on the organization of the preparation, edition, and management of the red book of the RUz" No.1034 dated December 19, 2018.
- Decree of the Supreme Council of Uzbekistan "On Reinforcement of the Protection of Valuable and Endangered Species of Flora and Fauna and Harmonization of their Use" No.937-XII dated September 03, 1993.
- Appendix of the Decree of the Cabinet of Ministers of the RUz "On Classification of techno genetic, natural and environmental emergencies" No.455 dated October 27, 1998.

The content of the national laws are briefly described in the following paragraphs.

Law "On Nature Protection" states legal, economic, and organizational bases for the conservation of the environment and the rational use of natural resources. Its purpose is to ensure balanced relations between man and nature, to protect the environmental system and to guarantee the rights of the population of a clean environment. Article 25 of this Law states that SEE is a mandatory measure

for environmental protection, preceded to decision-making process. In addition, Article 25 says that the implementation of the project without a positive conclusion of SEE is prohibited.

Law "On Protected Natural Territories" regulates relations in term of organization, protection, and use of protected natural territories. The main tasks of this Law are the preservation of typical, unique, valuable natural objects and complexes, the genetic fund of plants and animals, the prevention of the negative impact of human activities on nature, the study of natural processes, the monitoring of the environment, the improvement of environmental education.

Law "On Ecological Expertise" provides for conducting a mandatory expert assessment of impacts on the environment and human health, as well as a legal basis for conducting expert assessments.

Law "On Protected Natural Reserves" regulates relations in term of organization, protection, and use of protected natural territories. The main tasks of this Law are the preservation of typical, unique, valuable natural objects and complexes, the genetic fund of plants and animals, the prevention of the negative impact of human activities on nature, the study of natural processes, the monitoring of the environment, the improvement of environmental education.

Law "On Protection and Use of the Wildlife" regulates relations in the field of protection, use, restoration and reproduction of the wildlife in order to ensure the conditions of its existence, conservation of species diversity, integrity of natural communities and habitat.

Law "On Protection and Use of Flora" regulates protection and usage of flora growing in natural condition, as well as in cultivation and its reproduction and conservation of gene pool of wild plants.

Law "On Protection and Use of Fauna" regulates relations in the field of protection and use of wild animals living in a state of natural freedom on land, water, atmosphere and soil, constantly or temporarily inhabiting the territory of the Republic of Uzbekistan, as well as contained in semi-free conditions or artificially created habitat for scientific or nature protection goals.

Law "On Plant Quarantine" regulates measures on external and internal plant quarantine, aimed at the protection of the territory of the Republic of Uzbekistan from the penetration of quarantine and other dangerous pests, diseases of plants and weeds from foreign countries, which can cause significant economic damage to the national economy.

9.1.2 International Conventions/Protocols

In addition, Uzbekistan has adopted a number of international conventions, protocols, agreements, and memoranda of understanding in the field of environmental protection and sustainable development. The international agreements related to ecology in which Uzbekistan is involved are as follows:

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) dated July 01, 1997.
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) dated May 01, 1998.
- RAMSAR Convention on Wetlands of International Importance, especially as Waterfowl Habitat dated August 30,2001.
- United Nations Framework Convention on Climate Change (UNFCC) dated March 24, 1994.
- The Convention on Biological Diversity (CBD) dated October 17, 1995.
- United Nations Convention to Combat Desertification (UNCCD) dated August 31, 1995.

- Convention on Biodiversity, Cartogena Protocol dated October 11, 2019.

9.1.3 Lender Requirements

All the studies related to the terrestrial and aquatic ecology will be in line with the IFC Performance Standard (PS) 6: "*Biodiversity Conservation and Sustainable Management of Living Natural Resources*".

This PS reflects the objectives of the Convention on Biological Diversity to conserve biological diversity and promote use of renewable natural resources in a sustainable manner.

Since 1995, the RUz is a party to the "United Nations (UN) Framework Convention on Biological Diversity".

The laws of the RUz "On Nature Protection", "On Protected Natural Territories", "On Protection and Use of Flora", "On Protection and Use of Fauna" are the legislative basis in the field of biodiversity protection. In this respect, the main document is the "National Strategy and Action Plan on Biodiversity Conservation (1998)" [19].

Moreover, the Project will follow the ratified conventions and Habitats Directive 92/43/EEC and the Birds Directive 2009/147/EC, where applicable.

9.2 Biodiversity in Uzbekistan

9.2.1 General Overview

Uzbekistan is located in the central part of Central Asia and has borders with the five countries such as Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Afghanistan. This geographical location at the junction of several biogeographic regions determines antiquity, diversity, nature of origin, complex genetic relationships of flora and fauna. The gene pool of wild animals inhabiting the territory of the Republic of Uzbekistan is unique. Uzbekistan is an important habitat for endemic species and subspecies of animals of Central Asian origin. Most of it is represented by native fauna.

The special geographical position of Uzbekistan determines also the significant wealth of its animal world. At the same time, it is also a reflection of the exceptional diversity of the natural conditions of the Republic, where vast plains occupied by deserts of various types, mountain steppes, forests and alpine meadows, riparian thickets, reservoirs, cultural landscapes form characteristic ecosystems with their faunal assemblage.

The fauna of the Republic is distinguished by its antiquity and complex genetic relationships. Turanian and Turkestan endemic and autochthonous species play a significant role here. A large place also belongs to the group of animals that entered the Country in the historical past from other regions of Central Asia, Indochina, the Mediterranean, and the planes of Eurasia. Part of the fauna is represented by acclimatizers from the Far East, Transcaucasia, Europe, and America.

In general, the number of vertebrates in Uzbekistan is 714 (107 species of mammals, 467 species of birds, 61 species of reptiles, 3 species of amphibians and 76 species of fish), while the fauna of invertebrates is estimated as 15 thousand species. The flora of Uzbekistan accounts more than 4,000 species of vascular plants.

Over the past decades, because of increased nature management, many species of animals have experienced a strong anthropogenic impact and have reduced their area and number, and some of them have completely disappeared. The greatest threat is faced by large species of mammals and birds, which are of great practical value as objects of hunting, as well as endemic and locally widespread species found within vulnerable ecosystems intensively developed by humans. In particular, the Turanian tiger, cheetah, and Aral trout have already disappeared. On the verge of extinction are the leopard, striped hyena, bustard, Syrdarya, Amudarya small and large shovelnose sturgeon, Aral sturgeon. Ustyurt and Bukhara crested sparassis, markhoor, caracal lynx, Central Asian otter, stifftai, mute swan, marbled duck, houbara bustard, pin-tailed sand grouse, Hentaun toad agamas, striped Fergana desert lacertas, the Aral barbel, pike asp, some helmet-shell & insects. The number of many animals has not yet reached a critical level but is steadily decreasing. All this is a consequence of the economic development of territories, environmental pollution, and the irrational use of biological resources.

An ecological network, consisting of

- 7 reserves (e.g., Gissar, Zaamin, Kitab, Nurota, Kizilkum, etc.),
- 3 national natural parks (i.e., Zaamin, Ugam-Chatkal, and Zeravshan),
- Complex (landscape) nature reserve (i.e., Saigachy),
- State reserve "Sudochye",
- Reserves (e.g., Dengizkul, Karakir, Arnasaysky, etc.),
- Biosphere reserves (i.e., Nizhne-Amudarya and Ugam-Chatkal), and
- 10 natural monuments (e.g., Vardanzi, Yazyavan, Mingbulak, etc.).

Many species of animals included in the Red Book are protected in the Republic's reserves for example Bukhara deer, markhoor, Severtsov's crested sparassis, Menzbir's marmot, Turkestan lynx, large birds of prey, and invertebrates[35].

A promising direction in the preservation and restoration of the number of rare and endangered species of animals is their breeding in semi-free conditions. An important practical step in this regard is the work carried out in the Bukhara specialized nursery “Jeyran” in the Bukhara region. Here, species included in the national Red Book and the IUCN are preserved and bred (e.g., Equus onager, Przewalski's horse (Equus caballus), goitered gazelle, markhoor, Bukhara crested sparassis). Breeding of the endangered houbara bustard in artificial conditions with subsequent release into the wild is carried out in nurseries located in Navoi and Bukhara regions [35].

9.2.2 Protected and Important Biodiversity Areas

Uzbekistan’s current designated protected areas fall into five categories as follows:

- nature reserves/national reserves (zapovedniks);
- national parks;
- one ecological centre;
- wildlife areas (zakazniks); and
- landmarks.

The Project area does not occupy and does not border on any protected areas higher than Category V (forestry, hunting management areas, breeding centers) according to the classification of the status of protected natural areas as per the Law "On Protected Natural Areas" No.710-II. However, it is also

worth mentioning that the area is adjacent to the western end of the Kattakum sandy massif, which is home to rare and endemic plant and animal species (see Figure 71).

The territory of the Kattakum sandy massif is currently not nationally protected area. However, this massif is an isolated area from the rest of the sands, and it is inhabited by a number of endemic subspecies of reptiles.

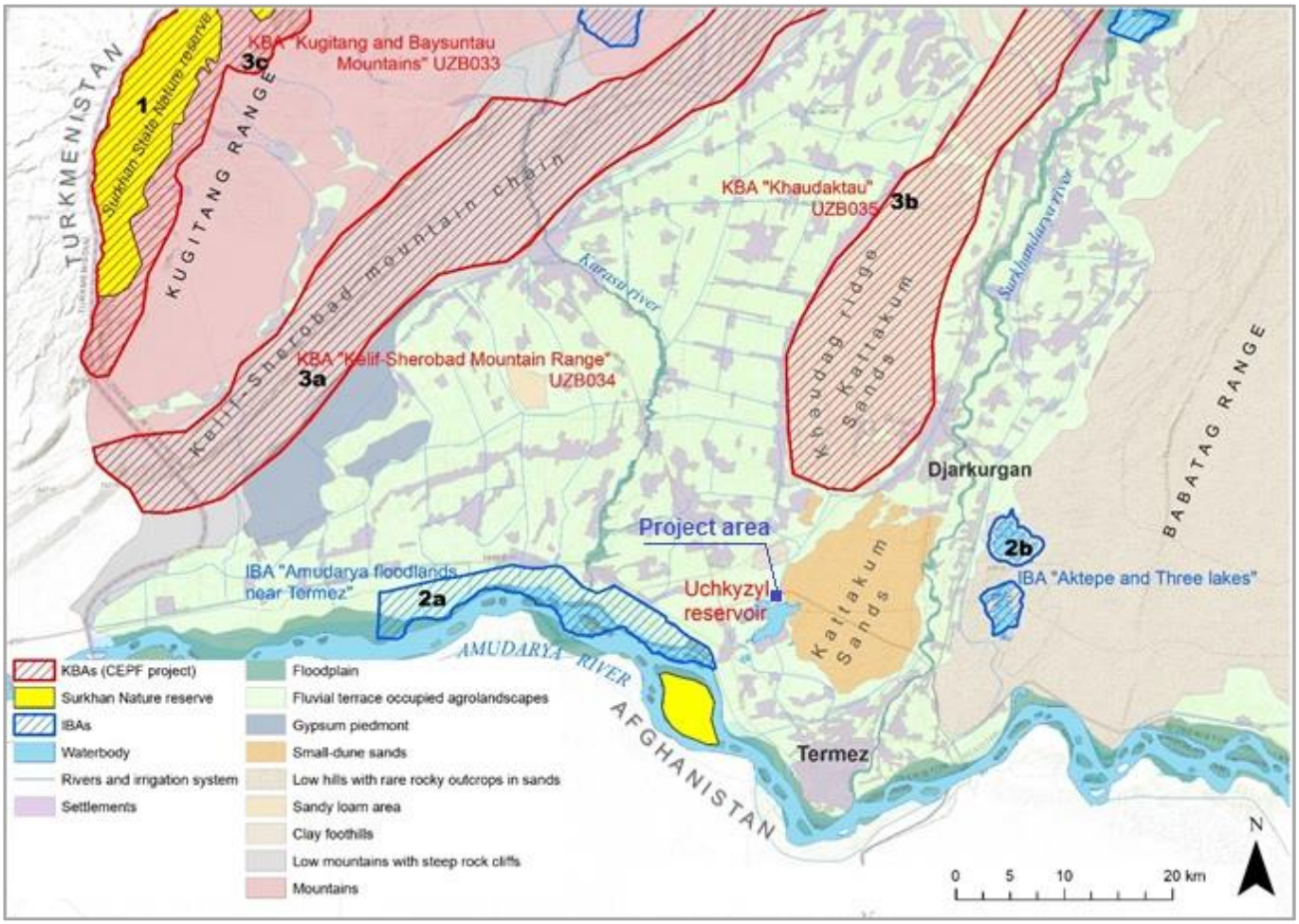


Figure 71: Map Showing the National and International protected areas near the Project Area

The areas with importance of biodiversity within 50 km radius of the Project area are listed in Table 106, below.

Table 106: Important bird Areas and Key Biodiversity Areas Within 50 Km Radius of The Project Area [98][99]

Name of the Protected Area	Distance from the Project area	Description
Amudarya Floodplain near Termez Important Bird Area (IBA)	10 km	Location: The IBA is situated 23 km to the NW of Termez town, in the first floodplain terrace of the Amudarya river between Kaptarhona and Sholiker villages (on the border with Afghanistan). It is 1.5-6 km wide and about 30 km long. The Amudarya river is on the south and south-west boundary, loess precipices which border the first and

Name of the Protected Area	Distance from the Project area	Description
		second floodplain terraces, waterlogged areas and reedbeds are the natural borders of the site. There are also rice and winter wheat fields, sandbanks, rivers, stream, marshes, canals and roads. Total area: 10,693 hectar. The Amudarya river is located on the south and south-west boundary, loess precipices which border the first and second floodplain terraces, waterlogged areas and reedbeds are the natural borders of the site. There are also rice and winter wheat fields, sandbanks, rivers, stream, marshes, canals and roads. Threat score as per the most recent IBA monitoring assessment (2006) is high.
Aktepe and Three Lakes Important Bird Area (IBA)	15 km	Location: Aktepe Reservoir, and adjoining lakes are located at 22-25 km North-east of Termez town and 7 km South-east of Jarkurgan town in the valley of the Surkhandarya River. It is situated in the sandy desert on the border of developed land. There are three islets with precipitous shores in the reservoir. Around the reservoir, there are shoreline thickets of reed, tugai forest and a sandy desert. A small canal flows into the South-east part of the reservoir, feeding it with the water from the Amuzang canal. The average depth is 6.5 m. The water flow is regulated. There is a wastewater canal in the South-east part of the reservoir. There is a chain of small lakes situated 7 km to the south of the reservoir, which include the so-called Three Lakes. The water level and salinity in these lakes have not been studied. In winter, these water bodies are not frozen. Total area: 2,987 hectar. Threat score as per the most recent IBA monitoring assessment (2018) is low.
Kugitang and Baysuntau mountains Key Biodiversity Area (KBA) and Koytendag Important Bird Area (IBA)	50 km	Location: The IBA occupies the southwest slope of the Koytendag (Kugitang) ridge - the southwest termination of the Hissar range of the Pamir-Alay mountain system. Administratively the IBA is located in the southeast of Turkmenistan, and occupies the middle. Total Area: -75,289 hectar Threat score as per the most recent IBA monitoring assessment (2007) is not assessed.
Kelif-Sherabad Range Key Biodiversity Area (KBA)	40 km	Location: This KBA is located on the Kelif-Sherabad Mountain Chain. Total Area: -95,000 hectar B1 Individual geographically restricted species type : Sites qualifying as KBAs under criterion B1 hold a significant proportion of the global population size of a geographically restricted species and so contribute significantly to the global persistence of biodiversity at the genetic and species level. Site regularly holds ⩾10% of the global population size AND ⩾10 reproductive units of a species

Name of the Protected Area	Distance from the Project area	Description
Khaudaktau Key Biodiversity Area (KBA)	10 km	Location: This KBA is located on Khaudag ridge and Kattakum Sands at 20 km north of the Termez. Total Area: -44,000 hectar B1 Individual geographically restricted species type : Sites qualifying as KBAs under criterion B1 hold a significant proportion of the global population size of a geographically restricted species and so contribute significantly to the global persistence of biodiversity at the genetic and species level. Site regularly holds ⩾10% of the global population size AND ⩾10 reproductive units of a species

9.3 Terrestrial Ecology

The terrestrial ecology surveys have been conducted in July-2021 and April-2022, which refers to summer and spring seasons, respectively. The surveys cover both the Project area and its surrounding. In this section of the ESIA, the baseline conditions with respect to the terrestrial ecology are discussed. The surveys aim to:

- Identify the terrestrial flora and fauna that may reside or range within the region of the proposed Project.
- Provide detailed lists of the plant, mammals, reptiles, and amphibian fauna species in the region.
- Provide the IUCN Red Data rating and protected status of the flora and fauna species in Uzbekistan, which were determined to be present or potentially occurring at the area.
- Identify the direct or indirect impacts, whether they are beneficial, adverse, or neutral, on the current terrestrial biodiversity and provide relevant mitigation measures.

In addition, the literature was also reviewed in order to gather information about the typical national, regional, and local flora and fauna within the Republic of Uzbekistan. The site survey team is presented Table 107.

Table 107: Terrestrial Ecology (Flora & Fauna) Site Survey Team

Name of the expert	Profession	Qualification
Timur Abduraupov	Herpetologist	Bachelor degree Department of Zoology, Faculty of Natural Sciences, Samarkand State University, Samarkand, Uzbekistan, 2009 Master degree Department of Zoology, Faculty of Natural Sciences, Samarkand State University, Samarkand, Uzbekistan
Anna Ten	Ornithologist	Bachelor degree National University of Uzbekistan, 2003 Master degree National University of Uzbekistan, 2005

Name of the expert	Profession	Qualification
		Post-graduate student Institute of Zoology of Uzbekistan Academy of Science, 2008
Maria Gritsyna	Theriologist	Bachelor degree Samarkand State University, 2004 Master degree Samarkand State University, 2008
Zuri Mustafayeva	Hydrobiologist	Bachelor degree Tashkent State University - Faculty of Biology, Department of Ichthyology and Hydrobiology, 1985
Ulugbek Mirzaev, PhD	Ichthyologists	Deputy director for science Institute of Zoology of the Academy of Sciences of the Republic of Uzbekistan
Askar Kuvatov	Ichthyologists	Bachelor degree Urganch State University, 2016 Master degree Uzbekistan National University, 2018

9.3.1 Baseline Conditions

The baseline studies cover protected areas, habitats and species, and ecosystem services with the information adopted and derived from the primary and secondary sources.

The absolute altitude on the study area is from 319 m near the water edge of the Uchkizil Reservoir up to 342 m above sea level. According to the scheme adopted in Uzbekistan for identifying the vertical geographical belts, the Project area belongs to the chul belt (plains).

Physiographically, the Project area is located in the south of Uzbekistan, in the Surkhandarya intermountain area (Surkhan-Sherabad valley), inclined from north to south, to the floodplain of the Amudarya river. In the north and west, the Surkhan-Sherabad valley is limited by the Gissar ridge, the height of the axial part of which exceeds 4,000 m above sea level and its southwestern spurs, including the Chulbair Mountains (the highest elevation 3,812 m above sea level), Baysuntau (3,920 m), Susyztau (2,124 m), Tyubere-Oland (2,139 m) and the ridge Kugitang (3,137 m).

In the east, the Surkhandarya intermountain area is bounded by the Babatag ridge (2,290 m above sea level), and in the south - by the Amudarya, which is the largest river in Central Asia. The territory of the Surkhan-Sherabad Valley is crossed in the meridional direction by the right-bank tributaries of the Amudarya - the Surkhandarya and Sherabaddarya rivers. In the central part of the valley, there are relict sand massifs of Kattakum and Khaudaktau and the remnant upland of Khaudaktau, composed of red sandstones.

The climatic conditions of the project region are determined by its geographic location and the peculiarities of the orography. The powerful mountain ridges of the Pamir-Alai protect this territory from the influence of cold northern air masses, and from the south, it is open to hot and dry air. According to the Köppen-Geiger climate classification [20], the territory is located in the cold desert climate zone (BWk). Due to high temperatures and moisture deficit, the region is characterized by intense chemical and physical weathering.

The landscape of the peripheral part of the Kattakum sands is a wavy or slightly hilly sandy plain, the central part is occupied by a rather extensive massif of semi-fixed hilly sands (the height of the hillocks is 3–7 m), among which there are small saline settlings. The Uchkizil Reservoir has an area of about 10 km^2 and a depth of maximum 37 m, a sandy bottom, and mostly low and gentle sandy and sandy loam shores, but its northern coast, adjacent to the Project area, has relatively steep, eroded slopes, composed of outcrops of gypsum and saline depressions.

The southern and southwestern expanses of the Surkhandarya region are open for the penetration of warm tropical air masses. The location of the mountain ridges prevents the penetration of cold air masses from the north, and the openness of the valleys from the south has formed a zone of dry subtropics with extremely hot, dry, and long summers and very mild winters. The Surkhan-Sherabad depression is currently almost completely developed and is a zone of irrigated agriculture. Various industrial crops are grown here; the largest number of sunny days in the country allows to harvest some garden crops 2-3 times a year; horticulture and viticulture are well developed [21].

These orographic features determine the natural and climatic features of this territory.

The low-lying part in the southern part of the valley (formerly the bottom of a brackish lagoon) is a flat fan that has undergone repeated aeolian treatment; an ancient, natural desert isolate with a unique spectrum of flora and fauna species.

Due to the isolation of the sandy massifs of the Surkhandarya region and the uniqueness of biodiversity, in particular, a number of reptile species living there, a number of authors proposed to create a specialized reserve in the Kattakum desert [21].

9.3.2 Survey Methodology

The baseline desktop and field studies focused on the flora and fauna species present in and around the Project area to identify the potential endemic, restricted-range, critically endangered (CR), endangered species (EN), and vulnerable species (VU).

Survey tracks and observation points for each ecology survey are represented in the respective figures. It should be noted following the additional terrestrial flora and fauna surveys to be performed in September 2022, transects will be further elaborated and plotted on the maps.

During the site visits, survey team interviewed with some of the shepherds and fishermen. It was revealed that, till the early 1970-1980s, goitered gazelles were observed, but in present they do not exist in the region. The interview is focused only on the species that are well known by the local residents.

The field survey was carried out September 18–20, 2022. Research of flora and fauna was carried out using standard methods.

For the purposes of implementation of IFC Performance Standard 6, habitats are divided into modified, natural, and critical. Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition. Modified habitats are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. Critical habitats are a subset of modified or natural habitats.

Botanical

During the field study, vegetation data were collected to identify habitat types and created a habitat map from satellite imagery. Plant species were identified, and distributions were checked using relevant literature. The conservation status of each of the plant species documented was researched using the IUCN data basesand the Uzbek Red List to determine the presence of species of conservation importance. Since the date of field studies was not in the appropriate season for flora researches, it is recommended to conduct secondary field surveys during the maximum vegetation development season (i.e. March to May and September).

During constitute of the preliminary list of the flora of the Kattakum sands, available sources, including reports, literature, herbarium data, as well as photographs taken by field team during the field survey was used. Latin names of plant species in the list of flora are given in alphabetical order, in accordance with the international taxonomic databases, as International Plant Names Index [22], The Plant List [23] and Plants of the World Online [24]. Their synonyms are given according to the "Conspectus Florae Asiae Mediae" [25] (optional) are provided in parentheses.

The field survey was carried out by traditional method of botanical research commonly used for sampling and mapping of vegetation, recognition of floristic composition and spatial patterns of plant communities, that is, the description of standardized sample plots (Field geobotany, 1959–1976[123]; Sutherland, 2006[122]; Kent, 2011[124]).

The structure of vegetation communities was described on 100x100 m geobotanical sample plots (squares) chosen in an area with homogeneous vegetation, representative for each habitat type identified within the project area as a result of previous studies. During the field survey, these habitat types were inspected, their boundaries and character of landscape and vegetation have been clarified. A pair of square sample plots was described for each habitat type: the “impact quadrat” located in the area directly affected by the construction and the “control quadrat” located outside the TPP construction site. In total, 20 geobotanical sample plots were described, they were numbered from 1 to 20. Sample plots 1, 5, 6, 7, 8, 9 and 10 are situated within the construction site of power plant, plots 2, 3, 4, 11, 12, 13, 14 and 15 are “control quadrats” located in surroundings of the project site, and plots 16-20 are situated along the planned power transmission line.

For each sample plot, photographs of the landscape and vegetation were taken using a digital camera (Canon EOS 800D), and following data were recorded: location and physical environment (including GPS coordinates, elevation, topography, and soil type), state of vegetation, level of disturbance, plant association, canopy cover (%), canopy height, all plant species present at the plot, their cover and abundance, phenological stage and height.

Abundance of plant species was determined using the Braun-Blanquet cover-abundance scale (1965) [125] widely used in geobotanical and ecological studies as rapid visual assessment technique, but robust and highly repeatable, minimizing among-observer differences:

+ – occasional and less than 1% cover of the sample plot area;

1 – abundant with low cover, or less abundant but with higher cover, 1–5% of the sample plot area;

2 – abundant with >5–25% of the sample plot area, irrespective of the number of individuals;

3 – >25–50% cover of the sample plot area, irrespective of the number of individuals;

4 – >50–75% cover of the sample plot area, irrespective of the number of individuals;

5 – >75% cover of the sample plot area, irrespective of the number of individuals.

Herpetological

During the field survey an attempt was made to assess the status of reptiles and amphibians in the study area (specification of the species and quantitative composition, territorial distribution, including places of concentration, the state of habitats). However, it should be noted that cold weather did not allow for a full survey in this area, while single records of reptiles do not give a complete understanding of the composition of the biodiversity in the area. Therefore, the combination of field survey and desktop analysis was used.

Patch sampling technique applies when looking for specific target species that might be confined to specific microhabitats within a larger habitat (Jaeger, 1994). The sampling arrays are normally specific microhabitats (e.g., logs, bushes). Each patch sampling had duration of about 30 minutes. The following requisites need to be met for the correct application of this technique:

- no animals leave the quadrat/patch before being observed;
- each patch is defined precisely;
- patches are distributed randomly within the study area.

Localities should be recorded via GPS. For each sampling points, identified species should be recorded on "Field Survey Forms". Also, photos of the species should be taken when it was possible.

Field studies were carried out according to generally accepted zoological methods for identifying species composition. The following methodological guidelines were used in the survey: L. G. Dinesman, M. L. Kaletskaya (1978) [56], V. M. Makeev, A. T. Bozhansky (1988) [57] and N. N. Shcherbak (1989) [58], D. A. Bondarenko, Chelintsev, (1996) [59]. Literature sources and statistical data had been processed.

The main research method used was mixed stationary and transect survey. Points and transects for conducting research were outlined at the project monitoring stations in accordance with different types of habitats.

The field research methodology reflects the following aspects:

- species composition in the study area;
- distribution across habitats;
- daily and seasonal changes in activity;

Thus, the method of quantitative assessment was based on the ecology of the species under consideration, landscape and geographical conditions, season and type of work.

The quantitative assessment of reptiles and amphibians was mainly based on the transect survey. The transect method consists in counting individuals along a fixed long line (transect), on both sides of it, with the duration of the survey determined by the known distance, which is selected depending on the type of reptile and the area, but does not exceed 1 km in one way. In this case, all individuals encountered on the transect are registered, regardless of the distance they are identified at. The perpendicular distance is measured between the transect axis and each individual. The results obtained are used to calculate the density of recorded reptiles. The one-kilometer transect was chosen because heaviest errors arise when long transects are used for species that, like the Russian Tortoise, have high density, daily and seasonal activity cycles fluctuations with high peak values, and are caused by incorrect selection of a minimum survey area for a particular species (Vashetko et al, 2001) [60].

The Russian tortoise population density (D) was calculated using the following formula (Bondarenko, Chelintsev, 1996) [59]:

$$D = \frac{n}{2LB}$$

Where;

n – number of animal individuals recorded on the transect;

L – length of the transect;

B – formula to calculate an effective width of the survey strip:

$$B = W(0,79F + 0,21F^4)$$

Where;

W – width of the limited strip on both sides of the transect axis;

$$F = \frac{2y}{W}$$

The use of perpendicular distances to carry out survey on a strip of limited width excludes underestimation of the population density of the Russian tortoise caused by a decrease in their detectability in remote parts of the survey strip, regardless of the degree of its limitation (Bondarenko and Chelintsev, 1996) [59].

The abundance of the reptiles in habitats was estimated using the following population density scale for 1 ha (Kuzyakin, 1962): 0.1 – 0.9 – rare, 1.0 – 9.9 – common, 10.0 and higher – abundant.

To analyze the availability /non-availability as well as to determine the degree of activity, a Bosch PTD 1 hygro-thermometer with function of infrared measurement of substrate surface temperature. We used also mobile phone with navigator application LocusPro to record survey tracks.

The survey in the project area was carried out both during the day and at night in order to maximize the study of the composition of the herpetofauna of the study area. Also during the night surveys, we used one of the best animal search headlamps Fenix HP30R. At the same time, surveys to study the herpetofauna were carried out only during periods of activity of reptiles - mainly in the morning and evening hours, since in the heat of the day many species hide in burrows from the heat.

Objects were photographed with a Nikon D7200 digital SLR camera with an AF-S Nikkor 18-200mm DX G ED lens.

Ornithological

The main goal of the study was to determine the species composition of the avifauna of the project area. The main research methods are point and transect counts (Bibby et al., 2000) [61]. Point count was used near water reservoir Uchkizil on the base of Delany's Guidance on water bird counts (2010) [62] and potential nesting raptors habitats (loess breaks around Uchkizil).

The transect count was the main ones, . All bird species, numbers and locations were recorded for the project site. –The next optical equipment was used, binocular Nikon ProStaff 7S x10, telescope Swarovski ATX 25-60X65, photo digital camera Nikon D750 with Tamron 200-600mm G2 lens. We used also mobile phone with navigator application LocusPro.The composition of the avifauna was supplemented by our previous studies near project site and Uchkizil, as well as available publications.

Each point observed about 60 minutes in duration. Observations was performed also along transects, simultaneously by two observers, at opposite directions along the midline of the transect route. 250 m distance band from the transect were surveyed and totally 500 m width area was surveyed. All identified bird species seen or heard should be recorded. Identified species were recorded on "Field Survey Forms" for each bird survey point.

Theriologycal

Research methods were divided into two phases: preparatory work before leaving the field was the analysis of detailed topographic maps of the area (scale: 1:100 000, 1:200 000) and satellite images of Google Earth. The maps were used to determine locations (GPS coordinates) of potential sites for setting up trail cameras, observations of the area and laying walking transects. The data were then transferred to the LocusPro smartphone program for further use in the field.

Field works, the following approaches were used to conduct zoological work:

Car Route Transects (CRT). Observations were made during all movements by car. The length of the vehicle transect was recorded using LocusPro. In case of mammal records, coordinates of the place of registration, time and species of the animal were recorded.

Walking Transects (WT), were carried out in pre-planned sites. The length of the route in one biotope was from 300 m to 2 km. The width of the transects for tracks, spoors, and burrows was 5 m; for medium-sized mammals, 200-500 m, depending on the landscape. The length of the transect was determined using LocusPro. Time of the transect start and end, biotope, and presence/absence and type of anthropogenic impact were recorded. During the transect surveys, the data obtained were entered into a field journal. In addition, animals and traces of their life activities were photographed (if possible). Binoculars were used to survey the area during the walking transects and at all points where stops were made.

During fauna survey, 18.5 km were covered by routes (transects) during the field trip for herpetafaunal and mammal observations. All facilities encountered were photographed and recorded in a field notebook. To analyze the availability /non-availability as well as to determine the degree of activity, a Nasedal hygro-thermometer with an elongated sensor was used to determine the temperature and humidity of the air and an infrared remote electronic thermometer to determine the temperature of the substrate DT-8380. A digital camera with wide-focus lens was used for visual record. In addition, in this section, it is tried to show the primary number of reptiles found during survey at the counting points (transects) and the average density at each of their transects derived by analyzing the primary data. In order to obtain more comprehensive information on vertebrate representation in the area, surveyed not only the area proposed for the construction, but also adjacent areas - the coastline on the east, south and west sides. The ornithological survey does not allow a full assessment of nesting birds in the project area as nesting ended in June. However, conclusions was made based on habitat conditions and the location of the area, how the area is used by birds. In total the survey covered 5 sites in different biotopes. In addition, the breeding and migratory habits were researched using Bird Life International databases to derive the species lists. Birds that could potentially frequent the proposed Project site have been classified according to their migratory, breeding and resident statuses.

Considering that the activity patterns of many terrestrial species are hugely variable (i.e. many are nocturnal), it is possible that certain small species (particularly small mammals, reptiles and amphibians) could have been overlooked during the daily site surveys.

Also during the night surveys, Fenix HP30R, one of the best animal search headlights, was used.

9.3.3 Habitat Classification

Like other intermountain valleys of Central Asia, the Surkhan-Sherabad Valley is a densely populated ancient agricultural oasis.. The vegetation of the project area is typical for southern deserts of Central Asia. Plant communities are characterized with sparse canopy cover, low species diversity and low to high level of anthropogenic disturbance. The canopy cover is 10–30% on most areas, 5-10% or less (sometimes almost 0%) on sandy cliffs, outcrops of sandstones, shore of the water reservoir, and on strongly disturbed areas. The areas with low level of disturbance are situated deep in the sand massif, along the planned power line, while the habitats of the construction site are medium to strongly disturbed.

Most of the Surkhan-Sherabad Valley is occupied by cultural landscapes (mainly agricultural landscape and residential landscape). Areas of natural landscapes preserved in the central part of the valley on the Kattakum sandy massif and on the Khaudaktau Upland are intensively used by the local population for grazing, including the project area.

Construction works will be carried out in and around the project layout of the facility, and the entire area has been exposed to low to high levels of anthropogenic disturbance due to grazing, garbage and mining. Local shrub species that form the Green Belt edge visual barrier will be used in and around the project construction site.

The habitat classification was conducted based on the available literature data and the data obtained during the field trip on the confinement of phytocenoses to a certain range of elevations, relief and soils, stock geobotanical descriptions, topographic, landscape and geobotanical maps, field survey and interpretation of satellite images available on Internet resources [27]. According to the studies of 2021 and 2022, following 7 types of biotopes were preliminarily identified in the project area (see Figure 72, Figure 73, Figure 74, Table 76 and Table 77.

- Flat or wavy sandy plain (Flat or wavy plain with sandy or sandy-loamy soil) with desert bindweed-ephemeral- ephemeroid (Convolvulus hamadae, Carex pachystylis, Carex physodes, Poa bulbosa, Bromus tectorum, Hordeum murinum subsp. leporinum), saltwort-desert bindweed-ephemeroid (Convolvulus hamadae, Salsola arbuscula, S. orientalis, Carex pachystylis, Carex physodes, Poa bulbosa) and ephemeroid-sagebrush (Artemisia diffusa, Carex physodes, Carex pachystylis, Poa bulbosa) vegetation;
- Shallow, semi-fixed sands (Semi-fixed hilly sands) with ephemeral-ephemeroid- Calligonum (Calligonum microcarpum, C. setosum, Carex physodes, Poa bulbosa, Bromus tectorum, Hordeum murinum subsp. leporinum) and ephemeral-desert bindweed-calligonum (Calligonum microcarpum, C. setosum, Carex physodes, Poa bulbosa, Bromus tectorum, Hordeum murinum subsp. bulbosa, Bromus tectorum, Hordeum murinum subsp. leporinum) vegetation, in places with saxaul and calligonum;
- Outcrops of gypsum (Sandy cliffs and outcrops of sandstones)-bearing and saline sandstones with camel thorn-saltwort vegetation (Salsola arbusculiformis, S. orientalis, Climacoptera sp., Halostachys caspica, Halimocnemis sp., Suaeda sp., Alhagi kirghisorum), in some places with tamarisk (Tamarix laxa) and bean caper (Zygophyllum atriplicoides);
- Anthropogenically disturbed areas (Transformed habitat) with sparse secondary weed-ephemeral vegetation (Poa bulbosa, Bromus tectorum, Hordeum murinum subsp. leporinum, Alhagi kirghisorum, Peganum garmala, Sophora pachycarpa, Salsola paulsenii).
- Coastal zone of the water reservoir almost devoid of vegetation due to water level fluctuations, sometimes with small plots of reeds (Phragmites australis), tamarisk (Tamarix ramosissima,

T. hispida), camel thorn (Alhagi pseudalhagi), Ravenna grass (Tripidium ravennae (Erianthus ravennae)) or annual saltworts (Caroxylon incanescens, C. turkestanicum, Climacoptera sukaczevii, Salsola paulsenii, Suaeda arcuata);

- Transformed habitat – abandoned channel, abandoned sand quarries, oil wells, garbage dumps, etc., with sparse communities of saltworts (Salsola rosmarinus, Haloxylon griffithii, Halothamnus subaphyllus, Xylosalsola arbuscula, Caroxylon incanescens, C. scleranthum), camel thorn (Alhagi pseudalhagi, A. kirghisorum) and desert blindweed (Convolvulus hamadae), sometimes with tamarisk (Tamarix ramosissima, T. hispida);
- Banks of channel with tamarisk scrub (Tamarix ramosissima, T. hispida, T. hohenackeri), camel thorn (Alhagi pseudalhagi) and annual saltworts (Caroxylon incanescens, C. scleranthum, C. turkestanicum, Salsola paulsenii).
- Water reservoir with water plants and algae.

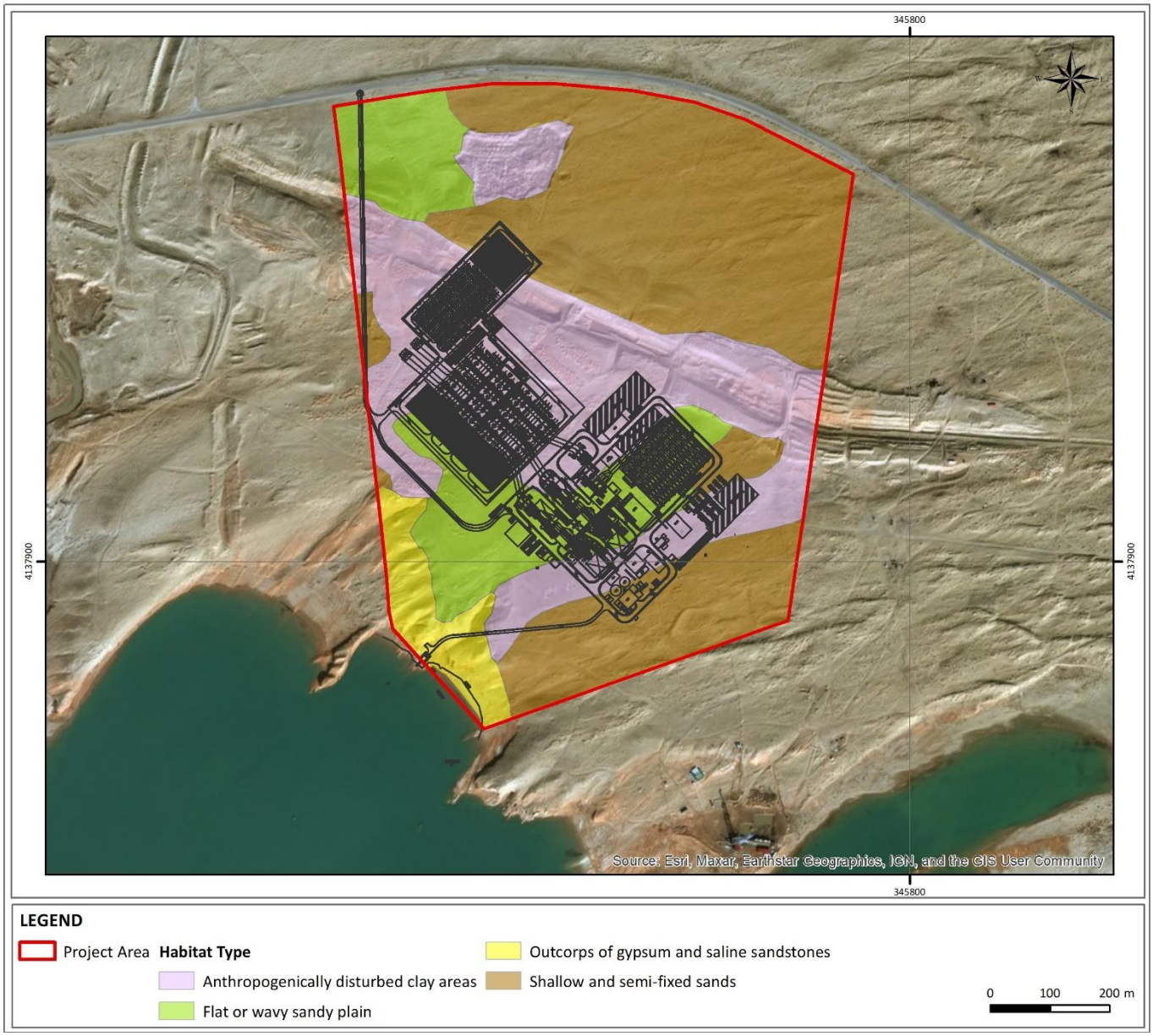


Figure 72: Biotope Map of The Project Area

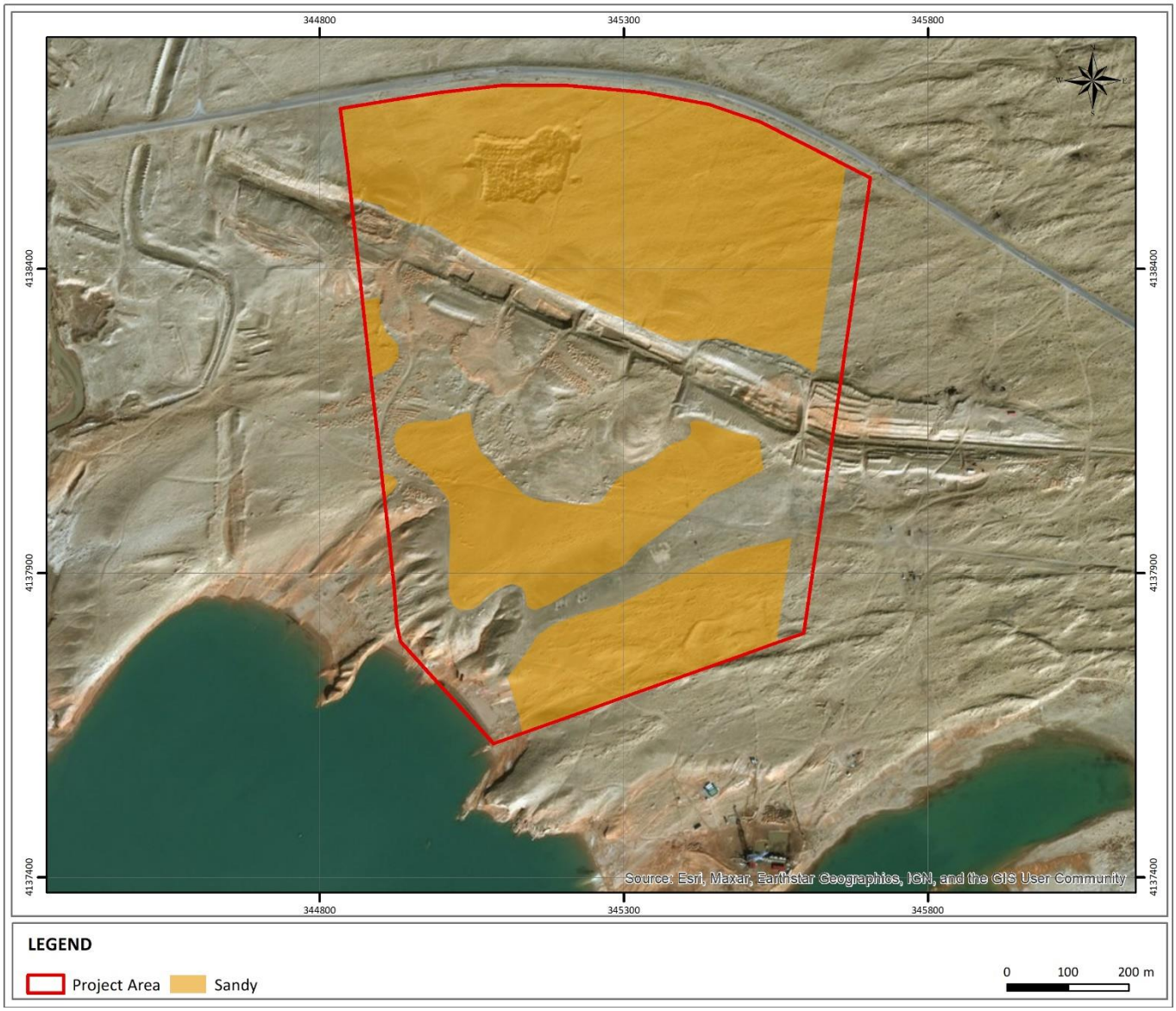


Figure 73: The Sandy Area in The Project Area

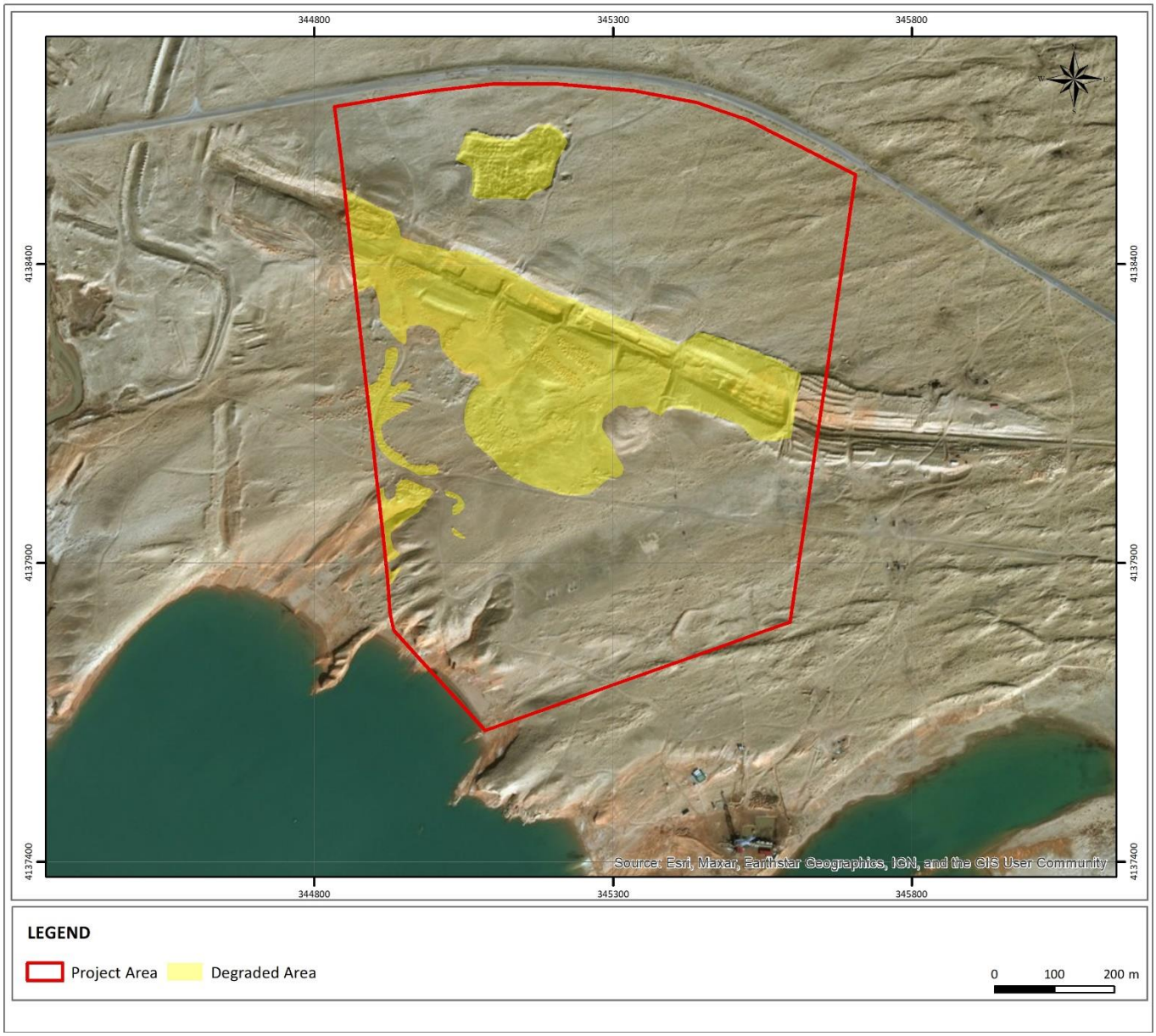


Figure 74: Map of Degraded Area Due to Clay Extraction

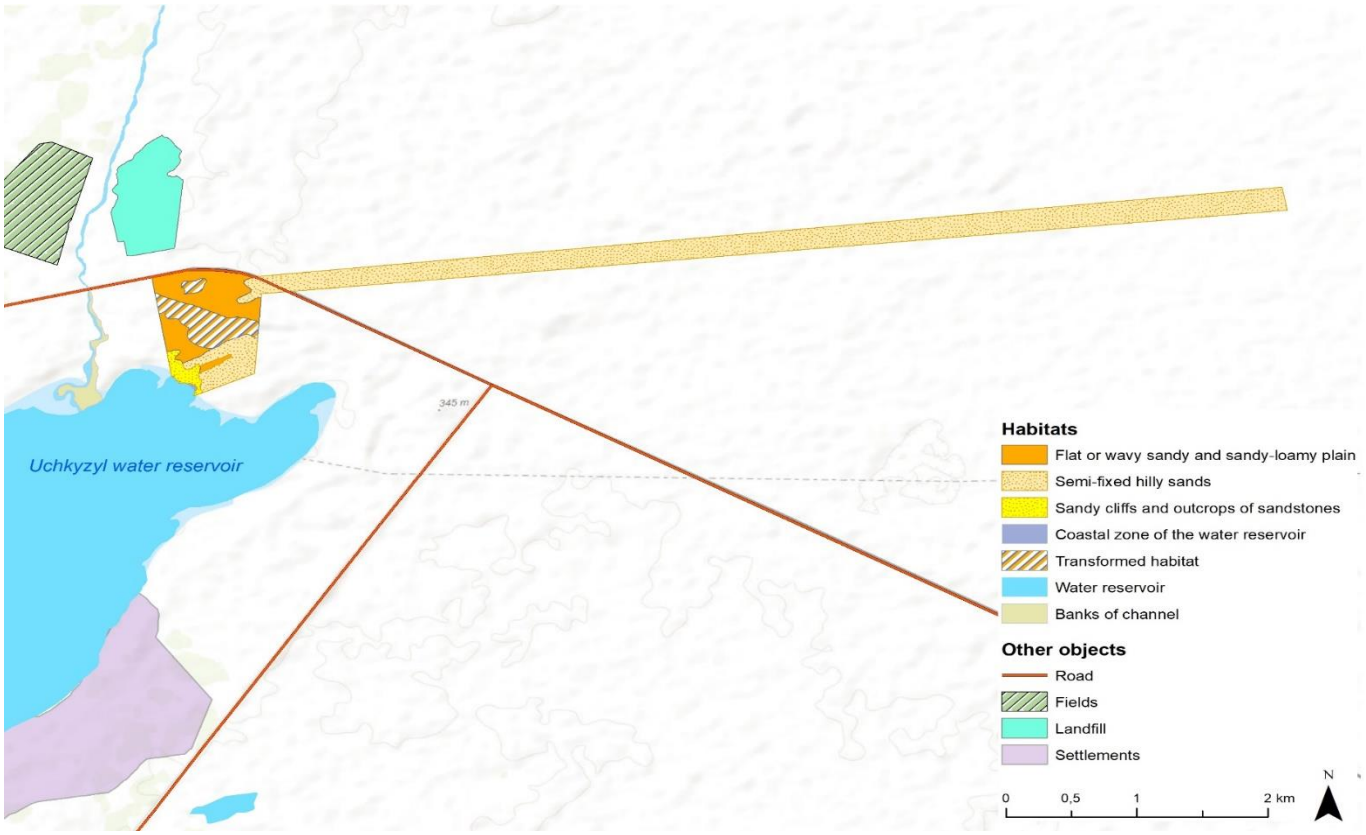


Figure 75: Habitat Map of The Project Area and Transmission Line

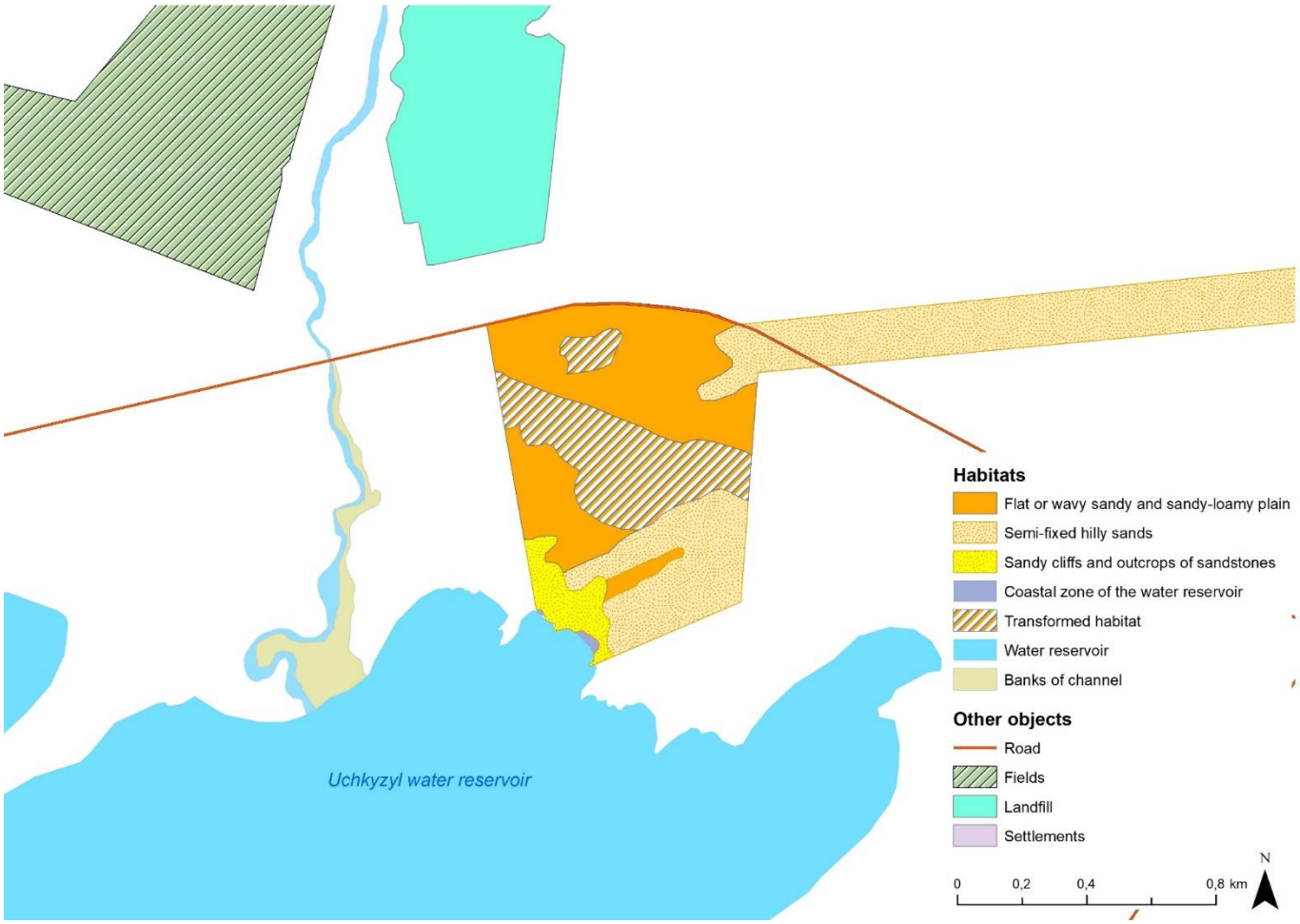


Figure 76: Habitat Map of The Project Area

Table 108: Habitat Types and The Level of Anthropogenic Disturbance in The Project Area

Plot number	The level of anthropogenic disturbance	Location	Habitat
Sample plot 1	Medium	Inside the project area	Eroded sandy cliffs, outcrops of sandstones and small areas of shallow blown sands
Sample plot 2	Medium	Outside the project area	The banks of the channel Zang in its lower reaches.
Sample plot 3	Medium	Outside the project area	Eroded sandy cliffs and outcrops of sandstones with small areas of shallow blown sands.
Sample plot 4	High	Outside the project area	Bare shore of the water reservoir with remains of concrete slabs.
Sample plot 5	Medium	Inside project area	Wavy sandy plain
Sample plot 6	High	Inside project area	Transformed habitat (abandoned channel or ditch).
Sample plot 7	Medium	Inside project area	Semi-fixed hilly sands with psammophilous open scrubs.
Sample plot 8	High	Inside project area	Transformed habitat (abandoned channel or ditch).
Sample plot 9	Medium	Inside project area	Wavy sandy plain with slightly gravelly surface.
Sample plot 10	Medium	Inside project area	Semi-fixed hilly sands with psammophilous open scrubs.
Sample plot 11	Medium	Outside the project area	Wavy sandy plain.
Sample plot 12	High	Outside the project area	Transformed habitat (abandoned channel or ditch, and the oil well).
Sample plot 13	Medium	Outside the project area	Semi-fixed hilly sands with psammophilous open scrubs.
Sample plot 14	Medium	Outside the project area	Wavy sandy plain.
Sample plot 15	High	Outside the project area	Transformed habitat (abandoned channel).
Sample plot 16	Medium	Inside planned power line	Semi-fixed hilly sands covered by psammophilous open scrubs.
Sample plot 17	Low	Inside planned power line	Semi-fixed hilly sands with psammophilous open scrubs.
Sample plot 18	Low	Inside planned power line	Semi-fixed hilly sands with psammophilous open scrubs.
Sample plot 19	Low	Inside planned power line	Semi-fixed hilly sands with psammophilous open scrubs.
Sample plot 20	Low	Inside planned power line	Semi-fixed hilly sands with psammophilous open scrubs.

In general, there are degraded areas of anthropogenic origin in the project area. There are quarries for clay extraction to produce bricks and sand extraction. All this led to a strong degradation of the substrate on the territory. There are anthropogenically disturbed areas from low to high levels inside and outside the project area. Due to this situation, there is no natural habitat area in the project area. In the quadrat method studies conducted for the flora within the scope of the survey autumn 2022, each habitat and the level of anthropogenic disturbance to which the habitat is exposed were determined. Anthropogenic disturbance level to which habitats are exposed and the sample plots where habitats are represented are given in Table 108. Sample plot locations are given in Table 110. (see Figure 87). The photographs of these habitats are represented between Figure 77 to Figure 83.

Figure 77: Wavy Sands with Saltwort-Desert Blindweed-Ephemeroid Vegetation

Figure 78: Semi-Fixed Hilly Sands on the Background – Anthropogenically Disturbed Area (Clay Extraction Place)

Figure 79: Anthropogenically Disturbed Area (Clay Extraction Place) With Community Formed by Camel Thorn, Saltworts and Weeds

Figure 80: Haloxylon And Sagebrush Communities on Fixed Sands

Figure 81: Steep Northern Coast of The Uchkizil Water Reservoir, With Outcrops of Saline Sandstones and With Sparse Camel Thorn-Saltwort Vegetation

Figure 82: Saline Lands with Tamarisk Thickets Near the Shore of Water Reservoir

Figure 83: Anthropogenically Disturbed Area with Camel Thorn And Weeds

9.3.4 Terrestrial Ecological Surveys

9.3.4.1 Flora and Vegetation

The flora and vegetation of the Surkhandarya region of the Republic of Uzbekistan, and in particular, the Surkhan-Sherabad valley are well studied. The history of botanical research in this region goes back about 140 years.

According to the modern scheme of botanical-geographical zoning of Uzbekistan the Uchkizil project area belongs to the Surkhan-Sherabad botanical-geographical region of the West Gissar district of the Mountainous Central Asian province. This botanical-geographical region covers the Surkhan-Sherabad valley, expanding from north to south, and the foothills of the Gissar ridge, Kugitang and Babatag, bordering it.

According to the typology of vegetation used in Uzbekistan, the predominant type of vegetation in the Kattakum sands is psammophilic vegetation of sandy deserts (Psammophyta), on the outcrops of sandstones, gypsophilic vegetation (Gypsophyta), and along the coast of the Uchkizil Reservoir and in saline depressions among the sands, there is fragmentary saline vegetation (Halophyta).

According to the literature data within the sandy massif of Kattakum, on hilly sands, psammophilic arboreal and shrub vegetation is developed, represented mainly by communities of the Juzgun formation (Calligoneta), such as the ephemeral-ephemeroid-saxaul-juzgun (Calligoneta) , *C. setosum, Haloxylon persicum, Carex physodes, Poa bulbosa, Bromus tectorum, Hordeum murinum subsp.leporinum*, *Calligonum microcarpum, Convolvulus hamadae, and Hordeum murinum subsp.leporinum*. In the vertical structure of these kindred, a shrub layer with a closeness of up to 0.3–0.4 is distinguished, formed by white saxaul bushes up to 2–2.5 m high and kandym or juzgun 100–150 cm high, in some places with the participation of sandy acacia (*Ammodendron conollyi*).

The herbaceous layer of the above associations is dominated by the most important edificator of the sandy deserts of Central Asia - rhizome psammophyte bloated sedge or silt (*Carex physodes*) as well as bulbous bluegrass (*Poa bulbosa*) and annual grasses. The projective cover of the grass layer is low, on semi-fixed sands, on average, up to 15–20%, and on broken sands it does not exceed 5–10%. Partec-ephemeral-ephemeroid (*Convolvulus hamadae, Carex pachystylis, Carex physodes, Poa bulbosa, Bromus tectorum, Hordeum murinum subsp.leporinum*), saltwort-partek-ephemeral orientalis, Carex pachystylis, Carex physodes, Poa bulbosa) and ephemeroid-wormwood (*Artemisia diffusa, Carex physodes, Carex pachystylis, Poa bulbosa*) phytocenoses, in places with local thickets of yantak or camel thorn (Alhagi) kirghalaum Persian (*Hulthemia persica*), which are confined to anthropogenically disturbed areas around settlements, livestock farms, etc. Sandstone outcrops are associated with sparse gypsophyte and ephemeroid-saltwort associations (*Salsola arbusculiformis, S. orientalis, Poa bulbosa, Carex pachystylis*) or saltwort (*Salsola arbusculiformis, S. orientalis, Climacoptera sp., Halimocnehaeda sp. kirghisorum*) kindred, in places with tamarisk (*Tamarix laxa*), carabarak (Halostachys caspica), and green leaf (*Zygophyllum atriplicoides*). In saline areas in relief depressions and near the shore of the reservoir, amber-saltwort-tamarisk (Tamarix laxa, Halostachys caspica, Climacoptera sp., Salsola sp., Suaeda sp, Alhagi kirghisorum) or annual saltwort kindred (*Climacoptera sp., Salsola sp., Suaeda sp*.).

The species composition of phytocenoses is formed by natural dominants, subdominants, and characteristic species. In general, the degree of vegetation degradation in the Kattakum sandy massif can be estimated as average. The main negative anthropogenic factors are grazing, cutting down psammophilic shrubs for firewood, spontaneous expansion of the roads network.

The flora survey was carried out in the Project area in 2021 and the observation locations for 2021 are presented in Figure 84.

Figure 84: Flora Survey Observation Locations

Species included in the IUCN Red List with the status of CR, EN or VU, according to preliminary data, are absent on the territory.

The preliminary list of the flora of the Kattakum sands, compiled on the basis of available sources, including reports, literature, herbarium data, as well as photographs taken by field team during the field survey, includes 131 species (see Table 109), this check-list contains mainly typical representatives of the flora of sandy and saline deserts of the southern part of Central Asia. All species are native. Latin names of plant species in the table are given in alphabetical order, in accordance with the international taxonomic databases, as International Plant Names Index [22], The Plant List and Plants of the World Online [23]. Their synonyms are given according to the "Conspectus Florae Asiae Mediae" [25] (optional) are provided in parentheses. Some representatives of the flora of the project area are given in Table 109 with family and status of each species. The families are listed according to the modern plant system APG IV [28]. The species assessed as threatened in the national Red Book or IUCN Red List, as well as alien species and weeds are indicated in the "Status" column. The status of alien species (non-native in Uzbekistan) and weeds was identified on the basis of available data [29] [30].

Table 109: Preliminary Flora List of Project Area of Influence

Plant species	Family	IUCN Category	Red Book of RUz
Adiantum capillus-veneris	Pteridaceae	LC (Least Concern)	N/A Native
Aeluropus litoralis	Poaceae	LC (Least Concern)	N/A Native
Agriophyllum lateriflorum	Amaranthaceae	N/A	N/A Native
Agriophyllum latifolium	Amaranthaceae	N/A	N/A Native

Plant species	Family	IUCN Category	Red Book of RUz
Alhagi canescens	Fabaceae	N/A	N/A Native
Alhagi kirghisorum	Fabaceae	N/A	N/A Native
Allium borszczowii	Amaryllidaceae	N/A	N/A Native
Allium caspium	Amaryllidaceae	N/A	N/A Native
Allium griffithianum	Amaryllidaceae	N/A	N/A Native
Allium ophiophyllum	Amaryllidaceae	N/A	N/A Native
Allium protensum	Amaryllidaceae	N/A	N/A Native
Alyssum desertorum	Brassicaceae	N/A	N/A Native
Ammodendron conollyi	Fabaceae	N/A	N/A Native
Arnebia coerulea	Boraginaceae	N/A	N/A Native
Arnebia decumbens	Boraginaceae	N/A	N/A Native
Artemisia diffusa	Asteraceae	N/A	N/A Native
Astragalus campylorrhynchus	Fabaceae	N/A	N/A Native
Astragalus chivensis	Fabaceae	N/A	N/A Native
Astragalus excedens	Fabaceae	N/A	N/A Native
Astragalus filicaulis	Fabaceae	N/A	N/A Native
Astragalus kelifi	Fabaceae	N/A	N/A Native
Astragalus oxyglottis	Fabaceae	N/A	N/A Native
Astragalus persipolitanus	Fabaceae	N/A	N/A Native
Astragalus petunnikovii	Fabaceae	N/A	N/A Native
Astragalus rubromarginatus	Fabaceae	N/A	N/A Native
Astragalus tribuloides	Fabaceae	N/A	N/A Native
Astragalus unifoliolatus	Fabaceae	N/A	N/A Native
Atriplex dimorphostegia	Amaranthaceae	N/A	N/A Native
Atriplex moneta	Amaranthaceae	N/A	N/A Native
Bromus tectorum	Poaceae	N/A	N/A Native (Ruderal)
Calligonum caput-medusae	Polygonaceae	N/A	N/A Native (Natural Dominant)
Calligonum microcarpum	Polygonaceae	N/A	N/A Native (Natural Dominant)
Calligonum mongolicum	Polygonaceae	N/A	N/A Native
Calligonum setosum	Polygonaceae	N/A	N/A Native (Natural Dominant)
Capparis spinosa	Capparaceae	N/A	N/A Native
Carex pachystilis	Cyperaceae	N/A	N/A Native (Natural Dominant)

Plant species	Family	IUCN Category	Red Book of RUz
Carex physodes	Cyperaceae	N/A	N/A Native (Natural Dominant)
Caroxylon incanescens	Amaranthaceae	N/A	N/A Native
Caroxylon orientale	Amaranthaceae	N/A	N/A Native
Caroxylon scleranthum	Amaranthaceae	N/A	N/A Native
Carthamus oxyacanthus	Asteraceae	N/A	N/A Native (Natural Dominant)
Ceratocarpus arenarius	Amaranthaceae	N/A	N/A Native (Ruderal)
Ceratocephala falcata	Ranunculaceae	N/A	N/A Native (Ruderal)
Chorispora tenella	Brassicaceae	N/A	N/A Native
Climacoptera longistylosa	Amaranthaceae	N/A	N/A Native
Climacoptera sukaczevii	Amaranthaceae	N/A	N/A Native
Climacoptera turcomanica.	Amaranthaceae	N/A	N/A Native
Colchicum robustum	Colchicaceae	N/A	N/A Native
Consolida camptocarpa	Ranunculaceae	N/A	N/A Native
Consolida rugulosa	Ranunculaceae	N/A	N/A Native
Convolvulus hamadae	Convolvulaceae	N/A	N/A Native
Cousinia oxiana	Asteraceae	N/A	N/A Native
Cousinia patentispina	Asteraceae	N/A	N/A Native
Cousinia pusilla	Asteraceae	N/A	N/A Native
Cousinia resinosa	Asteraceae	N/A	N/A Native
Cutandia memphitica	Poaceae	N/A	N/A Native
Cynanchum acutum subsp. sibiricum	Apocynaceae	N/A	N/A Native
Descurainia sophia	Brassicaceae	N/A	N/A Native (Ruderal)
Eminium lehmanii	Araceae	N/A	N/A Native
Epilasia acrolasia	Asteraceae	N/A	N/A Native
Eremopyrum bonaepartis	Poaceae	N/A	N/A Native
Eremopyrum orientale	Poaceae	N/A	N/A Native
Erodium ciconium	Geraniaceae	N/A	N/A Native (Ruderal)
Erodium cicutarium	Geraniaceae	N/A	N/A Native (Ruderal)
Fritillaria gibbosa	Liliaceae	N/A	N/A Native
Gagea divaricata	Liliaceae	N/A	N/A Native
Gagea pseudoreticulata	Liliaceae	N/A	N/A Native
Gagea stipitata	Liliaceae	N/A	N/A Native
Gamanthus gamocarpus	Amaranthaceae	N/A	N/A Native
Gastrocotyle hispida	Boraginaceae	N/A	N/A Native

Plant species	Family	IUCN Category	Red Book of RUz
Halimocnemis longifolia	Amaranthaceae	N/A	N/A Native
Halimocnemis mollissima	Amaranthaceae	N/A	N/A Native
Halimocnemis villosa	Amaranthaceae	N/A	N/A Native
Halocharis hispida	Amaranthaceae	N/A	N/A Native
Halocnemum strobilaceum	Amaranthaceae	N/A	N/A Native
Halostachys caspica	Amaranthaceae	N/A	N/A Native
Halothamnus subaphyllus	Amaranthaceae	N/A	N/A Native
Haloxylon griffithii	Amaranthaceae	N/A	N/A Native
Haloxylon persicum	Amaranthaceae	N/A	N/A Native
Heliotropium arguzioides	Boraginaceae	N/A	N/A Native
Heliotropium dasycarpum.	Boraginaceae	N/A	N/A Native
Heliotropium lasiocarpum	Boraginaceae	N/A	N/A Native
Heliotropium supinum	Boraginaceae	N/A	N/A Native
Holosteum umbellatum	Caryophyllaceae	N/A	N/A Native
Horaninovia ulicina	Amaranthaceae	N/A	N/A Native
Hordeum murinum subsp. leporinum	Poaceae	N/A	N/A Native (Ruderal)
Hulthemia persica	Rosaceae	N/A	N/A Native (Ruderal)
Hyalea pulchella	Asteraceae	N/A	N/A Native
Hyoscyamus pusillus.	Solanaceae	N/A	N/A Native
Iris longiscapa	Iridaceae	N/A	N/A Native
Ixiolirion tataricum	Ixioliriaceae	N/A	N/A Native
Koelpinia linearis	Asteraceae	N/A	N/A Native
Lagonychium farctum	Fabaceae	N/A	N/A Native (Ruderal)
Leptaleum filifolium	Brassicaceae	N/A	N/A Native
Lomelosia olivieri	Caprifiliaceae	N/A	N/A Native
Meniocus linifolius	Brassicaceae	N/A	N/A Native
Nonea caspica	Boraginaceae	N/A	N/A Native
Oligochaeta vvedenskyi	Asteraceae	N/A	VU Native
Onopordum leptolepis	Asteraceae	N/A	N/A Native (Ruderal)
Oreosalsola arbusculiformis	Amaranthaceae	N/A	N/A Native
Peganum harmala	Nitrariaceae	N/A	N/A Native (Ruderal)
Phlomoides boissieriana	Lamiaceae	N/A	N/A Native
Phragmites australis.	Poaceae	N/A	N/A Native
Poa bulbosa.	Poaceae	N/A	N/A Native (Natural Dominant)

Plant species	Family	IUCN Category	Red Book of RUz
Ranunculus pinnatisectus	Ranunculaceae	N/A	N/A Native
Ranunculus sewerzowii	Ranunculaceae	N/A	N/A Native
Salsola iberica	Amaranthaceae	N/A	N/A Native (Ruderal)
Salsola paulsenii	Amaranthaceae	N/A	N/A Native (Ruderal)
Senecio subdentatus	Asteraceae	N/A	N/A Native
Smirnowia turkestana	Fabaceae	N/A	N/A Native
Sophora pachycarpa	Fabaceae	N/A	N/A Native
Sphaerophysa salsula	Fabaceae	N/A	N/A Native
Stipagrostis karelinii	Poaceae	N/A	N/A Native
Stipagrostis pennata	Poaceae	N/A	N/A Native
Stipagrostis plumosa	Poaceae	N/A	N/A Native
Streptoloma desertorum	Brassicaceae	N/A	N/A Native
Strigosella grandiflora.	Brassicaceae	N/A	N/A Native
Strigosella turkestanica	Brassicaceae	N/A	N/A Native
Suaeda arcuata	Amaranthaceae	N/A	N/A Native
Suaeda microsperma	Amaranthaceae	N/A	N/A Native
Tamarix laxa	Tamaricaceae	N/A	N/A Native
Tamarix meyeri.	Tamaricaceae	N/A	N/A Native
Tamarix ramosissima	Tamaricaceae	N/A	N/A Native
Tribulus macropterus.	Zygophyllaceae	N/A	N/A Native
Tribulus terrestris.	Zygophyllaceae	N/A	N/A Native (Ruderal)
Trigonella geminiflora	Fabaceae	N/A	N/A Native
Xanthium spinosum	Asteraceae	N/A	N/A Native (Ruderal)
Xanthium strumarium.	Asteraceae	N/A	N/A Native (Ruderal)
Xylosalsola arbuscula	Amaranthaceae	N/A	N/A Native
Xylosalsola richteri	Amaranthaceae	N/A	N/A Native
Zygophyllum atriplicoides	Zygophyllaceae	N/A	N/A Native

The preliminary list of the flora of the Kattakum sands, compiled on the basis of reports, literature data, herbarium data and photographs taken by field team during the field survey includes 131 species, mainly typical representatives of the flora of sandy and saline deserts of the southern part of Central Asia. The vast majority of species are native; the number of alien plant species is extremely insignificant.

Only 3 species included in the Red Book of Uzbekistan (*Allium rhodanthum, Dipcadi turkestanicum, Oligochaeta vvedenskyi*) are noted based on literature and herbarium data for the sandy massifs of Kattakum and Khaudaktau in the central part of the Surkhan-Sherabad valley, the first two of them are known only from Khaudaktau and have not been noted for the past several decades, despite special searches. Nevertheless, there is a possibility of finding these species in the Kattakum sands (not excluding the project area).

The photos belonging to observed plant species are given Figure 85.

Convolvulus hamadae

Zygophyllum atriplicoides

Adiantum capillus-veneris

Xanthium strumarium and Tamarix sp.

Haloxylon persicum

Calligonum caput-medusae

Figure 85: The Examples Observed Plant Species in Project Area

Survey in September 2022

Flora research was carried out in the project area in September 2022 and the observation sites covering the plant site and the 9-km overhead power line are shown in Figure 86 and Figure 87. Descriptions of plant communities made during the field survey are presented below.

The main tasks of expert-botanist for the September survey, 2022, are following:

1. Carrying out the field botanical survey and processing of field data, including collection of the vegetation data to identify habitat types. During the field study, vegetation data should be collected using the standardized quadrats method [122] with a fixed sample size that allows statistical comparison of conditions before and after the construction of the project site. At each sample site, a pair of quadrats should be instituted: one quadrat (impact quadrat) should be located in the area directly affected by the construction and one quadrat (control quadrat) should located outside the area directly affected by the construction but within the same habitat type and at the same elevation in order to match the two quadrats and minimize variation between them. Quadrat locations should be recorded with GPS device.

2. Creation of a habitat map on the basis of visual interpretation of satellite imagery, using the data of field survey.

3. Identification of plant species recorded during the field survey and compilation of the check-list of flora. Distribution of plant species should be checked using relevant literature. The conservation status of each plant species should be checked using the IUCN Red List and the Red Data Book of the Republic of Uzbekistan [35] to determine the presence of species of conservation importance.

It should be noted that currently only 258 taxa of more than 4380 plant species recorded for the flora of Uzbekistan [35] were assessed by IUCN, 16 species of them were included in the IUCN Red List [31] as threatened (5 – CR, 8 – EN, 3 – VU), 8 of them are redlisted at the national level. The majority of species of the national flora has not yet been assessed by IUCN and belongs to NE category – Not Evaluated.

Thus, the vegetation of the project area is typical for southern deserts of Central Asia. Plant communities are characterized with sparse canopy cover, low species diversity and low to high level of anthropogenic disturbance. The canopy cover is 10–30% on most areas, 5-10% or less (sometimes almost 0%) on sandy cliffs, outcrops of sandstones, shore of the water reservoir, and on strongly disturbed areas. The areas with low level of disturbance are situated deep in the sand massif, along the planned power line, while the habitats of the construction site are medium to strongly disturbed.

In total, 61 plant species of 17 families were recorded within the project area during the field survey in September, 2022 5 of them are alien weeds.

Within the area of planned thermal power plant and along power transmission line, species listed as CR, EN or VU on the IUCN Red List, as well as plants included in the Red Data Book of Uzbekistan[35] were not found. One species (*Salsola rosmarinus*) is assessed as endangered (EN) in the neighboring country, Tajikistan[121]. *Salsola rosmarinus* is not endemic, it has a wide geographical range covering Middle East and southern part of Central Asia (Egypt, Arabian Peninsula, Iran, Afghanistan, Uzbekistan, Turkmenistan, and Tajikistan).

Most of species recorded for the project area are typical for southern deserts of Central Asia and more or less common and widely spread. Most of plants are native, the number of alien species is small (5), and their role in vegetation cover is unsignificant.

Table 110: Coordinates and Habitats at The Botanical Plots

Plot number	Coordinates	Altitude	Habitat
Sample plot 1	37°22'26.47" N 67°14'59.05" E	288-294 m.s.l.	Eroded sandy cliffs, outcrops of sandstones and small areas of shallow blown sands
Sample plot 2	37°22'28.25" N 67°14'30.19" E	283 m.s.l.	The banks of the channel Zang in its lower reaches.
Sample plot 3	37°21'47.05" N 67°15'03.19" E	282-288 m.s.l.	Eroded sandy cliffs and outcrops of sandstones with small areas of shallow blown sands.
Sample plot 4	37°21'32.59" N 67°11'57.19" E	282 m.s.l	Bare shore of the water reservoir with remains of concrete slabs.
Sample plot 5	37°22'51.06" N 67°15'14.67" E	302 m.s.l.	Wavy sandy plain
Sample plot 6	37°22'45" N 67°14'59.55" E	294 m.s.l.	Transformed habitat (abandoned channel or ditch).
Sample plot 7	37°22'33.21" N 67°15'18.48" E	302 m.s.l.	Semi-fixed hilly sands with psammophilous open scrubs.
Sample plot 8	37°22'39.66" N 67°15'19.16" E	292 m.s.l.	Transformed habitat (abandoned channel or ditch).
Sample plot 9	37°22'51.06" N 67°15'14.67" E	299 m.s.l.	Wavy sandy plain with slightly gravelly surface.
Sample plot 10	37°22'23.39" N 67°15'04.55" E	296 m.s.l.	Semi-fixed hilly sands with psammophilous open scrubs.

Plot number	Coordinates	Altitude	Habitat
Sample plot 11	37°22’58.19” N 67°15’25.14” E	291 m.s.l.	Wavy sandy plain.
Sample plot 12	37°22’36.31” N 67°15’28.45” E	290 m.s.l.	Transformed habitat (abandoned channel or ditch, and the oil well).
Sample plot 13	37°22’32.39” N 67°15’49.42” E	300 m.s.l.	Semi-fixed hilly sands with psammophilous open scrubs.
Sample plot 14	37°22’32.26” N 67°14’38.7” E	293 m.s.l.	Wavy sandy plain.
Sample plot 15	37°22’49.51” N 67°14’47.46” E	288-291 m.s.l.	Transformed habitat (abandoned channel).
Sample plot 16	37°22’51.84” N 67°15’52.34” E	295 m.s.l.	Semi-fixed hilly sands covered by psammophilous open scrubs.
Sample plot 17	37°22’53.6” N 67°16’31.73” E	289 m.s.l.	Semi-fixed hilly sands with psammophilous open scrubs.
Sample plot 18	37°22’57.21” N 67°18’04.07” E	290 m.s.l.	Semi-fixed hilly sands with psammophilous open scrubs.
Sample plot 19	37°23’02.11” N 67°19’45.32” E	294 m.s.l.	Semi-fixed hilly sands with psammophilous open scrubs.
Sample plot 20	37°23’04.29” N 67°20’37” E	300 m.s.l.	Semi-fixed hilly sands with psammophilous open scrubs.

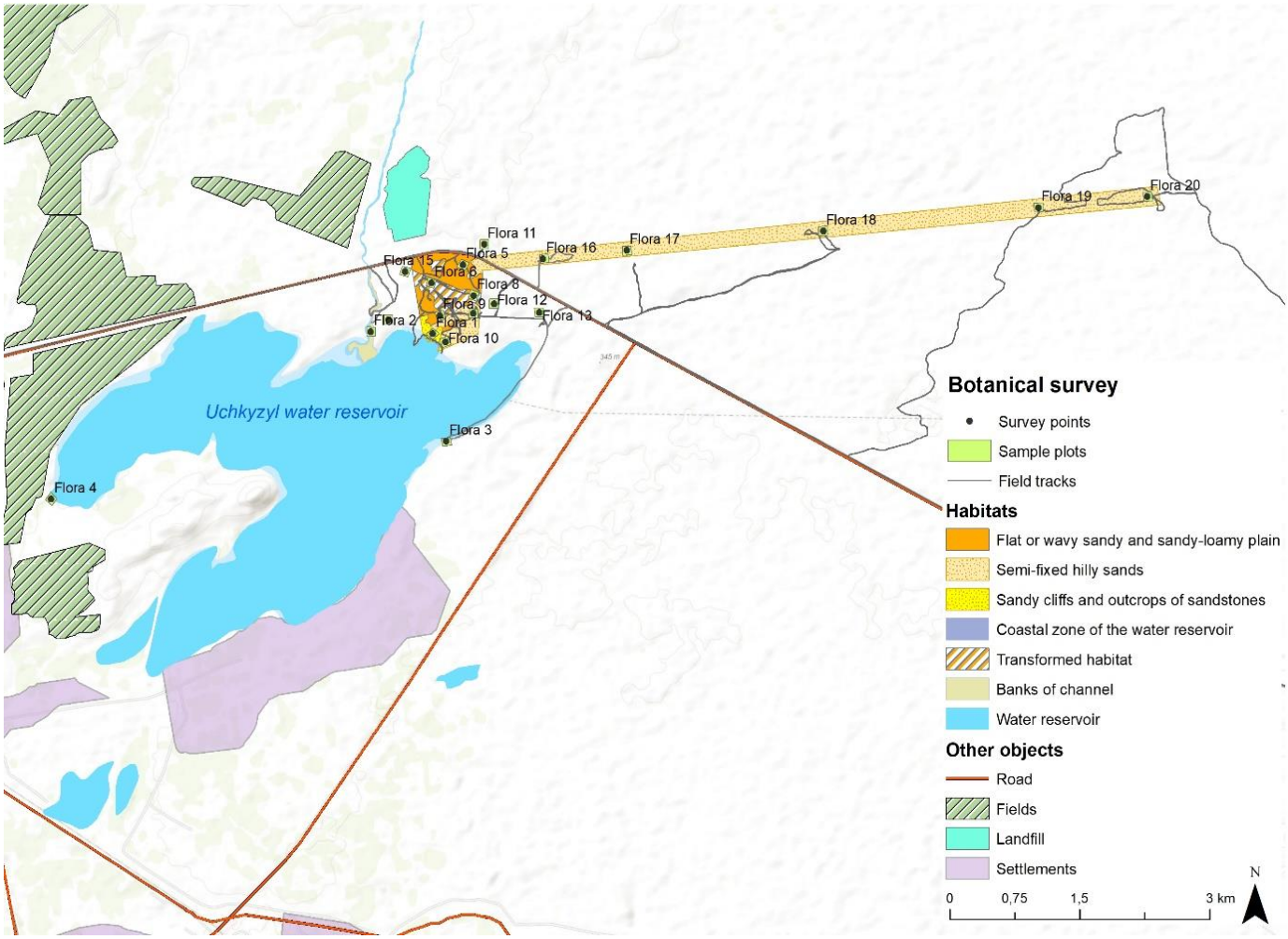


Figure 86: Location of Geobotanical Sample Plots

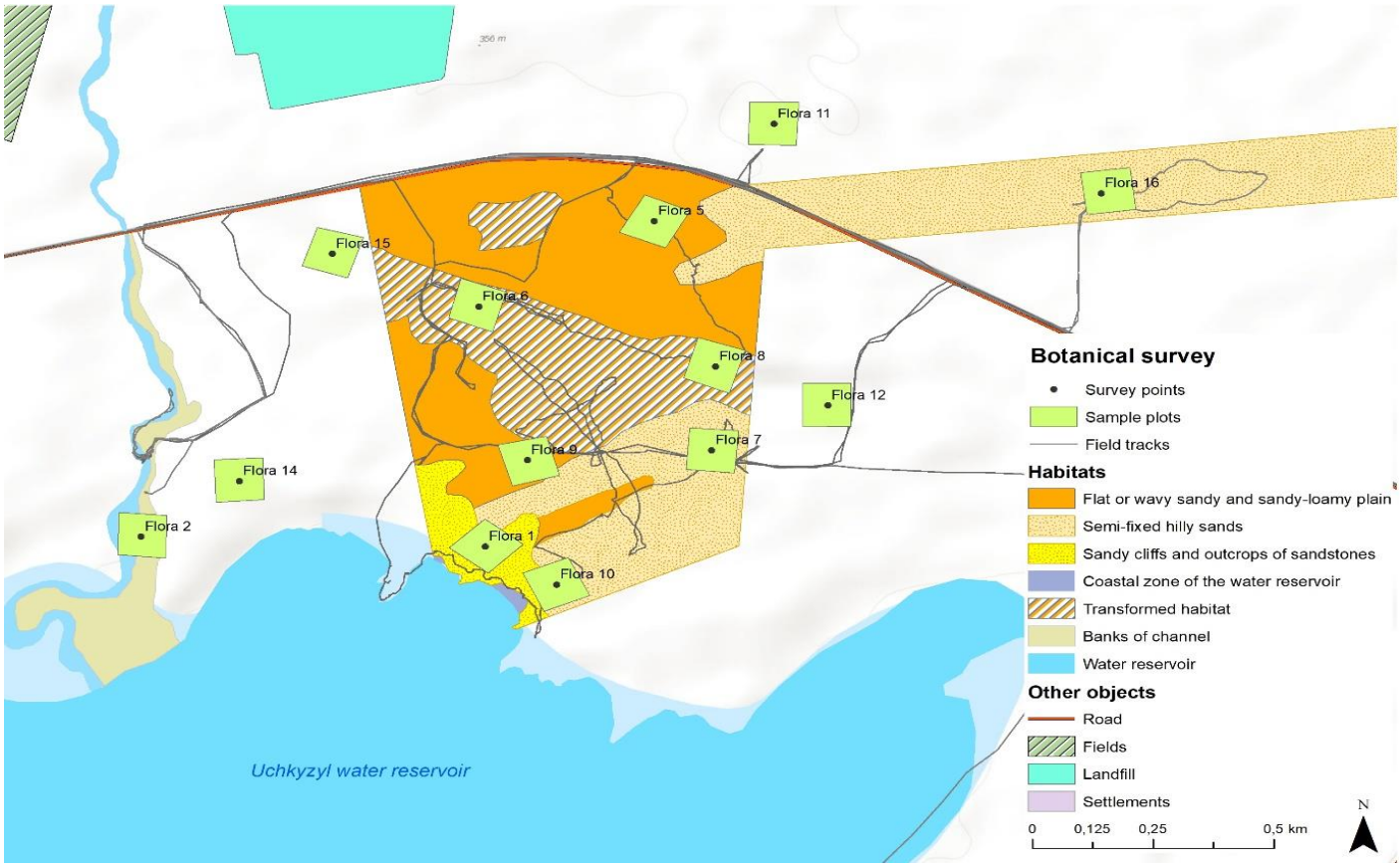


Figure 87: Location of Geobotanical Sample Plots Within the Power Plant Construction Site

Sample Plot 1

The northern coast of the Uchkizil water reservoir. Eroded sandy cliffs, outcrops of sandstones and small areas of shallow blown sands (Figure 88). The level of anthropogenic disturbance is medium (ground roads, grazing, garbage). The vegetation is very sparse (canopy cover is less than 5%). There are community of saltworts (*Salsola rosmarinus (Seidlitzia rosmarinus), Halothamnus subaphyllus, Xylosalsola arbuscula (Salsola arbuscula)),* camel thorn (*Alhagi pseudalhagi*), desert blindweed (*Convolvulus hamadae, C. divaricatus*) and *Zygophyllum atriplicoides,* with solitary black saxaul (*Haloxylon ammodendron*) and tamarisk (*Tamarix ramosissima*). Black saxaul grows along small ravines and on the blown sands, tamarisk grows near the coast, annual herbs occur mostly on the blown sands. On the cliff and along the coastal line, there are no plants. The sample plot 1 is the "impact quadrat" for this habitat type. In total, 28 plant species were recorded (Table 111). None of them are red-listed at the global level or included in the Red Data Book of Uzbekistan [35], but one species (*Salsola rosmarinus*) is assessed as endangered in the neighboring country, Tajikistan (Red Book of the Republic of Tajikistan, 2017) [121]. One species is alien weed (*Tribulus terrestris*, widely spread in ruderal places in Uzbekistan), but its abundance is low.

Figure 88: Sample plot 1. Northern Coast of The Uchkizil Reservoir – Sandy Cliffs, Outcrops of Sandstones and Reservoir's Shore with Very Sparse or Almost Devoid of Vegetation

Table 111: Check-list of Plants Recorded for Sample Plot 1

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Aeluropus littoralis	perennial	12-15	+	Vegetation, fruiting	IUCN - LC
Agriophyllum latifolium	annual	25-30	+	fruiting	no
Alhagi pseudalhagi	perennial	30-40	1	fruiting	no
Astragalus unifoliolatus	shrub	30-40	+	vegetation	no
Bromus tectorum	annual	12-15	+	dried	no
Calligonum microcarpum	shrub	40-50	+	vegetation	no
Caroxylon incanescens (Salsola incanescens)	annual	25-30	+	Flowering, fruiting	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Caroxylon scleranthum (Salsola sclerantha)	annual	25-30	+	Flowering, fruiting	no
Convolvulus divaricatus	semishrub	30-35	1	flowering	no
Convolvulus hamadae	semishrub	25-30	1	flowering	no
Cressa cretica	perennial	12-15	+	flowering	IUCN - LC
Eremopyrum bonaepartis	annual	8-10	+	dried	no
Halothamnus subaphyllus	semishrub	40-50	+	fruiting	no
Haloxylon ammodendron	Small tree	50-100	1	vegetation	no
Heliotropium dasycarpum	perennial	25-30	+	fruiting	no
Horaninovia ulicina	annual	20-25	+	Flowering, fruiting	no
Hordeum murinum subsp. leporinum	annual	20-25	+	dried	no
Launaea procumbens	perennial	12-15	+	Flowering, fruiting	no
Poa bulbosa	perennial	15-20	+	dried	no
Salsola paulsenii	annual	30-40	+	Flowering, fruiting	no
Salsola rosmarinus (Seidlitzia rosmarinus)	semishrub	30-40	1	flowering	Tajikistan - EN
Stipagrostis karelinii	perennial	50-70	+	fruiting	no
Suaeda arcuata	annual	20-25	+	fruiting	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Tamarix hispida	shrub	30-100	1	Vegetation	IUCN - LC
Tamarix ramosissima	shrub	30-100	1	vegetation	IUCN - LC
Tribulus terrestris	annual	10-15	+	Flowering, fruiting	Alien weed
Xylosalsola arbuscula	shrub	40-50	1	fruiting	no
Zygophyllum atriplicoides	shrub	30-40	+	fruiting	no

Sample plot 2

The banks of the channel Zang in its lower reaches, about 550 m to the west of planned power plant site and near the confluence with the Uchkizil reservoir. The level of anthropogenic disturbance is medium (ground roads, grazing, garbage, alien weeds). Floodplain and fluvial terraces are occupied by tamarisk scrub with the domination of *Tamarix ramosissima, T. hispida, T. hohenackeri,* camel thorn (*Alhagi pseudalhagi*) and annual saltworts (Figure 89). The sample plot 2 is the "control quadrat" for this habitat type. Within the power plant construction site, this habitat type is absent. Canopy cover is 30 to 90%. This habitat type belongs to so-called tugay, according to local classification. In total, 29 plant species were recorded (Table 112). None of them are red-listed at the global level or included in the Red Data Book of Uzbekistan [35]. 5 species are alien weeds.

Figure 89: Sample plot 2. Tamarisk Scrub in The Lower Reaches of The Channel Zang

Table 112: Check-list of Plants Recorded for Sample Plot 2

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Adiantum capillus-veneris	perennial	10-12	+	vegetation	IUCN - LC
Aeluropus littoralis	perennial	12-15	1	Vegetation, fruiting	IUCN - LC
Alhagi pseudalhagi	perennial	40-50	3	fruiting	no
Amaranthus retroflexus	annual	15-20	+	Flowering, fruiting	Alien weed
Bromus tectorum	annual	12-15	+	dried	no
Caroxylon incanescens (Salsola incanescens)	annual	30-40	1	Flowering, fruiting	no
Caroxylon scleranthum (Salsola sclerantha)	annual	25-30	+	Flowering, fruiting	no
Caroxylon turkestanicum (Salsola turkestanica)	annual	30-40	1	Flowering, fruiting	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Clematis orientalis	liana	150-180	+	Flowering, fruiting	no
Eclipta prostrata	Annual, perennial	12-15	+	Flowering, fruiting	Alien weed
Elaeagnus angustifolia	tree	180-200	+	vegetation	IUCN - LC
Equisetum ramosissimum	perennial	20-30	+	vegetation	IUCN - LC
Eremopyrum bonaepartis	annual	8-10	+	dried	no
Heliotropium dasycarpum	perennial	25-30	+	fruiting	no
Horaninovia ulicina	annual	30-40	+	Flowering, fruiting	no
Hordeum murinum subsp. leporinum	annual	20-25	+	dried	no
Launaea procumbens	perennial	12-15	+	Flowering, fruiting	no
Lycium depressum	shrub	100-150	+	Vegetation, fruiting	no
Mentha longifolia var. asiatica	perennial	30-40	+	flowering	no
Paspalum distichum	perennial	12-15	+	flowering	Alien weed
Poa bulbosa	perennial	15-20	+	dried	no
Salsola paulsenii	annual	30-40	+	Flowering, fruiting	no
Suaeda arcuata	annual	25-30	+	fruiting	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Symphyotrichum subulatum	annual	25-30	+	Flowering, fruiting	Alien weed
Tamarix hispida	shrub	150-180	1	Vegetation, flowering	IUCN - LC
Tamarix hohenackeri	shrub	150-180	1	Flowering, fruiting	no
Tamarix ramosissima	shrub	150-180	2	Vegetation, flowering	IUCN - LC
Tribulus terrestris	annual	10-15	+	Flowering, fruiting	Alien weed
Tripidium ravennae (Erianthus ravennae)	perennial	180-200	1	Flowering, fruiting	IUCN - LC

Sample plot 3

The eastern coast of the Uchkizil water reservoir. Eroded sandy cliffs and outcrops of sandstones with small areas of shallow blown sands. The level of anthropogenic disturbance is medium (ground roads, grazing, garbage). Sparse communities of saltworts (*Salsola rosmarinus (Seidlitzia rosmarinus), Halothamnus subaphyllus, Xylosalsola arbuscula (Salsola arbuscula)),* camel thorn (*Alhagi pseudalhagi*), desert blindweed (*Convolvulus hamadae, C.divaricatus*), with solitary *Zygophyllum atriplicoides* and black saxaul (*Haloxylon ammodendron*), and with groups of young tamarisk (*Tamarix ramosissima, T. hispida*) near the coast (Figure 90). The sample plot 3 is the "control quadrat" for this habitat type. The canopy cover is from 5-10 to 50%. Along the coastal line, there are no plants. In total, 32 plant species were recorded (Table 113). None of them are red-listed at the global level or included in the Red Data Book of Uzbekistan, but one species (*Salsola rosmarinus (Seidlitzia rosmarinus*)) is assessed as endangered in Tajikistan (Red Book of the Republic of Tajikistan, 2017) [121].. 2 species are alien weeds, but their abundance is unsignificant.

Figure 90: Sample plot 3. Eastern Coast of The Uchkizil Reservoir with Sandy Cliffs and Outcrops Of Sandstones, And With Community Of Camel Thorn, Saltworts And Desert Blindweed

Table 113: Check-list of Plants Recorded for Sample Plot 3

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Aeluropus littoralis	perennial	12-15	+	Vegetation, fruiting	IUCN - LC
Agriophyllum latifolium	annual	25-30	+	fruiting	no
Alhagi pseudalhagi	perennial	30-40	2	fruiting	no
Artemisia scoparia	biennial	30-40	+	flowering	no
Bromus tectorum	annual	12-15	+	dried	no
Calligonum microcarpum	shrub	40-50	+	vegetation	no
Caroxylon incanescens (Salsola incanescens)	annual	25-30	+	Flowering, fruiting	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Caroxylon scleranthum (Salsola sclerantha)	annual	25-30	+	Flowering, fruiting	no
Caroxylon turkestanicum (Salsola turkestanica)	annual	25-30	+	Flowering, fruiting	no
Climacoptera sukaczevii	annual	25-30	+	fruiting	no
Convolvulus divaricatus	semishrub	30-35	2	flowering	no
Convolvulus hamadae	semishrub	25-30	1	flowering	no
Cressa cretica	perennial	12-15	+	flowering	IUCN - LC
Cynodon dactylon	perennial	12-15	+	flowering	Alien weed
Eremopyrum bonaepartis	annual	8-10	+	dried	no
Halothamnus subaphyllus	semishrub	50-100	1	fruiting	no
Haloxylon ammodendron	Small tree	100-150	1	vegetation	no
Heliotropium dasycarpum	perennial	25-30	+	fruiting	no
Horaninovia ulicina	annual	20-25	+	Flowering, fruiting	no
Hordeum murinum subsp. leporinum	annual	20-25	+	dried	no
Launaea procumbens	perennial	12-15	+	Flowering, fruiting	no
Lycium depressum	shrub	50-70	+	Vegetation	no
Poa bulbosa	perennial	15-20	+	dried	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Salsola paulsenii	annual	30-40	+	Flowering, fruiting	no
Salsola rosmarinus (Seidlitzia rosmarinus)	semishrub	30-50	1	flowering	Tajikistan - EN
Stipagrostis karelinii	perennial	50-70	+	fruiting	no
Suaeda arcuata	annual	25-30	+	fruiting	no
Tamarix hispida	shrub	50-100	1	Vegetation	IUCN - LC
Tamarix ramosissima	shrub	50-100	1	vegetation	IUCN - LC
Tribulus terrestris	annual	10-15	+	Flowering, fruiting	Alien weed
Xylosalsola arbuscula	shrub	50-100	1	fruiting	no
Zygophyllum atriplicoides	shrub	50-100	1	fruiting	no

Sample plot 4

The south-western coast of the Uchkizil water reservoir. Bare shore of the water reservoir with remains of concrete slabs. This is transformed habitat, the level of anthropogenic disturbance is high (construction works, ground roads, garbage, recreation, water level fluctuations). Due to water level fluctuations, the shore is almost devoid of vegetation, except for solitary specimens of annual saltworts (*Caroxylon incanescens, C. turkestanicum, Salsola paulsenii*), camel thorn (*Alhagi pseudalhagi*), Crete alkaliweed (*Cressa cretica*), reeds (*Phragmites australis*) and young tamarisk (*Tamarix sp.*) (Figure 91). Within the construction site, this habitat type covers only a narrow stripe along the coastal line (up to 20-30 m in width). The canopy cover is nearly 0%. In total, 10 plant species were recorded (Table 114). None of them are red-listed at the global or national level. 1 species is alien weed, but its abundance is low.

Figure 91: Sample Plot 4. South-Western Coast of The Uchkizil Reservoir Almost Devoid of Vegetation

Table 114: Check-List of Plants Recorded for Sample Plot 4

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Aeluropus littoralis	perennial	12-15	+	vegetation	IUCN - LC
Alhagi pseudalhagi	perennial	20-25	+	vegetation	no
Bromus tectorum	annual	12-15	+	dried	no
Caroxylon incanescens (Salsola incanescens)	annual	15-20	+	Flowering, fruiting	no
Caroxylon turkestanicum (Salsola turkestanica)	annual	15-20	+	Flowering, fruiting	no
Phragmites australis	perennial	30-40	+	vegetation	IUCN - LC
Salsola paulsenii	annual	15-20	+	Flowering, fruiting	no
Suaeda arcuata	annual	15-20	+	fruiting	no
Tamarix sp.	shrub	30-40	+	vegetation	

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Tribulus terrestris	annual	10-15	+	Flowering, fruiting	Alien weed

Sample plot 5

The north-eastern part of the power plant construction site. The level of anthropogenic disturbance is medium (ground roads, grazing, garbage). Wavy sandy plain with the community of desert blindweed (*Convolvulus divaricatus, C.hamadae*), saltworts (*Xylosalsola arbuscula, Haloxylon griffithii (Hammada leptoclada*), *Halothamnus subaphyllus*), and desert sedge (*Carex physodes*), with solitary *Calligonum microcarpum* (Figure 92). The sample plot 5 is the "impact quadrat" for this habitat type, while 11 and 14 are "control quadrats". The canopy cover is 10-20%; 19 plant species were recorded (Table 115). None of them are red-listed at the global level or included in the Red Data Book of Uzbekistan [35]; one species (*Salsola rosmarinus*) is assessed as endangered in Tajikistan [121]. Alien weeds were not found.

Figure 92: Sample Plot 5. Wavy Sandy Plain with The Community of Desert Blindweed, Saltworts and Desert Sedge

Table 115: Check-List of Plants Recorded for Sample Plot 5

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Agriophyllum lateriflorum	annual	25-30	+	fruiting	no
Agriophyllum latifolium	annual	20-25	+	fruiting	no
Bromus tectorum	annual	12-15	+	dried	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Calligonum microcarpum	shrub	50-70	1	vegetation	no
Carex physodes	perennial	12-15	1	dried	no
Caroxylon scleranthum (Salsola sclerantha)	annual	25-30	+	Flowering, fruiting	no
Convolvulus divaricatus	semishrub	30-35	1	flowering	no
Convolvulus hamadae	semishrub	30-35	2	flowering	no
Eremopyrum bonaepartis	annual	8-10	+	dried	no
Halothamnus subaphyllus	semishrub	40-50	1	fruiting	no
Haloxylon griffithii (Hammada leptoclada)	semishrub	40-50	1	flowering	no
Heliotropium dasycarpum	perennial	25-30	+	fruiting	no
Horaninovia ulicina	annual	20-25	+	Flowering, fruiting	no
Salsola paulsenii	annual	30-40	+	Flowering, fruiting	no
Salsola rosmarinus (Seidlitzia rosmarinus)	semishrub	40-50	+	flowering	Tajikistan - EN
Schismus arabicus	annual	12-15	+	fruiting	no
Stipagrostis pennata	perennial	25-30	+	fruiting	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Stipagrostis plumosa	perennial	25-30	+	fruiting	no
Xylosalsola arbuscula	shrub	50-70	2	fruiting	no

Sample plot 6

Transformed habitat (abandoned channel or ditch) in northern part of the power plant construction site. In addition, the impact of grazing is significant, and garbage dumps occur on this disturbed area. Vegetation is the same native community of saltworts (*Salsola rosmarinus, Haloxylon griffithii, Halothamnus subaphyllus, Xylosalsola arbuscula),* camel thorn (*Alhagi kirghisorum*) and desert blindweed (*Convolvulus hamadae*) as in the surrounding undisturbed sandy-loamy plain, but very sparse (Figure 93). The sample plot 6 is the "impact quadrat" for this habitat type, while 12 and 15 are "control quadrats". The canopy cover is 5-10%. In total, 19 plant species were recorded (Table 116). None of them are red-listed at the global level or included in the Red Data Book of Uzbekistan [35]; one species (*Salsola rosmarinus*) is assessed as endangered in Tajikistan [121]. One species is alien weed, but its abundance is low.

Figure 93: Sample Plot 6. Abandoned Channel with Sparse Community of Saltworts, Camel Thorn and Desert Blindweed

Table 116: Check-list of Plants Recorded for Sample Plot 6

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Alhagi kirghisorum	perennial	30-40	1	fruiting	no
Bromus tectorum	annual	12-15	+	dried	no
Caroxylon incanescens (Salsola incanescens)	annual	25-30	+	Flowering, fruiting	no
Caroxylon scleranthum (Salsola sclerantha)	annual	25-30	+	Flowering, fruiting	no
Convolvulus divaricatus	semishrub	30-35	+	flowering	no
Convolvulus hamadae	semishrub	30-35	1	flowering	no
Eremopyrum bonaepartis	annual	8-10	+	dried	no
Halothamnus subaphyllus	semishrub	40-50	1	fruiting	no
Haloxylon griffithii (Hammada leptoclada)	semishrub	40-50	1	flowering	no
Heliotropium dasycarpum	perennial	25-30	+	fruiting	no
Horaninovia ulicina	annual	20-25	+	Flowering, fruiting	no
Hordeum murinum subsp. leporinum	annual	20-25	+	dried	no
Poa bulbosa	perennial	15-20	+	dried	no
Salsola paulsenii	annual	30-40	+	Flowering, fruiting	no
Salsola rosmarinus (Seidlitzia rosmarinus)	semishrub	30-50	1	flowering	Tajikistan - EN

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Tribulus terrestris	annual	10-15	+	Flowering, fruiting	Alien weed
Xylosalsola arbuscula	shrub	40-50	+	fruiting	no
Zygophyllum atriplicoides	shrub	30-40	+	fruiting	no

Sample plot 7

The south-eastern part of the construction site. The level of anthropogenic disturbance is medium (ground roads, grazing, garbage). Semi-fixed hilly sands with psammophilous open scrub (*Xylosalsola arbuscula, Calligonum leucocladum, C. microcarpum, Haloxylon persicum, Convolvulus divaricatus, C. hamadae, Carex physodes, Stipagrostis karelinii, Agriophyllum lateriflorum, A. latifolium*) (Figure 94). Canopy cover 10-20%. The sample plot 7 is the "impact quadrat" for this habitat type, while 13 is the "control quadrat". In total, 25 plant species were recorded (Table 117). None of them are red-listed at the global level or included in the Red Data Book of Uzbekistan [35]; one species (*Salsola rosmarinus*) is assessed as endangered in Tajikistan [121]. Alien species were not found.

Figure 94: Sample plot 7. Semi-Fixed Hilly Sands with Psammophilous Open Scrub

Table 117: Check-list of Plants Recorded for Sample Plot 7

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Agriophyllum lateriflorum	annual	30-35	1	fruiting	no
Agriophyllum latifolium	annual	25-30	1	fruiting	no
Alhagi kirghisorum	perennial	30-40	+	fruiting	no
Astragalus unifoliolatus	shrub	30-40	+	vegetation	no
Bromus tectorum	annual	12-15	+	dried	no
Calligonum leucocladum	shrub	50-70	1	vegetation	no
Calligonum microcarpum	shrub	40-50	+	fruiting	no
Carex physodes	perennial	12-15	1	dried	no
Caroxylon scleranthum (Salsola sclerantha)	annual	25-30	+	Flowering, fruiting	no
Convolvulus divaricatus	semishrub	30-35	1	flowering	no
Convolvulus hamadae	semishrub	25-30	1	flowering	no
Eremopyrum bonaepartis	annual	8-10	+	dried	no
Halothamnus subaphyllus	semishrub	30-50	+	fruiting	no
Haloxylon persicum	Small tree	50-100	1	vegetation	IUCN - LC
Heliotropium arguzioides	perennial	25-30	+	fruiting	no
Heliotropium dasycarpum	perennial	25-30	+	fruiting	no
Horaninovia ulicina	annual	30-35	+	Flowering, fruiting	no
Hordeum murinum subsp. leporinum	annual	20-25	+	dried	no
Salsola paulsenii	annual	30-40	+	Flowering, fruiting	no
Salsola rosmarinus (Seidlitzia rosmarinus)	semishrub	40-50	+	flowering	Tajikistan - EN

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Schismus arabicus	annual	12-15	+	fruiting	no
Stipagrostis karelinii	perennial	50-70	1	fruiting	no
Stipagrostis pennata	perennial	25-30	+	fruiting	no
Stipagrostis plumosa	perennial	25-30	+	fruiting	no
Xylosalsola arbuscula	shrub	40-50	1	fruiting	no

Sample plot 8

Transformed habitat (abandoned channel or ditch) in eastern part of the power plant construction site. Intensive grazing and garbage dumps also occur on this disturbed area. Vegetation is represented with the native community of saltworts (*Salsola rosmarinus, Haloxylon griffithii, Caroxylon incanescens, C. scleranthum),* camel thorn (*Alhagi kirghisorum*) and desert blindweed (*Convolvulus hamadae*), the same as in the surrounding undisturbed sandy-loamy plain, but very sparse (Figure 95). 8 and 6 are "impact quadrats" for this habitat type, while 12 and 15 are "control quadrats". The landscape and vegetation are similar with the sample plot 6. The canopy cover is 5-10%. In total, 16 plant species were recorded (Table 118). None of them are red-listed at the global level or included in the Red Data Book of Uzbekistan [35]; one species (*Salsola rosmarinus*) is assessed as endangered in Tajikistan. One species is alien weed.

Figure 95: Sample Plot 8. Abandoned Channel with Sparse Community of Saltworts, Camel Thorn and Desert Blindweed

Table 118: Check-list Of Plants Recorded for Sample Plot 8

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Alhagi kirghisorum	perennial	30-40	1	fruiting	no
Bromus tectorum	annual	12-15	+	dried	no
Caroxylon incanescens (Salsola incanescens)	annual	25-30	1	Flowering, fruiting	no
Caroxylon scleranthum (Salsola sclerantha)	annual	25-30	1	Flowering, fruiting	no
Convolvulus hamadae	semishrub	30-35	1	flowering	no
Eremopyrum bonaepartis	annual	8-10	+	dried	no
Halothamnus subaphyllus	semishrub	40-50	+	fruiting	no
Haloxylon griffithii (Hammada leptoclada)	semishrub	40-50	1	flowering	no
Heliotropium dasycarpum	perennial	25-30	+	fruiting	no
Horaninovia ulicina	annual	20-25	+	Flowering, fruiting	no
Hordeum murinum subsp. leporinum	annual	20-25	+	dried	no
Poa bulbosa	perennial	15-20	+	dried	no
Salsola paulsenii	annual	30-40	+	Flowering, fruiting	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Salsola rosmarinus (Seidlitzia rosmarinus)	semishrub	30-50	1	flowering	Tajikistan - EN
Tribulus terrestris	annual	10-15	+	Flowering, fruiting	Alien weed
Xylosalsola arbuscula	shrub	40-50	+	fruiting	no

Sample plot 9

The central part of the power plant construction site. Wavy sandy plain with slightly gravelly surface. The level of anthropogenic disturbance is medium (ground roads, grazing, garbage). The vegetation is represented with the community of desert blindweed (*Convolvulus hamadae*), saltworts (*Haloxylon griffithii*), and desert sedge (*Carex physodes*), with solitary *Xylosalsola arbuscula* (Figure 96). The sample plots 9 and 5 are the "impact quadrats" for this habitat type, while 11 and 14 are "control quadrats". The canopy cover is 10-20%. In total, 19 plant species were recorded (Table 119). None of them are red-listed at the global level or included in the Red Data Book of Uzbekistan [35]; one species (*Salsola rosmarinus*) is assessed as endangered in Tajikistan [121]. Alien weeds were not found.

Figure 96: Sample Plot 9. Wavy Sandy Plain with The Community Of Desert Blindweed, Saltworts and Desert Sedge, With Small Areas of Blown Sands

Table 119: Check-list of Plants Recorded for Sample Plot 9

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Agriophyllum lateriflorum	annual	20-25	+	fruiting	no
Agriophyllum latifolium	annual	20-25	+	fruiting	no
Bromus tectorum	annual	12-15	+	dried	no
Carex physodes	perennial	12-15	1	dried	no
Caroxylon scleranthum (Salsola sclerantha)	annual	20-25	+	Flowering, fruiting	no
Convolvulus divaricatus	semishrub	25-30	+	flowering	no
Convolvulus hamadae	semishrub	25-30	1	flowering	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Eremopyrum bonaepartis	annual	8-10	+	dried	no
Halothamnus subaphyllus	semishrub	30-40	+	fruiting	no
Haloxylon griffithii (Hammada leptoclada)	semishrub	30-40	1	flowering	no
Haplophyllum robustum	perennial	25-30	+	dried	no
Heliotropium dasycarpum	perennial	25-30	+	fruiting	no
Horaninovia ulicina	annual	20-25	+	Flowering, fruiting	no
Poa bulbosa	perennial	15-20	+	dried	no
Salsola paulsenii	annual	25-30	+	Flowering, fruiting	no
Salsola rosmarinus (Seidlitzia rosmarinus)	semishrub	30-40	+	flowering	Tajikistan - EN
Schismus arabicus	annual	12-15	+	fruiting	no
Stipagrostis plumosa	perennial	25-30	+	fruiting	no
Xylosalsola arbuscula	shrub	40-50	+	fruiting	no

Sample plot 10

Semi-fixed hilly sands with psammophilous open scrub (Xylosalsola arbuscula, Calligonum leucocladum, C. microcarpum, Haloxylon persicum, Convolvulus divaricatus, C. hamadae, Carex physodes) (Figure 97). Canopy cover 10-20%. The sample plot 10 is the "impact quadrat" for this habitat type, while 13 is the "control quadrat". In total, 24 plant species were recorded (Table 120). None of them are red-listed at the global level or included in the Red Data Book of Uzbekistan [35]; one species (Salsola rosmarinus) is assessed as endangered in Tajikistan [121].. One species is alien weed. The level of anthropogenic disturbance is medium (ground roads, grazing, garbage).

Figure 97: Sample Plot 10. Semi-Fixed Hilly Sands with Psammophilous Open Scrub

Table 120: Check-List of Plants Recorded for Sample Plot 10

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Agriophyllum lateriflorum	annual	30-35	+	fruiting	no
Agriophyllum latifolium	annual	25-30	+	fruiting	no
Alhagi pseudalhagi	perennial	30-35	+	fruiting	no
Bromus tectorum	annual	12-15	+	dried	no
Calligonum leucocladum	shrub	50-70	1	vegetation	no
Calligonum microcarpum	shrub	50-70	+	fruiting	no
Carex physodes	perennial	12-15	1	dried	no
Caroxylon scleranthum (Salsola sclerantha)	annual	25-30	+	Flowering, fruiting	no
Convolvulus divaricatus	semishrub	30-35	1	flowering	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Convolvulus hamadae	semishrub	25-30	1	flowering	no
Eremopyrum bonaepartis	annual	8-10	+	dried	no
Halothamnus subaphyllus	semishrub	30-40	+	fruiting	no
Haloxylon persicum	Small tree	50-100	+	vegetation	IUCN - LC
Heliotropium arguzioides	perennial	25-30	+	fruiting	no
Heliotropium dasycarpum	perennial	25-30	+	fruiting	no
Horaninovia ulicina	annual	30-35	+	Flowering, fruiting	no
Hordeum murinum subsp. leporinum	annual	20-25	+	dried	no
Salsola paulsenii	annual	30-35	+	Flowering, fruiting	no
Salsola rosmarinus (Seidlitzia rosmarinus)	semishrub	35-40	+	flowering	Tajikistan - EN
Schismus arabicus	annual	12-15	+	fruiting	no
Stipagrostis karelinii	perennial	40-50	+	fruiting	no
Stipagrostis pennata	perennial	25-30	+	fruiting	no
Tribulus terrestris	annual	10-15	+	Flowering, fruiting	Alien weed
Xylosalsola arbuscula	shrub	50-70	1	fruiting	no

Sample plot 11

This is the "control quadrat" for the habitat of wavy sandy plain, situated to the north of the power plant construction site and between the road, existing power line and garbage dump. The level of anthropogenic disturbance is medium (ground roads, grazing, garbage). The plant community is dominated by desert blindweed (*Convolvulus divaricatus, C.hamadae*), saltworts (*Xylosalsola arbuscula, Haloxylon griffithii (Hammada leptoclada*), *Halothamnus subaphyllus*), and desert sedge (*Carex physodes*), with solitary black saxaul (*Haloxylon ammodendron*) and *Calligonum microcarpum* (Figure 98). The canopy cover is 10-20%. In total, 21 plant species were recorded (Table 121). None of them are red-listed at the global or national level. One species is alien weed (*Tribulus terrestris*), but its abundance is low.

Figure 98: Sample Plot 11 The "Control Quadrat" For Wavy Sandy Plain with The Community of Desert Blindweed, Saltworts and Desert Sedge

Table 121: Check-List of Plants Recorded for Sample Plot 11

Plant species	Life form	Height, cm	Abundance	Phenol. Stage	Status
Agriophyllum latifolium	annual	15-20	+	fruiting	no
Artemisia scoparia	biennial	30-35	+	flowering	no
Bromus tectorum	annual	12-15	+	dried	no
Calligonum microcarpum	shrub	50-70	+	vegetation	no
Carex physodes	perennial	12-15	1	dried	no
Caroxylon scleranthum (Salsola sclerantha)	annual	20-25	+	Flowering, fruiting	no
Convolvulus divaricatus	semishrub	30-35	+	flowering	no
Convolvulus hamadae	semishrub	25-30	2	flowering	no
Eremopyrum bonaepartis	annual	8-10	+	dried	no
Halothamnus subaphyllus	semishrub	30-40	1	fruiting	no
Haloxylon ammodendron	Small tree	100-120	1	vegetation	no
Haloxylon griffithii (Hammada leptoclada)	semishrub	30-40	+	flowering	no
Heliotropium dasycarpum	perennial	20-25	+	fruiting	no
Horaninovia ulicina	annual	20-25	+	Flowering, fruiting	no

Plant species	Life form	Height, cm	Abundance	Phenol. Stage	Status
Salsola paulsenii	annual	20-25	+	Flowering, fruiting	no
Schismus arabicus	annual	12-15	+	fruiting	no
Smirnowia turkestana	shrub	40-50	+	vegetation	no
Stipagrostis plumosa	perennial	25-30	+	fruiting	no
Tribulus macropterus	annual	25-30	+	Flowering, fruiting	no
Tribulus terrestris	annual	10-15	+	Flowering, fruiting	Alien weed
Xylosalsola arbuscula	shrub	50-70	1	fruiting	no

Sample plot 12

Transformed habitat (abandoned channel or ditch, and the oil well), to the east of the power plant construction site. The level of anthropogenic disturbance is high (transformed landscape, oil well, ground roads, grazing, garbage). Vegetation is represented with the native community of saltworts (*Haloxylon griffithii, Caroxylon incanescens, C. scleranthum),* camel thorn (*Alhagi kirghisorum*) and desert blindweed (*Convolvulus hamadae*), the same as in the surrounding undisturbed sandy-loamy plain, but very sparse (Figure 99). 12 is the "control quadrat" for this habitat type. The landscape and vegetation are similar with the sample plot 8 ("impact quadrat"), situated in 250-300 m to the west. The canopy cover is 5-10%. In total, 17 plant species were recorded (Table 122). None of them are red-listed at the global level or included in the Red Data Book of Uzbekistan [35]; one species (*Salsola rosmarinus*) is assessed as endangered in Tajikistan [121]. One species is alien weed.

Figure 99: Sample Plot 12 The "Control Quadrat" For Transformed Habitat. Abandoned Channel with Sparse Community of Saltworts, Camel Thorn and Desert Blindweed

Table 122: Check-List of Plants Recorded for Sample Plot 12

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Alhagi kirghisorum	perennial	30-40	1	fruiting	no
Bromus tectorum	annual	12-15	+	dried	no
Caroxylon incanescens (Salsola incanescens)	annual	25-30	1	Flowering, fruiting	no
Caroxylon scleranthum (Salsola sclerantha)	annual	25-30	1	Flowering, fruiting	no
Caroxylon turkestanicum (Salsola turkestanica)	annual	25-30	+	Flowering, fruiting	no
Convolvulus hamadae	semishrub	30-35	1	flowering	no
Halothamnus subaphyllus	semishrub	30-40	+	fruiting	no
Haloxylon griffithii (Hammada leptoclada)	semishrub	40-50	1	flowering	no
Heliotropium dasycarpum	perennial	25-30	+	fruiting	no
Horaninovia ulicina	annual	20-25	+	Flowering, fruiting	no
Hordeum murinum subsp. leporinum	annual	20-25	+	dried	no
Poa bulbosa	perennial	15-20	+	dried	no
Salsola paulsenii	annual	30-40	+	Flowering, fruiting	no
Salsola rosmarinus (Seidlitzia rosmarinus)	semishrub	30-40	+	flowering	Tajikistan - EN
Tribulus macropterus	annual	15-20	+	Flowering, fruiting	no
Tribulus terrestris	annual	10-15	+	Flowering, fruiting	Alien weed
Xylosalsola arbuscula	shrub	40-50	+	fruiting	no

Sample plot 13

Semi-fixed hilly sands with psammophilous open scrub (*Xylosalsola arbuscula, Calligonum caput-medusae, C. leucocladum, C. microcarpum, Haloxylon persicum, H. ammodendron, Convolvulus divaricatus, C. hamadae, Carex physodes*) (Figure 100). Canopy cover 20-30%. The sample plot 13 is the "control quadrat" for this habitat type, located to the east of the construction site. In comparison with the "impact quadrat" 7, this sample plot notably differs with rather tall and dense psammophilous shrubs (white and black saxaul, species of *Calligonum*, *Xylosalsola arbuscula*). In total, 27 plant species were recorded (Table 123), none of them are red-listed or alien. The level of anthropogenic disturbance is medium (ground roads, grazing, garbage, firewood harvesting).

Figure 100: Sample Plot 13 – The "Control Quadrat" For Semi-Fixed Hilly Sands with Psammophilous Open Scrub

Table 123: Check-List of Plants Recorded for Sample Plot 13

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Agriophyllum lateriflorum	annual	30-35	+	fruiting	no
Agriophyllum latifolium	annual	25-30	+	fruiting	no
Alhagi kirghisorum	perennial	30-40	1	fruiting	no
Ammodendron conollyi	shrub	50-70	+	vegetation	no
Astragalus chiwensis	perennial	25-30	+	fruiting	no
Astragalus unifoliolatus	shrub	30-40	+	vegetation	no
Bromus tectorum	annual	12-15	+	dried	no
Calligonum caput-medusae	shrub	100-150	1	fruiting	no
Calligonum leucocladum	shrub	50-100	1	vegetation	no
Calligonum microcarpum	shrub	50-70	1	fruiting	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Carex physodes	perennial	12-15	1	dried	no
Caroxylon scleranthum (Salsola sclerantha)	annual	25-30	+	Flowering, fruiting	no
Convolvulus divaricatus	semishrub	30-35	+	flowering	no
Convolvulus hamadae	semishrub	25-30	1	flowering	no
Eremopyrum bonaepartis	annual	8-10	+	dried	no
Halothamnus subaphyllus	semishrub	30-50	+	fruiting	no
Haloxylon ammodendron	Small tree	150-180	1	vegetation	no
Haloxylon persicum	Small tree	150-180	2	vegetation	IUCN - LC
Heliotropium arguzioides	perennial	25-30	+	fruiting	no
Heliotropium dasycarpum	perennial	25-30	+	fruiting	no
Horaninovia ulicina	annual	30-35	+	Flowering, fruiting	no
Hordeum murinum subsp. leporinum	annual	20-25	+	dried	no
Salsola paulsenii	annual	30-40	+	Flowering, fruiting	no
Schismus arabicus	annual	12-15	+	fruiting	no
Stipagrostis karelinii	perennial	50-70	1	fruiting	no
Stipagrostis pennata	perennial	25-30	+	fruiting	no
Stipagrostis plumosa	perennial	25-30	+	fruiting	no
Xylosalsola arbuscula	shrub	50-70	2	fruiting	no

Sample plot 14

This is the second "control quadrat" for the habitat of wavy sandy plain, situated to the west of the power plant construction site and between the construction site and the channel Zang. The vegetation is dominated by desert blindweed (*Convolvulus hamadae*) (Figure 101). The canopy cover is 10-20%.

In total, 20 plant species were recorded (Table 124). None of them are red-listed at the global level or included in the Red Data Book of Uzbekistan [35]; one species (*Salsola rosmarinus*) is assessed as endangered in Tajikistan [121].. One species is alien weed (*Tribulus terrestris*), but its abundance is low. The level of anthropogenic disturbance is medium (ground roads, grazing, garbage).

Figure 101: Sample Plot 14 – The "Control Quadrat" For Wavy Sandy Plain with The Domination of Desert Blindweed.

Table 124: Check-List of Plants Recorded for Sample Plot 14

Plant species	Life form	Height, cm	Abundance	Phenol. Stage	Status
Agriophyllum latifolium	annual	15-20	+	fruiting	no
Alhagi pseudalhagi	perennial	25-30	+	fruiting	no
Bromus tectorum	annual	12-15	+	dried	no
Carex physodes	perennial	12-15	+	dried	no
Caroxylon scleranthum (Salsola sclerantha)	annual	20-25	+	Flowering, fruiting	no
Convolvulus hamadae	semishrub	25-30	2	flowering	no
Eremopyrum bonaepartis	annual	8-10	+	dried	no
Halothamnus subaphyllus	semishrub	30-40	+	fruiting	no
Haloxylon griffithii (Hammada leptoclada)	semishrub	30-40	+	flowering	no
Heliotropium dasycarpum	perennial	20-25	+	fruiting	no
Horaninovia ulicina	annual	20-25	+	Flowering, fruiting	no

Poa bulbosa	perennial	15-20	+	dried	no
Salsola paulsenii	annual	30-35	+	Flowering, fruiting	no
Salsola rosmarinus (Seidlitzia rosmarinus)	semishrub	30-40	+	flowering	Tajikistan - EN
Tribulus terrestris	annual	10-15	+	Flowering, fruiting	Alien weed
Xylosalsola arbuscula	shrub	40-75	+	fruiting	no

Sample plot 15

This is second "control quadrat" for transformed habitat (abandoned channel). It is located to the west of the power plant construction site. Vegetation is differing from the neighboring "impact quadrat" 6 by the presence of tamarisk (*Tamarix ramosissima, T. hispida*), while the herbaceous layer is composed with the same species – saltworts (*Salsola rosmarinus, Haloxylon griffithii),* camel thorn (*Alhagi pseudalhagi*) and desert blindweed (*Convolvulus hamadae*) (Figure 102). The canopy cover is 10-20%; 22 plant species were recorded (Table 125). None of them are red-listed at the global level or included in the Red Data Book of Uzbekistan [35]; one species (*Salsola rosmarinus*) is assessed as endangered in Tajikistan [121]. One species is alien weed. The level of anthropogenic disturbance is high.

Figure 102: Sample Plot 15. Abandoned Channel with Community of Tamarisk, Saltworts, Camel Thorn and Desert Blindweed.

Table 125: Check-List of Plants Recorded for Sample Plot 15

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Alhagi pseudalhagi	perennial	30-40	1	fruiting	no
Artemisia scoparia	biennial	30-40	+	flowering	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Bromus tectorum	annual	12-15	+	dried	no
Caroxylon incanescens (Salsola incanescens)	annual	25-30	+	Flowering, fruiting	no
Caroxylon scleranthum (Salsola sclerantha)	annual	25-30	+	Flowering, fruiting	no
Caroxylon turkestanicum (Salsola turkestanica)	annual	25-30	+	Flowering, fruiting	no
Climacoptera sukaczevii	annual	25-30	+	fruiting	no
Convolvulus hamadae	semishrub	25-30	1	flowering	no
Eremopyrum bonaepartis	annual	8-10	+	dried	no
Halothamnus subaphyllus	semishrub	30-40	+	fruiting	no
Haloxylon griffithii (Hammada leptoclada)	semishrub	40-50	1	flowering	no
Heliotropium dasycarpum	perennial	25-30	+	fruiting	no
Horaninovia ulicina	annual	20-25	+	Flowering, fruiting	no
Hordeum murinum subsp. leporinum	annual	20-25	+	dried	no
Poa bulbosa	perennial	15-20	+	dried	no
Salsola paulsenii	annual	30-40	+	Flowering, fruiting	no
Salsola rosmarinus (Seidlitzia rosmarinus)	semishrub	30-50	1	flowering	Tajikistan - EN
Tamarix hispida	shrub	150-180	1	Vegetation	IUCN - LC
Tamarix ramosissima	shrub	150-180	2	Flowering	IUCN - LC
Tribulus terrestris	annual	10-15	+	Flowering, fruiting	Alien weed
Xylosalsola arbuscula	shrub	40-50	+	fruiting	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Zygophyllum atriplicoides	shrub	30-40	+	fruiting	no

Sample plot 16

This sample plot is situated on the planned transmission line. Semi-fixed hilly sands covered by psammophilous open scrub with domination of *Xylosalsola arbuscula, Halothamnus subaphyllus, Convolvulus divaricatus, C. hamadae, Carex physodes* and *Stipagrostis karelinii*, with solitary white and black saxaul (*Haloxylon persicum, H. ammodendron*) and *Calligonum* (Figure 103). Canopy cover 20%. In total, 29 plant species were recorded (Table 126), none of them are red-listed, 1 species is alien. The level of anthropogenic disturbance is medium (ground roads, electric line, grazing, harvesting saxaul for firewood).

Figure 103: Sample Plot 16. Semi-Fixed Hilly Sands with Psammophilous Open Scrub

Table 126: Check-list of Plants Recorded for Sample Plot 16

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Agriophyllum lateriflorum	annual	30-35	+	fruiting	no
Agriophyllum latifolium	annual	25-30	+	fruiting	no
Alhagi kirghisorum	perennial	30-40	+	fruiting	no
Ammodendron conollyi	shrub	50-70	+	vegetation	no
Artemisia scoparia	biennial	30-40	+	flowering	no
Astragalus unifoliolatus	shrub	30-40	+	vegetation	no
Bromus tectorum	annual	12-15	1	dried	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Calligonum caput-medusae	shrub	100-150	+	fruiting	no
Calligonum microcarpum	shrub	50-70	+	fruiting	no
Calligonum setosum	shrub	100-150	+	fruiting	no
Carex physodes	perennial	12-15	1	dried	no
Caroxylon scleranthum (Salsola sclerantha)	annual	25-30	+	Flowering, fruiting	no
Convolvulus divaricatus	semishrub	30-35	1	flowering	no
Convolvulus hamadae	semishrub	30-35	1	flowering	no
Eremopyrum bonaepartis	annual	8-10	+	dried	no
Halothamnus subaphyllus	semishrub	40-50	1	fruiting	no
Haloxylon ammodendron	Small tree	180-200	1	vegetation	no
Haloxylon persicum	Small tree	180-200	1	vegetation	IUCN - LC
Heliotropium arguzioides	perennial	25-30	+	fruiting	no
Heliotropium dasycarpum	perennial	25-30	+	fruiting	no
Horaninovia ulicina	annual	30-35	+	Flowering, fruiting	no
Hordeum murinum subsp. leporinum	annual	20-25	+	dried	no
Salsola paulsenii	annual	30-40	+	Flowering, fruiting	no
Schismus arabicus	annual	12-15	+	fruiting	no
Smirnowia turkestana	shrub	40-50	+	vegetation	no
Stipagrostis karelinii	perennial	50-70	1	fruiting	no
Stipagrostis pennata	perennial	25-30	+	fruiting	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Tribulus terrestris	annual	15-20	+	Flowering, fruiting	Alien weed
Xylosalsola arbuscula	shrub	100-150	2	fruiting	no

Sample plot 17

This sample plot is situated on the planned transmission line. Semi-fixed hilly sands with psammophilous open scrub dominated by white saltwort (*Xylosalsola arbuscula*), *Calligonum caput-medusae, C. microcarpum,* desert sedge (*Carex physodes),* and *Stipagrostis karelinii*, with solitary black saxaul (*Haloxylon ammodendron*) (Figure 104). Canopy cover 20-30%. The level of anthropogenic disturbance is low. In total, 23 plant species were recorded (Table 127), none of them are red-listed or alien.

Figure 104 Sample Plot 17. Semi-Fixed Hilly Sands with Psammophilous Open Scrub

Table 127 Check-List of Plants Recorded for Sample Plot 17

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Agriophyllum lateriflorum	annual	30-35	+	fruiting	no
Agriophyllum latifolium	annual	25-30	+	fruiting	no
Alhagi kirghisorum	perennial	30-40	1	fruiting	no
Ammodendron conollyi	shrub	50-70	+	vegetation	no
Bromus tectorum	annual	12-15	+	dried	no
Calligonum caput-medusae	shrub	100-150	1	fruiting	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Calligonum microcarpum	shrub	50-70	1	fruiting	no
Carex physodes	perennial	12-15	1	dried	no
Caroxylon scleranthum (Salsola sclerantha)	annual	25-30	1	Flowering, fruiting	no
Convolvulus divaricatus	semishrub	30-35	+	flowering	no
Convolvulus hamadae	semishrub	30-35	+	flowering	no
Eremopyrum bonaepartis	annual	8-10	+	dried	no
Halothamnus subaphyllus	semishrub	30-50	+	fruiting	no
Haloxylon ammodendron	Small tree	200-250	1	vegetation	no
Heliotropium arguzioides	perennial	25-30	+	fruiting	no
Heliotropium dasycarpum	perennial	25-30	+	fruiting	no
Horaninovia ulicina	annual	30-35	+	Flowering, fruiting	no
Hordeum murinum subsp. leporinum	annual	20-25	+	dried	no
Schismus arabicus	annual	12-15	+	fruiting	no
Stipagrostis karelinii	perennial	50-70	2	fruiting	no
Stipagrostis pennata	perennial	25-30	+	fruiting	no
Stipagrostis plumosa	perennial	25-30	+	fruiting	no
Xylosalsola arbuscula	shrub	100-120	2	fruiting	no

Sample plot 18

This sample plot is situated on the planned transmission line. Semi-fixed hilly sands with psammophilous open scrub with domination of white saxaul (*Haloxylon persicum*), white saltwort (*Xylosalsola arbuscula*), *Calligonum caput-medusae, C. microcarpum,* and desert sedge (*Carex physodes*) (Figure 105). The level of anthropogenic disturbance is low. Canopy cover 20-30%. In total, 28 plant species were recorded (Table 128), none of them are red-listed or alien.

Figure 105: Sample Plot 18. Semi-Fixed Hilly Sands with Psammophilous Open Scrub with Domination of White Saxaul, White Saltwort and Calligonum

Table 128: Check-List of Plants Recorded for Sample Plot 18

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Agriophyllum lateriflorum	annual	30-35	+	fruiting	no
Agriophyllum latifolium	annual	25-30	+	fruiting	no
Alhagi kirghisorum	perennial	30-40	+	fruiting	no
Ammodendron conollyi	shrub	70-100	+	vegetation	no
Astragalus unifoliolatus	shrub	30-40	+	vegetation	no
Bromus tectorum	annual	12-15	1	dried	no
Calligonum caput-medusae	shrub	100-150	1	fruiting	no
Calligonum microcarpum	shrub	100-120	1	fruiting	no
Calligonum setosum	shrub	100-150	+	fruiting	no
Carex physodes	perennial	12-15	1	dried	no
Caroxylon scleranthum (Salsola sclerantha)	annual	25-30	+	Flowering, fruiting	no
Convolvulus divaricatus	semishrub	30-35	+	flowering	no
Convolvulus hamadae	semishrub	30-35	+	flowering	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Ephedra strobilacea	shrub	100-120	+	vegetation	IUCN - LC
Eremopyrum bonaepartis	annual	8-10	+	dried	no
Halothamnus subaphyllus	semishrub	50-70	+	fruiting	no
Haloxylon ammodendron	Small tree	150-180	+	vegetation	no
Haloxylon persicum	Small tree	150-180	2	vegetation	IUCN - LC
Heliotropium arguzioides	perennial	25-30	+	fruiting	no
Heliotropium dasycarpum	perennial	25-30	+	fruiting	no
Horaninovia ulicina	annual	30-35	+	Flowering, fruiting	no
Hordeum murinum subsp. leporinum	annual	20-25	+	dried	no
Poa bulbosa	perennial	15-20	+	dried	no
Salsola paulsenii	annual	30-40	+	Flowering, fruiting	no
Schismus arabicus	annual	12-15	+	fruiting	no
Stipagrostis karelinii	perennial	50-70	+	fruiting	no
Stipagrostis pennata	perennial	25-30	+	fruiting	no
Xylosalsola arbuscula	shrub	100-120	1	fruiting	no

Sample plot 19

This sample plot is situated on the planned transmission line. Semi-fixed hilly sands with psammophilous open scrub with domination of white saxaul (Haloxylon persicum), Calligonum caput-medusae, C. microcarpum, Xylosalsola arbuscula and desert sedge (Carex physodes) (Figure 106). The level of anthropogenic disturbance is low. Canopy cover 20-30%. In total, 26 plant species were recorded (Table 129), none of them are red-listed or alien.

Figure 106: Sample Plot 19. Semi-Fixed Hilly Sands with Psammophilous Open Scrub with Domination Of White Saxaul

Table 129: Check-List of Plants Recorded for Sample Plot 19

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Agriophyllum lateriflorum	annual	30-35	+	fruiting	no
Agriophyllum latifolium	annual	25-30	+	fruiting	no
Ammodendron conollyi	shrub	100-120	+	vegetation	no
Astragalus unifoliolatus	shrub	30-40	+	vegetation	no
Bromus tectorum	annual	12-15	1	dried	no
Calligonum caput-medusae	shrub	100-150	1	fruiting	no
Calligonum microcarpum	shrub	100-120	1	fruiting	no
Calligonum setosum	shrub	100-150	+	fruiting	no
Carex physodes	perennial	12-15	1	dried	no
Caroxylon scleranthum (Salsola sclerantha)	annual	25-30	+	Flowering, fruiting	no
Convolvulus divaricatus	semishrub	30-35	+	flowering	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Convolvulus hamadae	semishrub	30-35	+	flowering	no
Eremopyrum bonaepartis	annual	8-10	+	dried	no
Halothamnus subaphyllus	semishrub	50-70	+	fruiting	no
Haloxylon ammodendron	Small tree	180-200	+	vegetation	no
Haloxylon persicum	Small tree	180-200	2	vegetation	IUCN - LC
Heliotropium arguzioides	perennial	25-30	+	fruiting	no
Heliotropium dasycarpum	perennial	25-30	+	fruiting	no
Horaninovia ulicina	annual	30-35	+	Flowering, fruiting	no
Hordeum murinum subsp. leporinum	annual	20-25	+	dried	no
Poa bulbosa	perennial	15-20	+	dried	no
Salsola paulsenii	annual	30-40	+	Flowering, fruiting	no
Schismus arabicus	annual	12-15	+	fruiting	no
Stipagrostis karelinii	perennial	50-70	+	fruiting	no
Stipagrostis pennata	perennial	25-30	+	fruiting	no
Xylosalsola arbuscula	shrub	70-100	+	fruiting	no

Sample plot 20

This sample plot is situated on the planned power transmission line and near the existing high voltage power transmission line. Semi-fixed hilly sands with psammophilous open scrub with domination of

white saxaul (*Haloxylon persicum*), *Calligonum caput-medusae, C. microcarpum, Xylosalsola arbuscula* and desert sedge (*Carex physodes*) (Figure 107). The level of anthropogenic disturbance is medium (ground roads, power lines, grazing, firewood harvesting). Canopy cover 20-30%. In total, 24 plant species were recorded (Table 130), none of them is red-listed or alien.

Figure 107: Sample Plot 20. Semi-Fixed Hilly Sands with Psammophilous Open Scrub with Domination of White Saxaul

Table 130: Check-List of Plants Recorded for Sample Plot 20

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Agriophyllum lateriflorum	annual	30-35	+	fruiting	no
Agriophyllum latifolium	annual	25-30	1	fruiting	no
Astragalus unifoliolatus	shrub	30-40	+	vegetation	no
Bromus tectorum	annual	12-15	+	dried	no
Calligonum caput-medusae	shrub	100-150	1	fruiting	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Calligonum microcarpum	shrub	100-120	+	fruiting	no
Calligonum setosum	shrub	100-150	+	fruiting	no
Carex physodes	perennial	12-15	1	dried	no
Caroxylon scleranthum (Salsola sclerantha)	annual	25-30	+	Flowering, fruiting	no
Convolvulus divaricatus	semishrub	30-35	+	flowering	no
Convolvulus hamadae	semishrub	30-35	+	flowering	no
Eremopyrum bonaepartis	annual	8-10	+	dried	no
Halothamnus subaphyllus	semishrub	50-70	+	fruiting	no
Haloxylon persicum	Small tree	180-200	2	vegetation	IUCN - LC
Heliotropium arguzioides	perennial	25-30	+	fruiting	no
Heliotropium dasycarpum	perennial	25-30	+	fruiting	no
Horaninovia ulicina	annual	30-35	+	Flowering, fruiting	no
Hordeum murinum subsp. leporinum	annual	20-25	+	dried	no
Poa bulbosa	perennial	15-20	+	dried	no
Salsola paulsenii	annual	30-40	+	Flowering, fruiting	no
Schismus arabicus	annual	12-15	+	fruiting	no
Stipagrostis karelinii	perennial	50-70	+	fruiting	no

Plant species	Life form	Height, cm	Abundance	Phenol. stage	Status
Stipagrostis pennata	perennial	25-30	+	fruiting	no
Xylosalsola arbuscula	shrub	70-100	+	fruiting	no

9.3.4.2 Fauna

Herpetofauna

The lists of these species are preliminary and are based on the available literary, departmental, personal field data of the authors of the report for past studies and data from a short field trip in 2021. Tracks and locations are given in Figure 108.

Figure 108: Locations of Survey Tracks and Observation Points During Field Trip

There are 27 species of reptiles belonging to 12 families on a relatively small and rather highly urbanized project area.

The total number of reptile species at the project area surroundings is 43.5% of all reptile species of Uzbekistan. Also, the project area is inhabited by representatives of all available reptile families inhabiting the territory of Uzbekistan. Among them, 8 species included in the Red Book of the Republic of Uzbekistan (2019) (29.6% of the total number of species inhabiting the project area), 2 species included in the Red List of the International Union for the Conservation of Nature (IUCN Red List) [31] - 7.4% of the total number of species inhabiting the project area) and 4 species - in the Annex of the Convention on International Trade in Endangered Species of Fauna and Flora (14.8% of the total

number of species inhabiting the project area). The list of amphibians in the project area consists of 2 species from 2 families, which is 40% of the list of all amphibians in Uzbekistan (see Table 131).

Table 131: List of Potential Reptile Species Inhabiting the Project Area

No	Species name	Availability of species as per literature source.	History proprietary data	Field trip data for July 2021.	Abundance of species	Endemism	Status in accordance to		
							RB RUz	IUCN	CITES
Amphibia									
Bufonidae									
1	***Bufotes turanensis***	+	+		Normal	UZ, TM, IR, AF			
Ranidae									
2	***Pelophylax ridibundus***	+	+		Normal			LC	
Reptilia									
Testudinidae									
1	***Testudo horsfieldii***	+	+		Rare		2 (VU)	VU	II
Gekkonidae									
2	***Crossobamon eversmanni***	+	+	+	Normal				
3	***Tenuidactylus bogdanovi***	+	+	+	Normal	UZ, TJ, TM		LC	
Sphaerodactylidae									
4	***Teratoscincus scincus***	+	+	+	Normal				
Agamidae									
5	***Trapelus sanguinolentus***	+	+	+	Normal				
6	***Phrynocephalus mystaceus galli***	+	+		Not abundant			LC	
7	***Phrynocephalus raddei boettgeri***	+	+	+	Not abundant	UZ, TJ, TM	2 VU:D	LC	

No	Species name	Availability of species as per literature source.	History proprietary data	Field trip data for July 2021.	Abundance of species	Endemism	Status in accordance to		
							RB RUz	IUCN	CITES
8	***Phrynocephalus sogdianus***	+	+	+	Normal	UZ, TJ			
Anguidae									
9	***Pseudopus apodus***	+			Not abundant				
Scincidae									
10	***Ablepharus pannonicus***	+			Normal				
11	***Eumeces schneideri***	+			Not abundant				
Lacertidae									
12	***Eremias grammica***	+	+		Not abundant			LC	
13	***Eremias lineolata***	+	+	+	Normal	UZ, TJ, TM, KZ, AF		LC	
14	***Eremias nigrocellata***	+	+	+	Normal	UZ, TJ, TM, AF	2 VU:D	LC	
15	**Eremias velox**	+	+	+	Normal				
16	***Eremias scripta lazdini***	+	+	+	Normal	UZ, TJ		LC	
Varanidae									
17	***Varanus griseus caspius***	+	+	+	Rare		2 VU:D		I
Boidae									
18	***Eryx tataricus***	+	+		Rare		3(NT)		II
Colubridae									
19	***Boiga trigonata melanocephala***	+	+	+	Not abundant		2 VU:R		

No	Species name	Availability of species as per literature source.	History proprietary data	Field trip data for July 2021.	Abundance of species	Endemism	Status in accordance to		
							RB RUz	IUCN	CITES
20	***Psammophis lineolatus***	+	+	+	Normal				
21	***Hemorrhois ravergieri***	+	+		Normal				
22	***Platyceps karelinii***	+	+		Not abundant				
23	***Spalerosophis diadema***	+	+		Not abundant				
24	***Natrix tessellata***	+	+	+	Normal				
25	***Lycodon striatus bicolor***	+			Rare		2 (VU:R)		
Elapidae									
26	***Naja oxiana***	+			Rare		3 (NT)	DD	II
Viperidae									
27	***Echis multisquamatus***	+	+		Not abundant				

RBRUz - species / subspecies is included in the Red Book of the Republic of Uzbekistan (2019) (CR - Species on the verge of extinction; VU - vulnerable species; NT - species close to vulnerable position); IUCN - species included in the Red List of Vanishing Species of the International Union for Conservation of Nature (VU - vulnerable species; NT - species close to vulnerable position); CITES I, II - a species included in Appendix (I, II) of the Convention on International Trade in Endangered Species of Fauna and Flora; Endemism: AF-Afghanistan, KZ - Kazakhstan; TM - Turkmenistan; KG - Kyrgyzstan; TJ - Tajikistan; UZ – Uzbekistan

The list of reptile counts in the project area is presented in Table 132.

Table 132: Results of Reptile Counts in The Project Area During Field Trip 2021

No	North	East	Date	Species	No of sp.	Density in\ha	Soil t°C	Air t°C	Humidity
UK-Herp_1	37,37427	67,24974	16.07.2021	Comb-toed gecko *Crossobamon eversmanni*	1	1	+26,2	+26,5	28%

No	North	East	Date	Species	No of sp.	Density in\ha	Soil t°C	Air t°C	Humidity
				Bogdanov's thin-toed gecko *Tenuidactylus bogdanovi*	30	12			
				Common Wonder Gecko *Teratoscincus scincus*	2 set of footprints	-			
				Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	2	0,8			
				Lasdin's sand racerunner *Eremias scripta lasdini*	4	1,6			
				Rapid Racerunner *Eremias velox*	1	0,4			
				Indian gamma snake *Boiga trigonata*	1	0,19			
UK-Herp_2	37,37819	67,24296	17.07.2021	Bogdanov's thin-toed gecko *Tenuidactylus bogdanovi*	3	1,5	+42,8	+32,1	22%
				Steppe Agama *Trapelus sanguinolentus*	2	1,03			
				Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	3	1,5			
				Rapid Racerunner *Eremias velox*	2	1,03			
				Dice snake *Natrix tessellata*	1	0,5			

No	North	East	Date	Species	No of sp.	Density in\ha	Soil t°C	Air t°C	Humidity
				Sand racer *Psammophis lineolatus*	1	0,5			
UK-Herp_3	37,36358	67,25097	17.07.2021	Bogdanov's thin-toed gecko *Tenuidactylus bogdanovi*	5	3,3	+38,9	+33,1	24%
UK-Herp_4	37,35902	67,20017	17.07.2021	-	-	-	+36,7	+31,2	24%
UK-Herp_5	37,37885	67,25285	18.07.2021	Steppe Agama *Trapelus sanguinolentus*	4	2,3	+44	+32,3	24%
				Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	8	4,7			
				Boettger Caspian Toad-head Agama *Phrynocephalus raddei boettgeri*	2	1,2			
				Black-ocellated racerunner *Eremias nigrocellata*	5	2,9			
				Lasdin's sand racerunner *Eremias scripta lasdini*	3	1,7			
				Caspian Monitor *Varanus griseus caspius*	1 chain of footprints	-			
				Indian gamma snake *Boiga trigonata*	1	0,17			
UK-Herp_6	37,37947	67,24992	18.07.2021	Comb-toed gecko *Crossobamon eversmanni*	1	0,5	+27,6	+27,9	27%

No	North	East	Date	Species	No of sp.	Density in\ha	Soil t°C	Air t°C	Humidity
				Indian gamma snake *Boiga trigonata*	1 skin slough	-			
UK-Herp_7	37,37560	67,25628	19.07.2021	Comb-toed gecko *Crossobamon eversmanni*	1	0,4	+26,3	+27,3	28%
				Common Wonder Gecko *Teratoscincus scincus*	2	0,9			
UK-Herp_8	37,378215	67,256268	18.07.2021	Steppe Agama *Trapelus sanguinolentus*	3	2	+43,3	+32,2	24%
				Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	19	9,5			
				Boettger Caspian Toad-head Agama *Phrynocephalus raddei boettgeri*	2	1			
				Caspian Monitor *Varanus griseus caspius*	1 chain of footprints	-			

Despite the fact that the project area is sufficiently developed and even degraded in places, in a short time, field trip in 2021, it is noted 14 species of reptiles (22.6% of the entire list of species of Uzbekistan and 51.8% of those noted in this area for literature data of species), of which 4 species (28.6% of the encountered species) are rare and listed in the Red Book of the Republic of Uzbekistan, 1 species (7.1% of the encountered species) is included in CITES [32] Appendix I and 4 narrow-range, endemic taxa (28.6% of the encountered species).None of the species observed during the summer survey is listed in the IUCN.

The results of the reptile count in the project area during Spring 2022 site visit is given in Table 133.

Table 133: Results of Reptile Counts In The Project Area During Field Trip Spring 2022

No	North	East	Date	Species	Number	Density in\ha	Soil t°C	Air t°C	Humidity
UK_PL-Herp_1	37,37427	67,24974	26.04.2022	Comb-toed gecko *Crossobamon eversmanni*	12	9.6	Nocturnal census		
				Bogdanov's thin-toed gecko *Tenuidactylus bogdanovi*	16	12.8	+22.4	+17.2	48%
				Saw-scaled Viper *Echis carinatus*	2	1.6			
				Diadem Snake *Spalerosophis diadema*	1	0.4			
				Tartar Sand Boa *Eryx tataricus*	1	0.4			
			27.04.2022	Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	4	4.8	Daytime census		
				Lasdin's sand racerunner *Eremias scripta lasdini*	7	8.3	+30,5	+28,8	28%
				Rapid Racerunner *Eremias lineolata*	5	5,4			
				Black-ocellated racerunner *Eremias nigrocellata*	2	1.2			
				Steppe Agama *Trapelus sanguinolentus*	7	8.8			
				Boettger Caspian Toad-head Agama *Phrynocephalus raddei boettgeri*	2	1.2			
UK_PL-Herp_2	37,37819	67,24296	27.04.2022	Comb-toed gecko *Crossobamon eversmanni*	6	5.3	Nocturnal census		
				Common Wonder Gecko *Teratoscincus scincus*	8	2.3	+23.6	+18.1	42%

No	North	East	Date	Species	Number	Density in\ha	Soil t°C	Air t°C	Humidity
							Daytime census		
				Steppe Agama *Trapelus sanguinolentus*	2	1.03			
			28.04.2022	Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	5	4.3			
				Secret Toadhead Agama *Phrynocephalus mystaceus*	2	1.3	+42,8	+32,1	22%
				Reticulate Racerunner *Eremias grammica*	3	0.97			
				Caspian Monitor *Varanus griseus caspius*	1 chain of footprints				
UK_PL-Herp_3	37,36358	67,25097	28.04.2022	Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	6	5,2	+31,3	+27,8	29%
				Secret Toadhead Agama *Phrynocephalus mystaceus*	1	1			
				Reticulate Racerunner *Eremias grammica*	4	2,1			
				Steppe Ribbon Racer *Psammophis linealatus*	1	1			
UK_PL-Herp_4	37,35902	67,20017	28.04.2022	Steppe Agama *Trapelus sanguinolentus*	2	1,1	+44,2	+35,1	24%
				Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	4	3.6			
				Reticulate Racerunner	2	0.7			

No	North	East	Date	Species	Number	Density in\ha	Soil t°C	Air t°C	Humidity
				Eremias grammica					
				Steppe Ribbon Racer *Psammophis linealatus*	1	1			
				Caspian Monitor *Varanus griseus caspius*	1	0.5			
UK_PL-Herp_5	37,37885	67,25285	28.04.2022	Steppe Agama *Trapelus sanguinolentus*	1	0.7	+46,7	+37,2	20%
				Lasdin's sand racerunner *Eremias scripta lasdini*	3	2.3			
				Caspian Monitor *Varanus griseus caspius*	1 chain of footprints				
UK_PL-Herp_6	37,37947	67,24992	28.04.2022	Comb-toed gecko *Crossobamon eversmanni*	16	9.7	Nocturnal census		
				Common Wonder Gecko *Teratoscincus scincus*	13	1.9	+22.3	+18.2	43%
				Tartar Sand Boa *Eryx tataricus*	1 track				
			29.04.2022	Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	30	36.3	Daytime census		
				Lasdin's sand racerunner *Eremias scripta lasdini*	5	1.8	+32,8	+28,1	30%
				Rapid Racerunner *Eremias lineolata*	4	1.1			
				Reticulate Racerunner *Eremias grammica*	6	4.2			

No	North	East	Date	Species	Number	Density in\ha	Soil t°C	Air t°C	Humidity
				Steppe Agama *Trapelus sanguinolentus*	1	1.1			
				Secret Toadhead Agama *Phrynocephalus mystaceus*	3	0.8			
UK_PL-Herp_7	37,37560	67,25628	29.04.2022	Black-ocellated racerunner *Eremias nigrocellata*	3	9.3	+36,7	+29,5	23%
				Boettger Caspian Toad-head Agama *Phrynocephalus raddei boettgeri*	5	4.9			
UK_PL-Herp_8	37.532008°	67.325327°	30.04.2022	Black-ocellated racerunner *Eremias nigrocellata*	3	9.3	+37,5	+27,2	27%
				Boettger Caspian Toad-head Agama *Phrynocephalus raddei boettgeri*	5	4.9			
				Bogdanov's thin-toed gecko *Tenuidactylus bogdanovi*	8	7,6			
				Indian gamma snake *Boiga trigonata melanocephala*	1	1			
UK_PL-Herp_9	37.508306°	67.308283°		Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	29	29.06	+41,3	+31,4	23%
				Black-ocellated racerunner *Eremias nigrocellata*	2	5.3			
				Boettger Caspian Toad-head Agama	3	2.9			

No	North	East	Date	Species	Number	Density in\ha	Soil t°C	Air t°C	Humidity
				Phrynocephalus raddei boettgeri					
				Bogdanov's thin-toed gecko *Tenuidactylus bogdanovi*	10	12,6			
				Rapid Racerunner *Eremias lineolata*	3	4.7			
				Steppe Agama Trapelus sanguinolentus	1	0.3			
				Tartar Sand Boa *Eryx tataricus*	1	1			
UK_PL-Herp_10	37.568671°	67.285745°	30.04.2022	*Steppe Agama Trapelus sanguinolentus*	1	0.7	+42,1	+33,2	22%
				Black-ocellated racerunner *Eremias nigrocellata*	1	0.9			
				Bogdanov's thin-toed gecko *Tenuidactylus bogdanovi*	12	13,8			
				Rapid Racerunner *Eremias lineolata*	2	3.1			
				Lasdin's sand racerunner *Eremias scripta lasdini*	6	9.3			
				Reticulate Racerunner *Eremias grammica*	4	1.3			
				Boettger Caspian Toad-head Agama *Phrynocephalus raddei boettgeri*	1	0.7			
UK_PL-	37.532008°	67.325327°	30.04.2022	Turan toad *Bufotes turanensis*	7	7.3	+36,4	+34,4	29%

No	North	East	Date	Species	Number	Density in\ha	Soil t°C	Air t°C	Humidity
Herp_11				Eurasian marsh frog *Pelophylax ridibundus*	32	18,7			
				Rapid Racerunner *Eremias velox*	2	1,6			
				Dice snake *Natrix tessellata*	1	1			
UK_PL-Herp_12	37.508306°	67.308283°		Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	29	29.06	+38,6	+32,4	23%
				Boettger Caspian Toad-head Agama *Phrynocephalus raddei boettgeri*	3	2.7			
				Lasdin's sand racerunner *Eremias scripta lasdini*	6	4			
				Reticulate Racerunner *Eremias grammica*	6	5.3			
				Rapid Racerunner *Eremias lineolata*	4	4.7			
				Steppe Agama Trapelus sanguinolentus	1	0.3			
				Black-ocellated racerunner *Eremias nigrocellata*	4	7.2			
UK_PL-Herp_13	37.568671°	67.285745°	30.04.2022	*Steppe Agama Trapelus sanguinolentus*	1	0.7	+37,2	+31,1	24%
				Black-ocellated racerunner *Eremias nigrocellata*	3	1.9			
				Tajikistan Toadhead Agama	12	23.6			

No	North	East	Date	Species	Number	Density in\ha	Soil t°C	Air t°C	Humidity
				Phrynocephalus sogdianus					
				Rapid Racerunner *Eremias lineolata*	2	3.1			
				Lasdin's sand racerunner *Eremias scripta lasdini*	6	9.3			
				Reticulate Racerunner *Eremias grammica*	3	1.2			
				Boettger Caspian Toad-head Agama *Phrynocephalus raddei boettgeri*	4	3.4			

Despite the fact that the project area is sufficiently developed and even degraded in places, in a short time, field trip in Spring 2022, it is noted noted 16 species of reptiles (25.8% of the entire list of species of Uzbekistan and 59.2% of those noted in this area for literature data of species), of which 4 species (25% of the encountered species) are rare and listed in the Red Book of the Republic of Uzbekistan, 1 species (7.1% of the encountered species) is included in CITES [32] Appendix I and 4 narrow-range, endemic taxa (25% of the encountered species). None of the species observed during the spring survey is listed in the IUCN.

The photos are given observed species and potential species in Figure 109.

Crossobamon eversmanni at point UK-Herp_1

Tenuidactylus bogdanovi at the point UK-Herp_1

Eryx tataricus at point UK_PL-Herp_1

Eremias scripta lasdini at point UK_PL-Herp_1

Eremias nigrocellata at point UK_PL-Herp_1

Phrynocephalus mystaceus at point UK_PL-Herp_2

Eremias grammica at point UK_PL-Herp_2

Echis carinatus at point UK_PL-Herp_4

Teratoscincus scincus

Trapelus sanguinolentus at point UK-Herp_5

Phrynocephalus raddei boettgeri at point UK-Herp_5

Phrynocephalus sogdianus at point UK-Herp_2

Eremias lineolata at point UK-Herp_5

Eremias nigrocellata at point UK-Herp_5

Eremias velox at point UK-Herp_2

Eremias scripta lasdini at point UK-Herp_1

Tracks of a young Varanus griseus caspius at point UK-Herp_5

Eryx tataricus in Kattakum sand

Boiga trigonata melanocephala in Kattakum sands

Hemorrhois ravergieri at Karakyr foothill

Natrix tessellate at point UK-Herp_2

Echis multisquamatus in Kattakum sands

Figure 109: The Photos of Observed and Potential Reptile Species of the Project Area in 2021 and spring 2022

Survey in September 2022

A field visit to the project area was carried out from 18 to 20 of September 2022. As a result of this survey, the construction site of the thermal power plant on the northern shore of the Uchkizil reservoir as well as the proposed overhead power line have been surveyed. In total, 18,5 km were covered by pedestrian routes (transects) during the field trip. (See Figure 110)

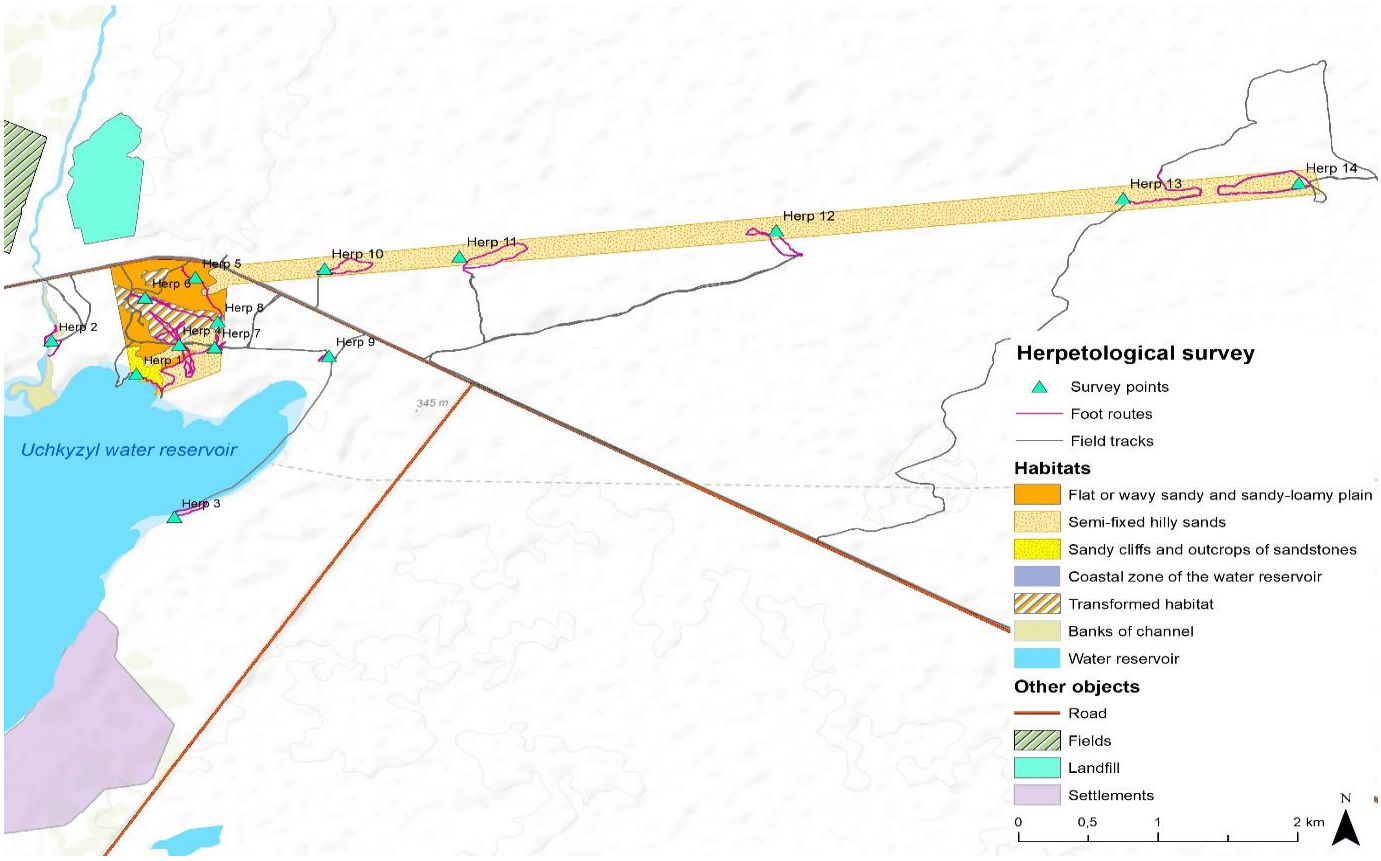


Figure 110: Tracks and Locations of Counts in The Project Area During A Field Trip in September 2022

The list of reptile counts in the project area is presented in Table 134.

Table 134: Results of Reptiles Counts in The Project Area During A Field Trip in September 2022

Site No/ length	North	East	Date	Species	Number	Density ind\ha	Soil t°C	Air t°C	Humidity
Herp_1 Route 1 / 300m	37,37427	67,24974	18.09. 2022	Central Asian tortoise *Testudo horsfieldii*	1 shell	-	+24, 8	+26, 8	29%
				Bogdanov's thin-toed gecko *Tenuidactylus bogdanovi*	67	223,3 ind/km			
				Boettger Caspian Toad-head Agama *Phrynocephalus raddei boettgeri*	2	6,6			
				Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	8	15,2			
				Steppe Agama *Trapelus sanguinolentus aralensis*	1	4,6			
				Rapid Racerunner *Eremias velox*	1	5,5			
Herp_1 Route 2 / 400m			18.09. 2022	Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	6	17,4	+28, 1	+27, 9	25%
				Lasdin's sand racerunner *Eremias scripta lasdini*	5	13,3			
				Striped racerunner *Eremias lineolata*	2	4,8			
				Black-ocellated racerunner *Eremias nigrocellata*	1	2,2			
				Tatary sand boa *Eryx tataricus*	2	2			
Herp_1			18.09. 2022	Boettger Caspian Toad-head Agama	2	5,7	+30, 3	+29, 1	23%

Site No/ length	North	East	Date	Species	Number	Density ind\ha	Soil t°C	Air t°C	Humidity
Route 3 / 400m				*Phrynocephalus raddei boettgeri*					
				Black-ocellated racerunner *Eremias nigrocellata*	5	11,6			
				Striped racerunner *Eremias lineolata*	1	2,2			
Herp_2 / 1000m	37,37819	67,24296	19.09. 2022	Eurasian marsh frog *Pelophylax ridibundus*	3	4,9	+35, 3	+38, 2	28%
				Bogdanov's thin-toed gecko *Tenuidactylus bogdanovi*	2	2 ind/km			
				Steppe Agama *Trapelus sanguinolentus*	3	1,7			
				Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	6	5,4			
				Rapid Racerunner *Eremias velox*	2	2,6			
				Lasdin's sand racerunner *Eremias scripta lasdini*	5	6,4			
				Striped racerunner *Eremias lineolata*	5	5,7			
				Dice snake *Natrix tessellata*	2	1,4			
Herp_3 / 600m	37,36358	67,25097	19.09. 2022	Bogdanov's thin-toed gecko *Tenuidactylus bogdanovi*	5	8,7 ind/km	+36, 5	+26, 9	31%
				Steppe Agama *Trapelus sanguinolentus*	1	1,7			

Site No/ length	North	East	Date	Species	Number	Density ind\ha	Soil t°C	Air t°C	Humidity
				Rapid Racerunner *Eremias velox*	2	3,6			
Herp_4 Route 1 / 700m	37.375903	67.252500	18.09.2022	Steppe Agama *Trapelus sanguinolentus*	1	1,2	+52,7	+35,6	19%
				Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	9	12,4			
				Secret toadhead Agama *Phrynocephalus mystaceus*	1	2,4			
				Boettger Caspian Toad-head Agama *Phrynocephalus raddei boettgeri*	3	5,4			
				Black-ocellated racerunner *Eremias nigrocellata*	2	3,7			
				Lasdin's sand racerunner *Eremias scripta lasdini*	6	9,5			
				Tatary sand boa *Eryx tataricus*	1	1,3			
Herp_4 Route 2 / 600m			18.09.2022	Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	7	12,1	+53,5	+35,9	19%
				Lasdin's sand racerunner *Eremias scripta lasdini*	4	6,8			
				Striped racerunner *Eremias lineolata*	3	5,6			
				Saw-scaled viper *Echis carinatus*	1	1,7			

Site No/ length	North	East	Date	Species	Number	Density ind\ha	Soil t°C	Air t°C	Humidity
Herp_4 Route 3 / 1300m night accounting			18.09. 2022	Comb-toed gecko *Crossobamon eversmanni*	5	3,3	+25, 6	+26, 8	28%
				Tatary sand boa *Eryx tataricus*	1	0,6			
Herp_5 / 600m	37,37885	67,25285	19.09. 2022	Steppe Agama *Trapelus sanguinolentus*	2	3,5	+49, 7	+34, 2	20%
				Secret toadhead Agama *Phrynocephalus mystaceus*	2	4,1			
				Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	12	20,2			
				Boettger Caspian Toad-head Agama *Phrynocephalus raddei boettgeri*	3	5,8			
				Black-ocellated racerunner *Eremias nigrocellata*	4	6,7			
				Lasdin's sand racerunner *Eremias scripta lasdini*	4	7,3			
				Tatary sand boa *Eryx tataricus*	2	1,7			
Herp_6 / 700m	37,37947	67,24992	18.09. 2022	Bogdanov's thin-toed gecko *Tenuidactylus bogdanovi*	4	6,7 ind/km	+52, 0	+34, 4	20%
				Steppe Agama *Trapelus sanguinolentus*	2	3,2			
				Tajikistan Toadhead Agama	10	17,4			

Site No/ length	North	East	Date	Species	Number	Density ind\ha	Soil t°C	Air t°C	Humidity
				Phrynocephalus sogdianus					
				Black-ocellated racerunner *Eremias nigrocellata*	3	4,8			
				Striped racerunner *Eremias lineolata*	6	10,4			
Herp_7 / 500m	37,37560	67,25628	18.09. 2022	Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	8	14,7	+45, 0	+37, 1	16%
				Boettger Caspian Toad-head Agama *Phrynocephalus raddei boettgeri*	2	4,9			
				Black-ocellated racerunner *Eremias nigrocellata*	5	11,2			
				Lasdin's sand racerunner *Eremias scripta lasdini*	3	7,6			
				Striped racerunner *Eremias lineolata*	2	4,7			
				Tatary sand boa *Eryx tataricus*	1	1,4			
Herp_8 / 500m	37,378215	67,256268	19.09. 2022	Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	8	17,3	+49, 2	+34, 2	20%
				Black-ocellated racerunner *Eremias nigrocellata*	2	4,4			
				Lasdin's sand racerunner *Eremias scripta lasdini*	6	12,3			

Site No/ length	North	East	Date	Species	Number	Density ind\ha	Soil t°C	Air t°C	Humidity
				Striped racerunner *Eremias lineolata*	2	5,1			
Herp_9 / 300m	37,37461	67,26454	18.09. 2022	Steppe Agama *Trapelus sanguinolentus*	3	5,1	+45, 5	+37, 7	15%
				Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	7	18,3			
				Lasdin's sand racerunner *Eremias scripta lasdini*	5	13,2			
				Reticulate racerunner *Eremias grammica*	2	6,1			

Despite the fact that the project area is sufficiently developed and even degraded in places, in a short time, field trip in September 2022. It is noted 15 species of reptiles (24.2% of the entire list of species of Uzbekistan and 55.6% of those noted in this area for literature data of species), of which 4 species (26.7% of the encountered species) are rare and listed in the Red Book of the Republic of Uzbekistan, 1 species is listed in the IUCN Red List [31] (6,7% of the encountered species), 2 species (13.3% of the encountered species) is included in CITES [32] and 4 narrow-range, endemic taxa (26.7% of the encountered species).

5 points were examined in the area of the future power transmission line with a length of 9 km to the east. The habitats on the territory of the projected transmission line, in contrast to the main project area for the construction of a thermal power plant on the Uchkizil reservoir, are homogeneous. Biotopes at all points of the study of power lines are similar to each other and represent fixed and semi-fixed sandy dunes sands overgrown with saxaul and sandy acacia (See Figure 111).

Figure 111: Semi-Fixed Sandy Dunes at Herp_13(Left) And Herp_14(Right)

The species composition of reptiles here turned out to be less diverse than in the main project area due to the homogeneity of biotopes (See Table 135).

Table 135: Results of Reptiles Counts on the 9 Km Power Transmition Line During A Field Trip in September 2022

Site No/ length	North	East	Date	Species	Number	Density in\ha	Soil t°C	Air t°C	Humidity
Herp_ 10 / 1000m	37,38085	67,26441	20.09. 2022	Steppe Agama *Trapelus sanguinolentus*	2	1,8	+47 ,0	+30, 5	27%
				Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	24	26,3			
				Secret toadhead Agama *Phrynocephalus mystaceus*	2	3,2			
				Lasdin's sand racerunner *Eremias scripta lasdini*	8	9,3			
				Reticulate racerunner *Eremias grammica*	12	11,6			

Site No/ length	North	East	Date	Species	Number	Density in\ha	Soil t°C	Air t°C	Humidity
				Tatary sand boa *Eryx tataricus*	1	0,8			
				Saw-scaled viper *Echis carinatus*	1	0,7			
Herp_ 11 / 400m	37.380139	67.276344	20.09. 2022	Steppe Agama *Trapelus sanguinolentus*	2	3,5	+38 ,3	+31, 9	23%
				Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	6	13,9			
				Lasdin's sand racerunner *Eremias scripta lasdini*	5	11,6			
				Reticulate racerunner *Eremias grammica*	6	13,3			
				Tatary sand boa *Eryx tataricus*	1	1,8			
Herp_ 12 / 1000m	37.380734	67.302961	20.09. 2022	Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	8	9,7	+42 ,7	+33, 5	20%
				Lasdin's sand racerunner *Eremias scripta lasdini*	6	7,8			
				Reticulate racerunner *Eremias grammica*	8	8,5			
Herp_	37.383927	67.329435	20.09. 2022	Tajikistan Toadhead Agama	17	22,6	+56 ,1	+37, 9	18%

Site No/ length	North	East	Date	Species	Number	Density in\ha	Soil t°C	Air t°C	Humidity
13 / 1000m				*Phrynocephalus sogdianus*					
				Secret toadhead Agama *Phrynocephalus mystaceus*	2	3,7			
				Lasdin's sand racerunner *Eremias scripta lasdini*	6	8,1			
				Reticulate racerunner *Eremias grammica*	7	7.5			
Herp_ 14/ 1000m	37.384342	67.344364	20.09. 2022	Tajikistan Toadhead Agama *Phrynocephalus sogdianus*	12	16,4	+43 ,9	+34, 7	17%
				Lasdin's sand racerunner *Eremias scripta lasdini*	7	8,1			
				Reticulate racerunner *Eremias grammica*	8	11,4			

On the territory of the projected transmission line with a length of 9 km to the east. It is noted 7 species of reptiles (11.3% of the entire list of species of Uzbekistan and 25.9% of those noted in this area for literature data of species), of which 1 species (14.3% of the encountered species) are rare and listed in the Red Book of the Republic of Uzbekistan, 1 species (14.3% of the encountered species) is included in CITES [32] and 2 narrow-range, endemic taxa (28.5% of the encountered species).

Lasdin's sand racerunner at point Herp-1

Central Asian tortoise at point Herp-1

Black-ocellated racerunner at point Herp-5

Boettger Caspian Toad-head Agama at point Herp-3

Bogdanov's thin-toed gecko at point Herp-1

Main habitats of Bogdanov's thin-toed gecko in the project area

Figure 112: The Photos of Observed and Potential Reptile Species of the Project Area in September 2022

The Central Asian tortoise, whose shell was found during the field trip in September 2022, most likely lives either in small numbers on the periphery of the project area, or this shell was brought to the territory by predatory mammals (fox, jackal) or birds of prey (vulture, black vulture). In the spring period, no tortoise was found in the project area, which indicates either its absence or extremely low abundance.

Ornithofauna

The project area is located on the shore of the Uchkizil reservoir in Surkhandarya region, 10 km from IBA "Amudarya flood lands near Termez". This is the territory of regular mass wintering of a large number of waterfowl and near-water birds. This is due to the location of the region on the Central Asian flyway. Despite the fact that IBA has great attractiveness for most species, nevertheless, Uchkizil can potentially also attract them due to the water surface, food and as a recreation area.

Within the framework of this analysis, a list of key bird species (endemism, International Union for Conservation of Nature (IUCN) [31], Convention on International Trade in Endangered Species (CITES) [32], UN Convention on the Conservation of Migratory Species of Wild Animals (CMS) [34], Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) [33], Uzbekistan Red Data Book [35] was given in Table 136.

A total of 149 bird species can be identified for the region around the project area, which are rare or listed. The only endemic bird of Uzbekistan, Podoces panderi does not live here. Among them, 21 species have IUCN statuses (NT-10 species, VU - 7 species and EN - 4 species). 33 species are included in the Red Book of Uzbekistan (2019) 4 species with the EN status, 23 - VU and 6 NT species. CITES Appendix I includes 5 species, and 33 species in Appendix II. Appendix II of the Berne Convention included 104 species. The CMS (Convention on Migratory Species) list in Appendix I included 12 types, and in Appendix II - 82 types. Of these species, representatives of 12 orders: Galliformes - 1 species, Anseriformes - 21 species, Pelecaniformes - 3 species, Ciconiiformes - 9 species, Podicipediformes - 2 species, Falconiformes - 29 species, Gruiformes - 3 species, Charadriiformes - 31 species, Pterocliformes - 1 species, Columbiformes - 1 species, Strigiformes - 3 species, Caprimulgiformes - 1

species, Apodiformes - 1 species, Coraciiformes - 3 species, Bucerotiformes - 1 species, Passeriformes - 25 species (see Table 136)[31] [32] [33] [34] [35].

During the field surveys, 49 bird species were recorded, 26 of them directly in the planned area (see Table 136) also shows the association of birds with the project area.

Table 136: Inventory of Ornithofauna for the Amudarya Floodplain Area and The Southern Part of The Surkhandarya Region

ID	Scientific name of the species	English name	Status of residence*	IUCN status 2020	Uzbek Red Book 2019	CITES	CMS	Bern conv	Field data July 2021-2022	Previously data
	Galliformes	Gallinaceous								
1	**Coturnix coturnix**	Common Quail	M				II			
	Anseriformes	Geese & allies								
2	**Cygnus olor**	Mute Swan	B,M,W		NT		II			
3	**Anser albifrons**	Greater White-fronted Goose	W				II			Amudarya 21Jan2018 - 200 birds (Lampila et al. 2018a), 9Dec2018 - 500 (Lampila et al. 2019), 18 birds in 2003-2005 in Amudarya (Lanovenko 2008a)
4	**Anser erythropus**	Lesser White-fronted Goose	W	VU	VU:R		I	II		Amudarya 21Jan2018 - 10 birds (Lampila et al. 2018a), 9Dec2018 - 50 birds (Lampila et al. 2019), IBA data 54-500 birds in 2003-2005 in Amudarya (Lanovenko 2008a)
5	**Anser anser**	Greylag Goose	B,M,W				II			Amudarya 21Jan2018 - 800 bird (Lampila et al. 2018a), 9Dec2018 - 700-1000 (Lampila et al. 2019), 5Mar2020-170 (Ten pers.data), IBA data 5942-31010 birds in 2003-2005 in Amudarya (Lanovenko 2008a)
6	**Branta ruficollis**	Red-breasted Goose	W	VU	VU:R	II	I	II		
7	**Tadorna ferruginea**	Ruddy Shelduck	B,M,W				II	II		Amudarya 21Jan2018 - 3 birds (Lampila et al. 2018a), 9Dec2018 - 4 birds (Lampila et al. 2019), IBA data 31-69 birds in 2003-2005 in Amudarya, and 14 birds in 2004 in Aktepa (Lanovenko 2008b)
8	**Tadorna tadorna**	Common Shelduck	B,W				II	II		
9	**Anas penelope**	Eurasian Wigeon	M,W				II			IBA data 7-146 birds in 2003-2005 in Amudarya (Lanovenko 2008a), and 113-1669 birds in 2003-06 in Aktepa (Lanovenko 2008b)
10	**Anas strepera**	Gadwall	M,W				II			Amudarya 5Mar2020- -14 birds (Ten pers.data), IBA data 1-3 birds in 2003-2005 in Amudarya (Lanovenko 2008a), and 4-9 birds in 2003-06 in Aktepa (Lanovenko 2008b)
11	**Anas crecca**	Common Teal	M,W				II		25 birds at Uchkizil water reserve at 27.04.2022	Amudarya 21Jan2018 - 10 birds (Lampila et al. 2018a), 9Dec2018 – 200 (Lampila et al. 2019), 10 Mar2020 -234, IBA data 8-818 birds in 2003-2005 İn Amudarya(Lanovenko 2008a), and 10-575 birds in 2003-06 in Aktepa(Lanovenko 2008b)
12	**Anas platyrhynchos**	Mallard	B,M,W				II			Amudarya 21Jan2018 - 4000 birds (Lampila et al. 2018a), 9Dec2018 - 4000 (Lampila et al. 2019), IBA data 5728-14057 birds in 2003-2005 in Amudarya (Lanovenko 2008a), and 308-1892 birds in 2003-06 in Aktepa (Lanovenko 2008b)
13	**Anas acuta**	Northern Pintail	M,W				II			IBA data 2 birds in 2003 in Aktepa (Lanovenko 2008b)
14	**Anas clypeata**	Northern Shoveler	W				II			IBA data 86 birds in 2003-2005 in Amudarya (Lanovenko 2008a)
15	**Marmaronetta angustirostris**	Marbled Teal	B,W	VU	EN		I	II		IBA data 4 birds in 2005-06 in Aktepa (Lanovenko 2008b)

ID	Scientific name of the species	English name	Status of residence*	IUCN status 2020	Uzbek Red Book 2019	CITES	CMS	Bern conv	Field data July 2021-2022	Previously data
16	**Netta rufina**	Red-crested Pochard	B,M,W				II			Amudarya 21Jan2018 - 4 birds (Lampila et al. 2018a), IBA data 10-141 birds in 2003-2005 in Amudarya (Lanovenko 2008a), and 1-457 birds in 2003-06 in Aktepa(Lanovenko 2008b)
17	**Aythya ferina**	Common Pochard	B,M,W	VU			II			Amudarya 21Jan2018 - 4 birds (Lampila et al. 2018a), 5Mar2020- 7 birds (Ten pers.data), IBA data 30-35 birds in 2003-2005 in Amudarya (Lanovenko 2008a), and 451-1067 birds in 2003-06 in Aktepa (Lanovenko 2008b)
18	**Aythya nyroca**	Ferruginous Duck	B,M,W	NT	VU:D		I			IBA data 1 birds in 2003-2005 in Amydarya (Lanovenko 2008a) and 1-3 in 2003-2006 in Aktepa (Lanovenko 2008b)
19	**Aythya fuligula**	Tufted Duck	M,W				II			Aktepe 21Jan2018 - 5 birds (Lampila et al. 2018a), 7Mar2020- -4 birds (Ten pers.data), IBA data 15-117birds in 2003-06 in Aktepa (Lanovenko 2008b)
20	**Bucephala clangula**	Common Goldeneye	W				II			Yuzhno-Surkhan reservoir 22 Jan2018 – 10 (Lampila et al. 2018a), IBA data 8 in 2004 in Aktepa (Lanovenko 2008b)
21	**Mergus merganser**	Goosander	W				II			Yuzhno-Surkhan reservoir 22 Jan2018 – 2 (Lampila et al. 2018a)
22	**Mergellus albellus**	Smew	W				II	II		IBA data 11-197 birds in 2003-06 in Aktepa (Lanovenko 2008b)
	Pelecaniformes	Pelicans & allies								
23	**Pelecanus onocrotalus**	Great White Pelican	M,W		VU:D		I	II		IBA data 1 birds in 2003in Amudarya (Lanovenko 2008b)
24	**Pelecanus crispus**	Dalmatian Pelican	M,W	NT	EN	I	I	II		IBA data 3 birds in 2003 in Amudarya (Lanovenko 2008a), and 3 birds in 2004-05 in Aktepa (Lanovenko 2008b)
25	**Phalacrocorax pygmeus**	Pygmy Cormorant	B,M,W		NT		II	II	8 bird Uchkizil at 17Jul2021	Amudarya 21Jan2018 - 10 birds (Lampila et al. 2018a), IBA data 30-103 birds in 2003-2005 in Amudarya (Lanovenko 2008a)
26	**Phalacrocorax carbo**	Great Cormorant	W				II	II		IBA data 9-2211 birds in 2003-2005 in Amudarya and 444-2687 in Aktepa (Lanovenko 2008a)
	Ciconiiformes	Storks & allies								
27	**Ardeola ralloides**	Squacco Heron	W		VU:R			II		Amudarya 9Dec2018 – 1 (Lampila et al. 2019)
28	**Botaurus stellaris**	Eurasian Bittern	B,W				II	II		IBA data 3 birds in 2003-2005 in Amudarya (Lanovenko 2008a)
29	**Ixobrychus minutus**	Little Bittern	B,M				II	II		
30	**Nycticorax nycticorax**	Black-crowned Night Heron	B,W					II		Amudarya 5Mar2020- - 2 birds (Ten pers.data)
31	**Egretta garzetta**	Little Egret	M,W		VU:D			II		IBA data 1 birds in 2003-2005 in Amudarya (Lanovenko 2008a)
32	**Casmerodius albus**	Great Egret	B,M,W				II	II		Amudarya 21Jan2018 - 5 birds (Lampila et al. 2018a), 9Dec2018 - 5 (Lampila et al. 2019), IBA data 27-103 birds in 2003-2005 in Amudarya (Lanovenko 2008a)
33	**Ardea cinerea**	Grey Heron	BW						8 birds in project area at 30.04.2022	

ID	Scientific name of the species	English name	Status of residence*	IUCN status 2020	Uzbek Red Book 2019	CITES	CMS	Bern conv	Field data July 2021-2022	Previously data
34	**Ardea purpurea**	Purple Heron	B				II	II		IBA data 2 birds in 2005 in Aktepa (Lanovenko 2008b)
35	**Ciconia nigra**	Black Stork	B		VU:R	II	II	II		Sherobad river 13Mar2020 – 1 (Ten pers.data), IBA data 2 birds in 2003-2005 in Amudarya (Lanovenko 2008a)
36	**Ciconia ciconia**	White Stork	B		NT		II	II		fields 1 nest 6Mar2020(Ten pers.data) IBA data 9 birds in 2003 (Lanovenko 2008a)
37	**Plegadis falcinellus**	Glossy Ibis	M	LC	VU:D		II		14 birds in project area at 30.04.2022	
	Podicipediformes	Grebes								
38	**Tachybaptus ruficollis**	Little Grebe	B,M,W					II	1 bird Uchkizil at 17Jul2021	Amudarya 21Jan2018 - 1 bird (Lampila et al. 2018a), IBA data 2-1 birds in 2003-2005 in Amudarya (Lanovenko 2008a)
39	**Podiceps cristatus**	Great Crested Grebe	M,W						2 birds in project area at 27.04.2022	
40	**Podiceps nigricollis**	Black-necked Grebe	W					II		Amudarya 21Jan2018 - 15 birds (Lampila et al. 2018a), 17-137 birds in 2003-06 in Aktepa (Lanovenko 2008b)
	Falconiformes	Falcons & allies								
41	**Falco naumanni**	Lesser Kestrel	B		NT	II	I	II		
42	**Falco tinnunculus**	Common Kestrel	B,W			II	II	II		Amudarya 21Jan2018 - 2 birds (Lampila et al. 2018a), 9Dec2018 – 5 (Lampila et al. 2019), IBA data 9-10 birds in 2003-2005 in Amudarya (Lanovenko 2008a)
43	**Falco columbarius**	Merlin	W			II	II	II		Amudarya 21Jan2018 - 2 birds (Lampila et al. 2018a), 9Dec2018 - 2(Lampila et al. 2019)
44	**Falco subbuteo**	Eurasian Hobby	B			II	II	II		
45	**Falco cherrug**	Saker Falcon	B	EN	EN	II	I	II		IBA data observed in Amudarya (Lanovenko 2008a)
46	**Falco peregrinus**	Peregrine Falcon	M,W		VU:R	I	II	II		IBA data observed in Aktepa (Lanovenko 2008b)
47	**Falco pelegrinoides**	Barbary Falcon	B		VU:R	I	II	II		IBA data observed in Aktepa (Lanovenko 2008b)
48	**Pandion haliaetus**	Osprey	M,W		VU:R	II	II	II		
49	**Haliaeetus leucoryphus**	Pallas's Fish-eagle	W	EN	EN	II	I	II		IBA data 1 birds in 2005 in Aktepa (Lanovenko 2008b)
50	**Haliaeetus albicilla**	White-tailed Sea-eagle	W		VU:R	I	I	II		Amudarya 21Jan2018 - 5 birds (Lampila et al. 2018a), 9Dec2018 – 5 (Lampila et al. 2019), IBA data 6-14 birds in 2003-2005 in Amudarya (Lanovenko 2008a), IBA data 1-14 birds in 2003-06 in Aktepa(Lanovenko 2008b)
51	**Gyps fulvus**	Griffon Vulture	R		VU:D	II	II	II	1 bird in project site at 30.04.2022	Kattakum and Khaudag sands 4-5Mar2020 - 1(Ten pers.data)
52	**Aegypius monachus**	Cinereous Vulture	R	NT	NT	II	II	II	1 bird in project site at 30.04.2022	Kattakum and Khaudag sands 4-5Mar2020 - 1(Ten pers.data)
53	**Gypaetus barbatus**	Bearded Vulture	R	NT	VU:R	II	II	II		Kattakum and Khaudag sands 4-5Mar2020 - 1(Ten pers.data)
54	**Neophron percnopterus**	Egyptian Vulture	B,M	EN	VU:D	II	II	II	1 juv bird in project sites at 17Jul2021 1 bird in project site at 30.04.2022	Kattakum and Khaudag sands 4-5Mar2020 - 2, project site - 1 juv (Ten pers.data)

ID	Scientific name of the species	English name	Status of residence*	IUCN status 2020	Uzbek Red Book 2019	CITES	CMS	Bern conv	Field data July 2021-2022	Previously data
55	**Circaetus gallicus**	Short-toed Snake-eagle	B		VU:D	II	II	II		
56	**Circus aeruginosus**	Western Marsh Harrier	B,W			II	II	II	2 birds in project sites and 5 birds near Uchkizil at 17Jul2021	Amudarya 21Jan2018 - 15 birds (Lampila et al. 2018a), 9Dec2018 – 10 (Lampila et al. 2019), Kattakum and Khaudag sands 4-5Mar2020 – 1 (Ten pers.data), IBA data 27-55 birds in 2003-2005 in Amudarya (Lanovenko 2008a), IBA data 3-14 birds in 2003-06 in Aktepa (Lanovenko 2008b)
57	**Circus cyaneus**	Hen Harrier	M,W			II	II	II		Amudarya 21Jan2018 - 5 birds (Lampila et al. 2018a), 9Dec2018 – 3 (Lampila et al. 2019), Kattakum and Khaudag sands 4-5Mar2020 – 1 (Ten pers.data) IBA data 86 birds in 2003-20052-4 in Amudarya (Lanovenko 2008a), IBA data 2 birds in 2005 in Aktepa (Lanovenko 2008b)
58	**Circus macrourus**	Pallid Harrier	M,W	NT	NT	II	II	II		Amudarya 21Jan2018 - 1 birds (Lampila et al. 2018a), IBA data 1 birds in 2003-2005 in Amuda rya (Lanovenko 2008a)
59	**Circus pygargus**	Montagu's Harrier	M			II	II	II		
60	**Accipiter badius**	Shikra	B			II	II	II		
61	**Accipiter nisus**	Eurasian Sparrowhawk	B,M			II	II	II		Amudarya 21Jan2018 - 1 birds (Lampila et al. 2018a) fields near Karasu 5Mar2020-3 (Ten pers.data)
62	**Accipiter gentilis**	Northern Goshawk	M			II	II	II		
63	**Buteo buteo**	Eurasian Buzzard	M,W			II	II	II		Kattakum and Khaudag sands 4-5Mar2020 – 1 (Ten pers.data), IBA data 1 birds in 2003-2005 in Amudarya (Lanovenko 2008a)
64	**Buteo rufinus**	Long-legged Buzzard	B,M,W			II	II	II		Amudarya 21Jan2018 - 4 birds (Lampila et al. 2018a), Kattakum and Khaudag sands 4-5Mar2020 – 1 (Ten pers.data), IBA data 6 birds in 2003-2005 in Amudarya (Lanovenko 2008a)
65	**Aquila clanga**	Greater Spotted Eagle	M,W	VU	VU:R	II	I	II		IBA data 1 birds in 2003-2005 in Amudarya(Lanovenko 2008a)
66	**Aquila nipalensis**	Steppe Eagle	M,W	EN	VU:D	II	II	II		Amudarya 5Mar2020- - 2 birds (Ten pers.data), IBA data 5 birds in 2003-2005 in Amudarya (Lanovenko 2008a), IBA data 2 birds in 2003 in Aktepa (Lanovenko 2008b)
67	**Aquila heliaca**	Eastern Imperial Eagle	M,W	VU	VU:D	I	I	II		Amudarya 21Jan2018 - 3 birds (Lampila et al. 2018a), 9Dec2018 – 1 (Lampila et al. 2019), 5Mar2020 - 1, Kattakum and Khaudag sands 4Mar2020 - 1, (Ten pers.data) IBA data 1-6 birds in 2003-2005 in Amudarya (Lanovenko 2008a), IBA data 2 birds in 2004 in Aktepa (Lanovenko 2008b)
68	**Aquila chrysaetos**	Golden Eagle	R		VU:R	II	II	II		IBA data 1 birds in 2003-2005 in Amudarya (Lanovenko 2008a)
	Gruiformes	Cranes, Rails, And Relatives								
69	**Anthropoides virgo**	Demoiselle Crane	M			II	II	II		IBA data 140-1500 birds in 2003-2005 in Amudarya (Lanovenko 2008a)
70	**Grus grus**	Common Crane	M,W			II	II	II		Amudarya 21Jan2018 - 2210 birds (Lampila et al. 2018a), 9Dec2018 – 1000 (Lampila et al. 2019), 5Mar2020-368 (Ten pers.data), Kattakum 5Mar2020-9 (Ten pers.data), IBA data

ID	Scientific name of the species	English name	Status of residence*	IUCN status 2020	Uzbek Red Book 2019	CITES	CMS	Bern conv	Field data July 2021-2022	Previously data
										6010-22169 birds in 2003-2005 in Amudarya (Lanovenko 2008a)
71	**Tetrax tetrax**	Little Bustard	M,W	NT	VU:D	II		II		Amudarya 21Jan2018 - 1980 birds (Lampila et al. 2018a), 9Dec2018 – 400 (Lampila et al. 2019), IBA data 150-2000 birds in 2003-2005 in Amudarya (Lanovenko, 2008 a)
	Charadriiformes	Shorebirds								
72	**Burhinus oedicnemus**	Eurasian Thick-knee	B				II	II		IBA data 1 birds in 2006 in Aktepa (Lanovenko 2008b)
73	**Haematopus ostralegus**	Eurasian Oystercatcher	B	NT						IBA data 4 birds in 2006 in Aktepa (Lanovenko 2008a)
74	**Himantopus himantopus**	Black-winged Stilt	B					II	1 bird near Uchkizil at 17Jul2021 15 birds at Uchkizi water reserve at 27.04.2022	
75	**Recurvirostra avosetta**	Pied Avocet	M				II	II		
76	**Vanellus vanellus**	Northern Lapwing	M,W	NT			II			Amudarya 21Jan2018 - 18 birds (Lampila et al. 2018a), 9Dec2018 –55 (Lampila et al. 2019) IBA data 7-2193 birds in 2003-2005 in Amudarya (Lanovenko 2008a), IBA data 2-490 birds in 2003-06 in Aktepa (Lanovenko 2008b)
77	**Vanellochettusia leucura**	White-tailed Lapwing	B				II			IBA data 2 birds in 2006 in Aktepa (Lanovenko 2008b)
78	**Charadrius dubius**	Little Ringed Plover	B				II	II	4 birds in project sites and 8 birds near Uchkizil at 17Jul2021 5 birds in project sites at 30.04.2022 and 3 birds near Uchkizil at 27.04.2022	IBA data 7 birds in 2006 in Aktepa (Lanovenko 2008b)
79	**Charadrius alexandrinus**	Kentish Plover	B,M				II	II	2 birds in project sites at 17Jul2021	
80	**Gallinago gallinago**	Common Snipe	W				II			Amudarya 21Jan2018 - 2 birds (Lampila et al. 2018a)
81	**Limosa limosa**	Black-tailed Godwit	W	NT	VU:D		II			Amudarya 9Dec2018 – 15 (Lampila et al. 2019)
82	**Actitis hypoleucos**	Common Sandpiper	M,W				II			
83	**Tringa totanus**	Common Redshank	M,W				II			Amudarya 21Jan2018 - 1 birds (Lampila et al. 2018a), 9Dec2018 - 4 (Lampila et al. 2019), IBA data 2-23 birds in 2003-06 in Aktepa (Lanovenko 2008b)
84	**Tringa stagnatilis**	Marsh Sandpiper	M				II	II		
85	**Tringa nebularia**	Common Greenshank	M,W				II		2 birds at Uchkizil water reserve at 27.04.2022	Amudarya 9Dec2018 – 1 (Lampila et al. 2019), IBA data 2-6 birds in 2003-06 in Aktepa (Lanovenko 2008b)
86	**Tringa ochropus**	Green Sandpiper	M,W				II	II		Amudarya 9Dec2018 - 2 (Lampila et al. 2019), Kattakum an d Khaudag sands, fields near Karasu 4-5Mar2020 - 4 (Ten pers.data), IBA data 2 birds in 2003-2005 in Amudarya (Lanovenko 2008a)

ID	Scientific name of the species	English name	Status of residence*	IUCN status 2020	Uzbek Red Book 2019	CITES	CMS	Bern conv	Field data July 2021-2022	Previously data
87	**Tringa glareola**	Wood Sandpiper	M				II		2 birds in project area at 30.04.2022	
88	**Calidris minuta**	Little Stint	M				II	II		IBA data 3 birds in 2006 in Aktepa (Lanovenko 2008b)
89	**Calidris temminckii**	Temminck's Stint	M				II	II		
90	**Calidris ferruginea**	Curlew Sandpiper	M	NT			II	II		
91	**Calidris alpina**	Dunlin	M,W				II	II		
92	**Philomachus pugnax**	Ruff	M				II			
93	**Glareola pratincola**	Collared Pratincole	B,M				II	II		IBA data 21 birds in 2006 in Aktepa (Lanovenko 2008b)
94	**Limicola falcinellus**	Broad-billed Sandpiper	M				II			
95	**Larus ichthyaetus**	Pallas's Gull	M,W		VU:D		II			IBA data 1 birds in 2005 in Aktepa (Lanovenko 2008b)
96	**Larus genei**	Slender-billed Gull	M				II	II		IBA data 11-55 birds in 2005 in Aktepa (Lanovenko 2008b)
97	**Gelochelidon nilotica**	Common Black-headed Gull	B,M							
98	**Larus minutus**	Little Gull	M					II		
99	**Gelochelidon nilotica**	Common Gull-billed Tern	M				II			IBA data 36 birds in 2005 in Aktepa (Lanovenko 2008b)
100	**Chlidonias niger**	Black Tern	B				II	II		IBA data 2 birds in 2005 in Aktepa (Lanovenko 2008b)
101	**Hydroprogne caspia**	Caspian Tern	M,W				II	II		
102	**Sterna hirundo**	Common Tern	B,M				II		33 birds in project sites and 19 birds near Uchkizil at 17Jul2021 50 birds near Uchkizil at 27.04.2022	IBA data 168 birds in 2005 in Aktepa (Lanovenko 2008b)
103	**Sterna albifrons**	Little Tern	B				II		1bird near Uchkizil at 17-18Jul2021 2 birds near Uchkizil at 27.04.2022	IBA data 85 birds in 2005 in Aktepa (Lanovenko 2008b)
	Pterocliformes	Sandgrouses								
104	**Pterocles orientalis**	Black-bellied Sandgrouse	B					II		Kattakum and Khaudag sands, fields near Karasu 4-5Mar2020 – 18 (Ten pers.data), IBA data 9 birds in 2005 in Aktepa (Lanovenko 2008b)
	Columbiformes	Pigeons								
105	**Streptopelia turtur**	European Turtle-dove	B,M	VU	VU:D		II			IBA data 1 birds in 2005 in Aktepa (Lanovenko 2008b)
106	**Columba livia**	Rock Pigeon	R						15 birds in project sites at 30.04.2022 and 5 birds near Uchkizil at 27.04.2022	
	Strigiformes	Owls								
107	**Bubo bubo**	Eurasian Eagle-owl	R			II		II		

ID	Scientific name of the species	English name	Status of residence*	IUCN status 2020	Uzbek Red Book 2019	CITES	CMS	Bern conv	Field data July 2021-2022	Previously data
108	**Athene noctua**	Little Owl	B			II		II	2 birds in project sites and 2 birds near Uchkizil at 17-18Jul2021 1 bird in project area at 30.04.2022	Kattakum and Khaudag sands 4-5Mar2020 – 1 (Ten pers.data), BA data 1 birds in 2006 in Aktepa (Lanovenko 2008b)
109	**Asio flammeus**	Short-eared Owl	W			II		II		Amudarya 21Jan2018 - 2 birds (Lampila et al. 2018a), IBA data 4 birds in 2003-2005 in Amudarya (Ten pers.data)
	Caprimulgiformes	Nightjars								
110	**Caprimulgus aegyptius**	Egyptian Nightjar	B					II	1 bird near Uchkizil at 27.04.2022	IBA data 1 birds in 2006 in Amudarya (Lanovenko 2008a)
	Apodiformes	Swifts								
111	**Apus melba**	Alpine Swift	M					II		IBA data 3 birds in 2006in Aktepa (Lanovenko 2008b)
112	**Apus apus**	Common Swift	B,M						8 birds in project area at 29.04.2022	
	Coraciiformes	Rollers								
113	**Coracias garrulus**	European Roller	B				II	II	1 bird in project area at 30.04.2022	IBA data 21 birds in 2006in Aktepa (Lanovenko 2008b)
114	**Alcedo atthis**	Common Kingfisher	R					II		IBA data 1 birds in 2004-06 in Aktepa (Lanovenko 2008b)
115	**Merops apiaster**	European Bee-eater	B				II	II		
116	**Merops persicus**	Blue-cheeked Bee-eater	B						6-7 birds in project sites at 28-29.04.2022 and 3 birds near Uchkizil at 27.04.2022	
	Bucerotiformes	Hoopoes								
117	**Upupa epops**	Common Hoopoe	B,W					II	1 bird near Uchkizil at 17Jul2021 2 birds in project sites at 28.04.2022	Amudarya 9Dec2018 – 1 (Lampila et al. 2019), Kattakum and Khaudag sands 4-5Mar2020 – 1 (Ten pers.data)
	Passeriformes	Passerins								
118	**Galerida cristata**	Crested Lark	R						1 bird in project sites at 28.04.2022 and 1 bird near Uchkizil at 27.04.2022	
119	**Melanocorypha calandra**	Calandra Lark	W					II		Amudarya 21Jan2018 - 300 birds (Lampila et al. 2018a), 9Dec2018 – 200 (Lampila et al. 2019)
120	**Riparia riparia**	Collared Sand Martin	B					II		IBA data 89 birds in 2006in Aktepa (Lanovenko 2008b)
121	**Riparia diluta**	Pale Sand Martin	B					II		
122	**Hirundo rustica**	Barn Swallow	B					II	12 birds in project sites and 115 birds near Uchkizil at 17Jul2021	IBA data 134 birds in 2006in Aktepa (Lanovenko 2008b)

ID	Scientific name of the species	English name	Status of residence*	IUCN status 2020	Uzbek Red Book 2019	CITES	CMS	Bern conv	Field data July 2021-2022	Previously data
123	**Delichon urbicum**	Northern House Martin	B					II		
124	**Motacilla flava**	Yellow Wagtail	M					II		
125	**Motacilla lutea**	Yellow-headed Wagtail	M					II		
126	**Motacilla citreola**	Citrine Wagtail	M					II		IBA data 1 birds in 2006 in Aktepa (Lanovenko 2008b)
127	**Motacilla alba**	White Wagtail	M					II		
128	**Motacilla personata**	Masked Wagtail	B					II	1 bird in project sites at 28.04.2022 and 1 bird near Uchkizil at 27.04.2022	
129	**Erythropygia galactotes**	Rufous Scrub-robin	B					II		IBA data 6 birds in 2006 in Aktepa (Lanovenko 2008b)
130	**Erithacus rubecula**	European Robin	W					II		
131	**Luscinia megarhynchos**	Common Nightingale	B					II		IBA data 3 birds in 2006 in Aktepa (Lanovenko 2008b)
132	**Luscinia svecica**	Bluethroat	B						1 bird in project sites at 28.04.2022	
133	**Saxicola maurus**	Siberian Stonechat	M					II	2 birds in project sites at 30.04.2022 and 2 birds in vicinity of Uchkizil at 27.04.2022	
134	**Oenanthe pleschanka**	Pied Wheatear	B					II		IBA data 1 birds in 2006in Aktepa (Lanovenko 2008b)
135	**Oenanthe isabellina**	Isabelline Wheatear	B					II		
136	**Oenanthe finschii**	Finsch's Wheatear	B						2 birds in project sites at 30.04.2022	
137	**Phylloscopus collybita**	Common Chiffchaff	M						10 birds in project sites at 27.04.2022	
138	**Muscicapa striata**	Spotted Flycatcher	M			II		II		
139	**Sylvia communis**	Common Whitethroat	M					II		
140	**Sylvia curruca**	Lesser Whitethroat	M					II	8 birds in project sites at 27.04.2022 and 3 birds in project sites at 27.04.2022	
141	**Sylvia nana**	Asian Desert Warbler	B					II		
142	**Parus bokharensis**	Turkestan Tit	B					II		IBA data 4 birds in 2006 in Amudarya, (Lanovenko 2008a), IBA data 4 birds in 2006in Aktepa (Lanovenko 2008b)
143	**Lanius isabellinus**	Isabelline Shrike	B					II		
144	**Lanius phoenicuroides**	Red-tailed Shrike	M					II		Kattakum and Khaudag sands 4-5Mar2020 - 6 migrating (Ten pers.data)
145	**Lanius schach**	Long-tailed Shrike	B					II		
146	**Lanius meridionalis**	Steppe Grey Shrike	M					II		Fields near Karasu 4-5Mar2020 - 4 migrating (Ten pers.data)

ID	Scientific name of the species	English name	Status of residence*	IUCN status 2020	Uzbek Red Book 2019	CITES	CMS	Bern conv	Field data July 2021-2022	Previously data
147	**Pastor roseus**	Rosy Starling	B						1000 birds near Uchkizil at 27.04.2022	

*Status of residence was identified for southern part of Surkhandarya region including Project area, Uchkizil reservoir, Amudarya floodlands, Aktepa and Three lakes: R –resident, B –breeding-migrating species, M –migrating species, W - wintering species.

The spring and summer field surveys revealed the presence of 33 bird species on and off the Project site (see Table 137). Nesting of Common Tern and Little Tern terns were noted on islands and capes in the reservoir to the south of the Project area. Western Marsh Harrier nesting has been noted in reed and tamarisk thickets along the Zang Canal. Little Ringed Plover, Little Owl, European Roller, Blue-cheeked Bee-eater, Common Hoopoe, Crested Lark, Pale Sand Martin, Pied Wheatear, Isabelline Wheatear and Rock Pigeon can nest in the project area. The rest of the birds are migratory, wintering or nesting in the nearby area.

In total the survey covered 5 sites in different biotopes: UK-Orn_1 - aeolian deposits forming sandy loam hills and low bluffs near the shore up to 5-6m high; UK-Orn_2 - a ravine in sandstone formed by the Amu-Zang River flowing into the reservoir, low bluffs up to 4-5m, with moss and ferns growing along the gully bed; UK-Orn_3 - southern sandy bank of the reservoir with rare comb and ambergrass bushes, low bluffs up to 5-6 m high; UK-Orn_4 - sandy bank with rare comb and ambergrass bushes, low bluffs up to 4-5 m high; UK-Orn_5 - sandy fine-hilly plain near the route with Kandym and Sarsazan (see Figure 113).

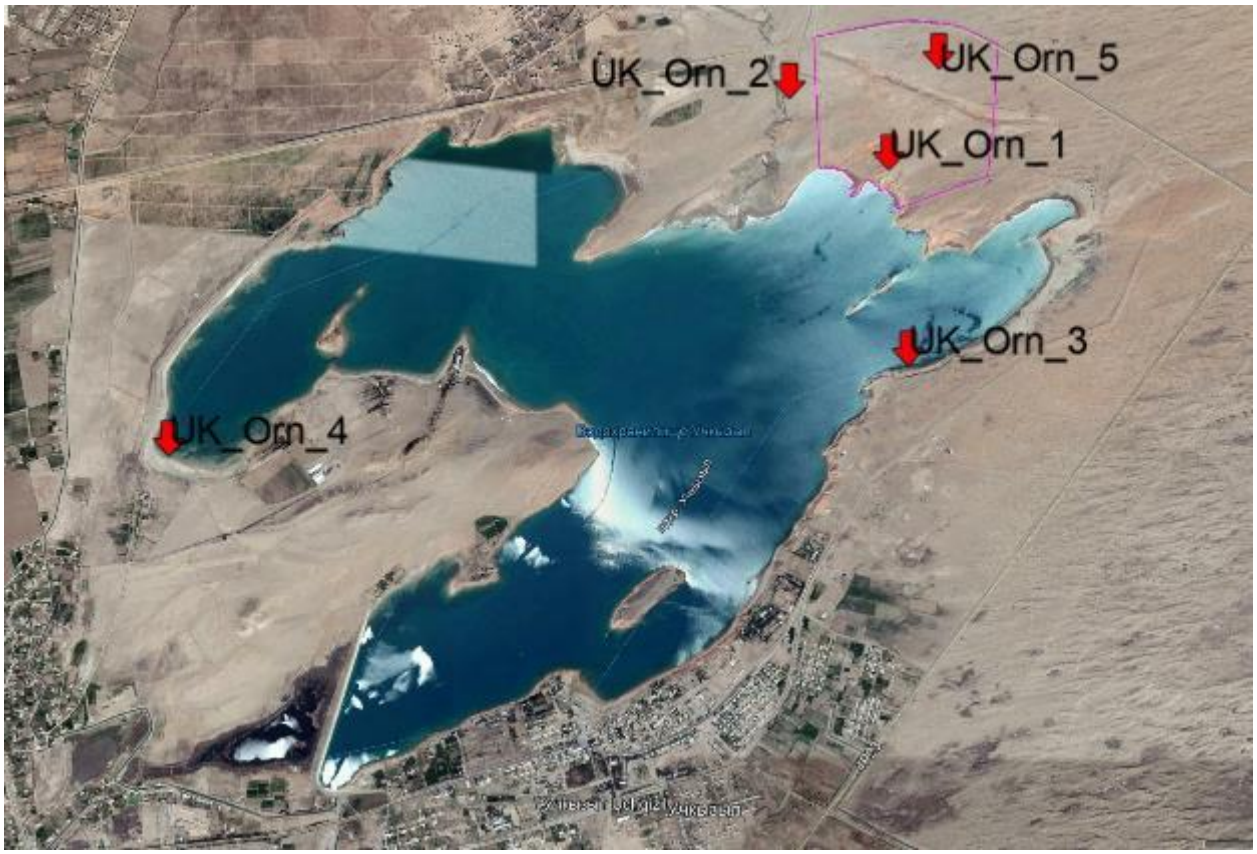


Figure 113: The Ornithological Fauna Survey Points at Uchkizil Also Covered the Adjoining Area

Table 137: Field Ornithological Survey Data in The Area In 2021

Site №	North	Eeast	Date	Biotope	Species	Number	Activities
UK_Orn-1	37,37427	67,24974	17.07.2021	Sandy loam hills, aeolian deposits, low cliffs up to 5-6 m high	Common Tern - Sterna hirundo	33	nesting, close foraging area on lake
UK_Orn-1	37,37427	67,24974	17.07.2021	Sandy loam hills, aeolian deposits, low cliffs up to 5-6 m high	Grey Heron - Ardea cinerea	9	close foraging area on lake
UK_Orn-1	37,37427	67,24974	17.07.2021	Sandy loam hills, aeolian deposits, low cliffs up to 5-6 m high	Barn Swallow - Hirundo rustica	12	nesting, foraging area
UK_Orn-1	37,37427	67,24974	17.07.2021	Sandy loam hills, aeolian deposits, low cliffs up to 5-6 m high	Rock Dove - Columba livia	12	crossing
UK_Orn-1	37,37427	67,24974	17.07.2021	Sandy loam hills, aeolian deposits, low cliffs up to 5-6 m high	Little Ringed Plover - Charadrius dubius	4	nesting, close foraging area on lake
UK_Orn-1	37,37427	67,24974	17.07.2021	Sandy loam hills, aeolian deposits, low cliffs up to 5-6 m high	Common Sandpiper - Actitis hypoleucos	4	Foraging area on lake
UK_Orn-1	37,37427	67,24974	17.07.2021	Sandy loam hills, aeolian deposits, low cliffs up to 5-6 m high	Masked Wagtail - Motacilla personata	1	Foraging area on lake
UK_Orn-1	37,37427	67,24974	17.07.2021	Sandy loam hills, aeolian deposits, low cliffs up to 5-6 m high	Western Marsh Harrier - Circus aeruginosus	2	Foraging area
UK_Orn-1	37,37427	67,24974	17.07.2021	Sandy loam hills, aeolian deposits, low cliffs up to 5-6 m high	Blue-cheeked Bee-eater - Merops persicus	6	nesting in close sites, foraging area
UK_Orn-1	37,37427	67,24974	17.07.2021	Sandy loam hills, aeolian deposits, low cliffs up to 5-6 m high	Common Coot - Fulica atra	7	Foraging area on lake
UK_Orn-1	37,37427	67,24974	17.07.2021	Sandy loam hills, aeolian deposits, low	Crested Lark - Galerida cristata	2	nesting

Site №	North	Eeast	Date	Biotope	Species	Number	Activities
				cliffs up to 5-6 m high			
UK_Orn-1	37,37427	67,24974	17.07.2021	Sandy loam hills, aeolian deposits, low cliffs up to 5-6 m high	Kentish Plover - Charadrius alexandrinus	2	nesting
UK_Orn-1	37,37427	67,24974	17.07.2021	Sandy loam hills, aeolian deposits, low cliffs up to 5-6 m high	Black-headed Gull - Larus ridibundus	1	nesting
UK_Orn-1	37,37427	67,24974	17.07.2021	Sandy loam hills, aeolian deposits, low cliffs up to 5-6 m high	Little Owl - Athene noctua	1	nesting
UK_Orn-2	37,37819	67,24296	17.07.2021	A small river in a sandstone flowing into a reservoir, low cliffs up to 4-5 m, mosses and ferns grow along the river bed	Common Tern - Sterna hirundo	2	nesting
UK_Orn-2	37,37819	67,24296	17.07.2021	A small river in a sandstone flowing into a reservoir, low cliffs up to 4-5 m, mosses and ferns grow along the river bed	Barn Swallow - Hirundo rustica	около сотни	nesting
UK_Orn-2	37,37819	67,24296	17.07.2021	A small river in a sandstone flowing into a reservoir, low cliffs up to 4-5 m, mosses and ferns grow along the river bed	Indian Sparrow - Passer indicus	38	nesting
UK_Orn-2	37,37819	67,24296	17.07.2021	A small river in a sandstone flowing into a reservoir, low cliffs up to 4-5 m, mosses and ferns grow along the river bed	Little Ringed Plover- Charadrius dubius	4	nesting
UK_Orn-2	37,37819	67,24296	17.07.2021	A small river in a sandstone flowing into a	Masked Wagtail -Motacilla personata	2 juv	Foraging area

Site №	North	Eeast	Date	Biotope	Species	Number	Activities
				reservoir, low cliffs up to 4-5 m, mosses and ferns grow along the river bed			
UK_Orn-2	37,37819	67,24296	17.07.2021	A small river in a sandstone flowing into a reservoir, low cliffs up to 4-5 m, mosses and ferns grow along the river bed	Western Marsh Harrier - Circus aeruginosus	1	Foraging area
UK_Orn-3	37,36358	67,25097	17.07.2021	southern shore of the reservoir, sandy shore with rare tamarix and camel torn bushes, low cliffs max. 5-6m	Little Owl - Athene noctua	1	nesting
UK_Orn-3	37,36358	67,25097	17.07.2021	southern shore of the reservoir, sandy shore with rare tamarix and camel torn bushes, low cliffs max. 5-6m	Western Marsh Harrier - Circus aeruginosus	2	Foraging area
UK_Orn-3	37,36358	67,25097	17.07.2021	southern shore of the reservoir, sandy shore with rare tamarix and camel torn bushes, low cliffs max. 5-6m	Little Ringed Plover - Charadrius dubius	3	nesting
UK_Orn-3	37,36358	67,25097	17.07.2021	southern shore of the reservoir, sandy shore with rare tamarix and camel torn bushes, low cliffs max. 5-6m	Common Tern - Sterna hirundo	4	nesting

Site №	North	Eeast	Date	Biotope	Species	Number	Activities
UK_Orn-3	37,36358	67,25097	17.07.2021	southern shore of the reservoir, sandy shore with rare tamarix and camel torn bushes, low cliffs max. 5-6m	Caspian Gull - Larus cachinnans	1	nesting
UK_Orn-3	37,36358	67,25097	17.07.2021	southern shore of the reservoir, sandy shore with rare tamarix and camel torn bushes, low cliffs max. 5-6m	Barn Swallow - Hirundo rustica	15	nesting
UK_Orn-3	37,36358	67,25097	17.07.2021	southern shore of the reservoir, sandy shore with rare tamarix and camel torn bushes, low cliffs max. 5-6m	Blue-cheeked Bee-eater - Merops persicus	8	nesting
UK_Orn-3	37,36358	67,25097	17.07.2021	southern shore of the reservoir, sandy shore with rare tamarix and camel torn bushes, low cliffs max. 5-6m	Eurasian Hoopoe - Upupa epops	1	nesting
UK_Orn-4	37,35902	67,20017	17.07.2021	Sandy shore with rare tamarix and camel torn bushes. Low cliffs with a maximum height of 4-5m	Black-winged Stilt- Himantopus himantopus	6	nesting
UK_Orn-4	37,35902	67,20017	17.07.2021	Sandy shore with rare tamarix and camel torn bushes. Low cliffs with a maximum height of 4-5m	Little Grebe - Tachybaptus ruficollis	1	Foraging area

Site №	North	Eeast	Date	Biotope	Species	Number	Activities
UK_Orn-4	37,35902	67,20017	17.07.2021	Sandy shore with rare tamarix and camel torn bushes. Low cliffs with a maximum height of 4-5m	Grey Heron - Ardea cinerea	4	Foraging area
UK_Orn-4	37,35902	67,20017	17.07.2021	Sandy shore with rare tamarix and camel torn bushes. Low cliffs with a maximum height of 4-5m	Caspian Gull - Larus cachinnans	1	Foraging area
UK_Orn-4	37,35902	67,20017	17.07.2021	Sandy shore with rare tamarix and camel torn bushes. Low cliffs with a maximum height of 4-5m	Western Marsh Harrier - Circus aeruginosus	2	Foraging area
UK_Orn-4	37,35902	67,20017	17.07.2021	Sandy shore with rare tamarix and camel torn bushes. Low cliffs with a maximum height of 4-5m	Common Tern - Sterna hirundo	13	nesting
UK_Orn-4	37,35902	67,20017	17.07.2021	Sandy shore with rare tamarix and camel torn bushes. Low cliffs with a maximum height of 4-5m	Little Ringed Plover - Charadrius dubius	1	nesting
UK_Orn-4	37,35902	67,20017	17.07.2021	Sandy shore with rare tamarix and camel torn bushes. Low cliffs with a maximum height of 4-5m	Little Tern - Sterna albifrons	1	nesting
UK_Orn-4	37,35902	67,20017	17.07.2021	Sandy shore with rare tamarix and	Common Myna - Acridotheres tristis	2	Foraging area

Site №	North	Eeast	Date	Biotope	Species	Number	Activities
				camel torn bushes. Low cliffs with a maximum height of 4-5m			
UK_Orn-4	37,35902	67,20017	17.07.2021	Sandy shore with rare tamarix and camel torn bushes. Low cliffs with a maximum height of 4-5m	Little Owl - Athene noctua	1	nesting
UK_Orn-4	37,35902	67,20017	17.07.2021	Sandy shore with rare tamarix and camel torn bushes. Low cliffs with a maximum height of 4-5m	Wood Sandpiper - Tringa glareola	2	Foraging area
UK_Orn-4	37,35902	67,20017	17.07.2021	Sandy shore with rare tamarix and camel torn bushes. Low cliffs with a maximum height of 4-5m	Pygmy Cormorant - Phalacrocorax pygmaeus	8	Foraging area
UK_Orn-5	37,37971	67,25319	18.07.2021	sandy shallow hilly plain near the road, Calligonum and Halocnemum bushes.	Egyptian vulture - Neophron percnopterus	1 juv	Foraging area
UK_Orn-5	37,37971	67,25319	18.07.2021	sandy shallow-hilly plain near the road, Calligonum and Halocnemum bushes.	Little Owl - Athene noctua	1	nesting
UK_Orn-5	37,37971	67,25319	18.07.2021	sandy shallow-hilly plain near the road, Calligonum and Halocnemum bushes.	Indian Sparrow - Passer indicus	12	nesting

Site №	North	Eeast	Date	Biotope	Species	Number	Activities
UK_Orn-5	37,37971	67,25319	18.07.2021	sandy shallow-hilly plain near the road, Calligonum and Halocnemum bushes.	Crested Lark - Galerida cristata	3	nesting
UK_Orn-5	37,37971	67,25319	18.07.2021	sandy shallow-hilly plain near the road, Calligonum and Halocnemum bushes.	Rock Dove - Columba livia	5	Foraging area
UK_Orn-5	37,37971	67,25319	18.07.2021	sandy shallow-hilly plain near the road, Calligonum and Halocnemum bushes.	Blue-cheeked Bee-eater - Merops persicus	6	nesting
UK_Orn-5	37,37971	67,25319	18.07.2021	sandy shallow-hilly plain near the road, Calligonum and Halocnemum bushes.	Streaked Scrub Warbler - Scotocerca inquieta	2	nesting

Table 138: Field Ornithological Survey Data in The Area In 2022

No	North	East	Date	Biotope	Species	Number	Activities
UK_PL-Orn-1	37,37819	67,24296	27.04.2022	North-Eastern coast of Uch Kizil storage reservoir, with the sandy loam hills, aeolian deposits, low cliffs up to 5-6 m high	Common Tern *Sterna hirundo*	50	nesting, close foraging area on lake
					Black-headed Gull *Larus rudibundus*	6	over the lake
					Little Tern *Sterna albifrons*	2	over the lake
					Rock Dove *Columba livia*	5	crossing
					Masked Wagtail *Montacilla personata*	15	feeding on the shore
					Rose-collored Starling *Sturnus roseus*	1000	crossing
					Teal *Anas crecca*	25	Foraging area on lake
					Great Crested Grebe *Podiceps cristatus*	2	Foraging area
					Marsh Harrier *Circus aerogenosus*	1	nesting in close sites, foraging area
					Little Ringed Plover *Charadrius dubius*	3	
					Black-winged Stilt *Himantopus himantopus*	15	nesting
					Common Sandpipper *Actitis hupoleucos*	2	nesting

No	North	East	Date	Biotope	Species	Number	Activities
					Greenshank *Tringa nebularia*	2	nesting
					Little Owl - *Athene noctua*	1	nesting
UK_PL-Orn-2	37,37819	67,24296	27.04.2022	Sand dunes with typical desert Vegetation along transmission line	Crested Lark - *Galerida cristata*	1	
					Masked Wagtail - *Motacilla personata*	4	Foraging area
					Blue-cheeked Bee-eater - *Merops persicus*	3	
UK_PL-Orn-3	37,36358	67,25097	27.04.2022	Depression surround by sandy missives with tamarix and camel torn bushes.	Egyptian Vulture *Neophon percnopterus*	1	crossing
					Sibirian Stonechat *Saxicola maurus*	2	
					Chiffchaff *Phylloscopus collebita*	10	crossing
					Lesser Whitethroat *Sylvia curruca*	8	nesting
UK_PL-Orn-4	37,35902	67,20017	28.04. 2022	Sand dunes with typical desert Vegetation along transmission line	Blue-cheeked Bee-eater - *Merops persicus*	6	
					Crested Lark - *Galerida cristata*	1	
UK_PL-Orn-5	37,37971	67,25319	28.04. 2022	Sand dunes with typical desert Vegetation along	Bluethroat *Luscinia svecica*	1	crossing

No	North	East	Date	Biotope	Species	Number	Activities
				transmission line			
				Sand dunes with typical desert Vegetation along transmission line	Common Hoopoe *Upupa epops*	2	crossing
				Sand dunes with typical desert Vegetation along transmission line	Eurasian Nightjar *Caprimulgus europaeus*	1	nesting
				Sand dunes with typical desert Vegetation along transmission line	Western Marsh Harrier *Circus aeruginosus*	2	nesting
					Little Ringed Plover *Charadrius dubius*	5	nesting
					Wood Sandpiper *Tringa glareola*	2	crossing
					Masked Wagtail *Motacilla personata*	2	crossing

Survey in September 2022

Visual counts of birds were carried out covering the plant site and the overhead power line during the autumn field trip from September 18 to September 20, 2022. the time of counting at points was to 1 hour. The counting radius at the points was 250 m. Thus, the counting area at each point was 0.62 km^2. Data were obtained on the species and quantitative composition of the bird fauna making radial surveys on the ground (See Figure 114, Figure 115).

Figure 114: Route Transects for The Survey of Avifauna

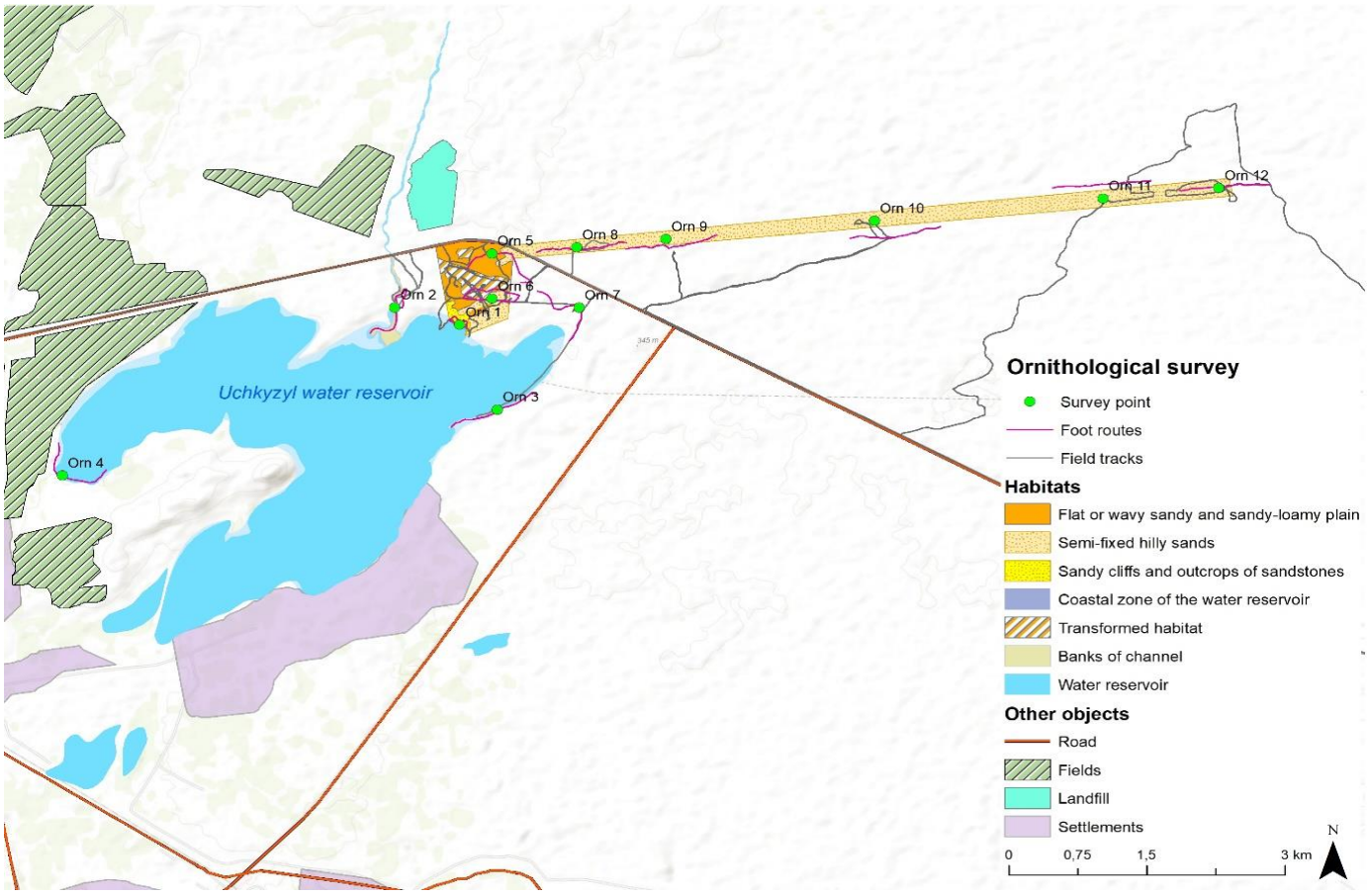


Figure 115: Location of Bird's Survey Points

At all points we recorded all species information. However, the fall of 2022 turned out to be very dry, as was the summer. This affected the desiccation of vegetation, the low number of rodents, and, as a result, the low level of occurrence of birds in the dry zone of the Asian steppes and semi-deserts.

To analyze the composition of the fauna, the territory was conditionally divided into three zones.

The water area of the Uchkizil reservoir and the delta of the inflowing Zang channel (points Orn-1, Orn-2, Orn-3, Orn-4);

Arid zone of the construction site itself (points Orn-5, Orn-6, Orn-7);

Sandy ridge Kattakum under the power line (Points Orn-8, Orn-9, Orn-10, Orn-11, Orn-12).

1st Zone: Uchkizil water reservoir

27 species of birds were recorded, of which 17 species were waterfoul with total number is only 299 individuals. Such low number is associated with a long summer and the absence of waterfowl passage – waders flew in August; ducks flew only in mid-October. So, we saw just end of waders migtanition and start of duck migration. Status of residence is given in Table 139.

It is very difficult to catch the passage of rare bird species in the south of Uzbekistan, since many factors in the north of the Central Asian region (weather, availability of food supply, human disturbance factors) influence the timing of the passage. According to observations, the passage of waterfowl in Uzbekistan in the autumn of 2022 began only in the second half of October. However, in winter, when there is no more migration and winter concentrations of birds are formed, it may be more adequate to conduct a census of rare species. Thus, conducting surveys in mid-January will most clearly reflect the importance of the reservoir for waterfowl.

Table 139: Birds Count on Points on The Uchkizil Water Reservoir

Latin name	Common name	Status of residence	18-19.09.2022		19.09.2022	
			Orn-1	Orn-2	Orn-3	Orn-4
			8.50-9.50 8.00-9.00	13.00-14.00 15.00-16.00	9.25-10.25	10.55-11.55
Phalacrocorax carbo	Great Cormorant	M, W				1
Ardea cinerea	Grey Heron	B, M, W	3	2	2	4
Anas platyrhynchos	Mallard	M, W	52			11
Anas strepera	Gadwall	M, W				1
Anas crecca	Common Teal	M, W	97			38

Latin name	Common name	Status of residence	18-19.09.2022		19.09.2022	
			Orn-1	Orn-2	Orn-3	Orn-4
			8.50-9.50 8.00-9.00	13.00-14.00 15.00-16.00	9.25-10.25	10.55-11.55
Anas clypeata	Northern Shoveler	M, W	1			10
Buteo rufinus	Long-legged Buzzard	R		1		
Circus aeruginosus	Western Marsh Harrier	R	2			2
Falco tinnunculus	Common Kestrel	R			1	
Fulica atra	Common Coot	M, W	22			
Himantopus himantopus	Black-winged Stilt	B, M				2
Tringa ochropus	Green Sandpiper	M, W	2			
Tringa nebularia	Common Greenshank	M, W	2			
Philomachus pugnax	Ruff	M	6			
Larus cachinnans	Caspian Gull	R	8	1		6
Columba livia	Rock Dove	R				50
Athene noctua	Little Owl	R	1			
Alcedo atthis	Common Kingfisher	B, M, W			1	1
Coracias garrulus	European Roller	B, M		1		
Merops persicus	Blue-cheeked Bee-eater	B, M	17	4	18	

Latin name	Common name	Status of residence	18-19.09.2022		19.09.2022	
			Orn-1	Orn-2	Orn-3	Orn-4
			8.50-9.50 8.00-9.00	13.00-14.00 15.00-16.00	9.25-10.25	10.55-11.55
Galerida cristata	Crested Lark	R	11		8	
Motacilla flava	Yellow Wagtail	M	2			
Motacilla alba	White Wagtail	M, W		4		
Riparia riparia	Sand Martin	M	16			
Phylloscopus tristis	Siberian Chiffchaff	M, W		3	2	
Oenanthe isabellina	Isabelline Wheatear	R	1			
Acridoteres tristis	Common Myna	R			4	
Comments: R – resident, B – breeding, M – migrant, W – wintering						

Grey heron at point Orn-3

Caspian gull at point Orn-1

Long-legged Buzzard at point Orn-2

Western Marsh Harrier at point Orn-4

Figure 116: Observed Bird Species in First Zone

2nd Zone: Project area

The project area located in close proximity to the reservoir, in fact, it is very dry, arid area devoid of a source of drinking water. The terrain is very indented with ravines and pits of artificial origin. The main set of species here is typical for the arid areas of Uzbekistan. Rare and significant species were not noted. General records are brought in Table 140.

Table 140: Birds Count on Points on The Project Area

Latin name	Common name	Status of residence	18.09.2022		
			Orn-5	Orn-6	Orn-7
			11.15-12.15	10.05-11.05	15.50-16.50
Athene noctua	Little Owl	R	1		
Caprimulgus europaeus	European Nightjar	B	1		
Merops persicus	Blue-cheeked Bee-eater	B, M		7	24
Merops apiaster	European Bee-eater	B, M			3
Galerida cristata	Crested Lark	R	4		4
Alauda arvensis	Eurasian Skylark	B			2
Motacilla flava	Yellow Wagtail	M		2	

Latin name	Common name	Status of residence	18.09.2022		
			Orn-5	Orn-6	Orn-7
			11.15-12.15	10.05-11.05	15.50-16.50
Acrocephalus dumetorum	Blyth's Reed-warbler	B		1	
Oenanthe oenanthe	Northern Wheatear	R		3	
Oenanthe isabellina	Isabelline Wheatear	R	2		1
Corvus corax	Common Raven	R	4		

Crested Lark at point Orn-5

Blyth's Reed-warbler at point Orn-6

Isabelline Wheatear at point Orn-5

Common Raven at point Orn-5

Figure 117: Observed Bird Species in Second Zone

3d Zone: Under the power line

This zone is located on medium hilly sands, out of the water. Nevertheless, the composition of species indicates the integrity of the state of the sandy section of the project area with a characteristic set of species (see Table 141).

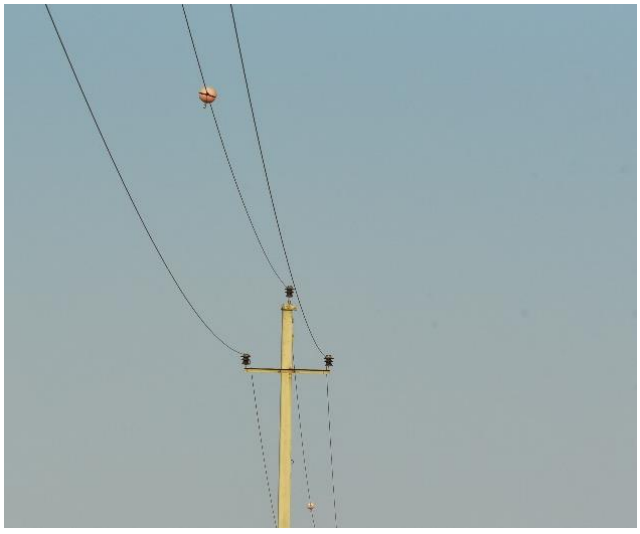
Among migratory species, Pallid Harrier Circus macrourus has been noted with IUCN NT status, and also at the national level 3 NT. This is a migratory species that falls under the CMS (Appendix II) convention, and therefore, when laying power lines, it is necessary to install isolate for birds protecting devices (see Figure 118) for birds and monitor them during spring and autumn migration.

Table 141: Birds Count on Points Under the Power Line

Latin name	Common name	Status of residence	20.09.2022				
			Orn-8	Orn-9	Orn-10	Orn-11	Orn-12
			15.05-16.05	12.30-13.30	11.15-12.15	9.35-10.30	8.10-9.10
Falco tinnunculus	Common Kestrel	R				1	
Circus macrourus	Pallid Harrier	M		1			1
Caprimulgus europaeus	European Nightjar	M		1			
Merops persicus	Blue-cheeked Bee-eater	B, M	24		11		
Merops apiaster	European Bee-eater	B	3				
Galerida cristata	Crested Lark	R	4	4	2		4
Anthus trivialis	Tree Pipit	R	7				
Phylloscopus tristis	Siberian Chiffchaff	R		2			
Sylvia curruca	Lesser Whitethroat	R					1
Scotocerca inquieta	Streaked Scrub Warbler	B, M				1	
Oenanthe isabellina	Isabelline Wheatear	R	1			1	

Latin name	Common name	Status of residence	20.09.2022				
			Orn-8	Orn-9	Orn-10	Orn-11	Orn-12
			15.05-16.05	12.30-13.30	11.15-12.15	9.35-10.30	8.10-9.10
Acridoteres tristis	Common Myna	R					
Corvus corax	Common Raven	R	1			1	2

Isolate device for power cap of pillar



View red marker for spans of wires

Figure 118: Bird Protection Devices Images

Common Kestrel at point Orn-11

Pallid Harrier at point Orn-9

Isabelline Wheatear at point Orn-8

Common Raven at point Orn-12

Figure 119: Observed Bird Species in Third Zone

During the autumn field trip (2022), 37 species of birds were recorded on the territory. Of these, the rare Pallid Harrier Circus macrourus has been noted with IUCN NT status, and also at the national level 3 NT. This is the largest number of species in 3 field visits. Also, during the autumn trip, the largest number of duck species was recorded for all 3 trips - this is due to the autumn migration of this group of birds through the Uchkizil reservoir. However, it should be noted that the number of these birds was extremely low. It is worth pointing out that waterfowl do not much prefer this reservoir, due to the fact that it is relatively deep and of strong concern from the local population.

A total of 57 species of birds were noted during 3 field trips. Of these, 6 species are listed in the National Red Book (2019) and 3 species of Egyptian Vulture (EN), Cinereous Vulture (NT) and Pallid Harrier (NT) are listed in the IUCN Red List.

Theriofauna

Approximately 22 species of mammals belonging to 6 families have been recorded in project area its surrounding area based on available literature sources.

The territory is potentially inhabited by 6 species of mammals included in the Red Book of the Republic of Uzbekistan [35]; *Otonycteris hemprichi, Vulpes corsak turkmenicus, Vormela peregusna, Lutra lutra seistanica, Hyaena hyaena, Felis margarita, Caracal caracal michaelis, Vormela peregusna*. and the 5 species are included CITES (*Lutra lutra, felis chaus, Felis lybica, Felis margarita, Caracal caracal michaelis*). Two species are Central Asian endemics that *Rhinolophus bocharicus* and *Allactaga severtzovi* (see Table 137). *Gazella subgutturosa* that used to inhabit the area has been completely exterminated.

Table 142: Rare Mammal Species Potentially Inhabiting the Project Area

No.	Type	Red Book (2019)	IUCN status (2021)	CITES	CMS	Endemity
1	***Rhinolophus bocharicus***	-	LC	-	-	AF, IR, KZ, KR, TM, TJ, UZ
2	***Otonycteris hemprichi***	2(VU:R)	LC	-	-	-
3	***Allactaga severtzovi***	-	LC	-	-	KZ, TM, TJ, UZ
4	***Vulpes corsak turkmenicus***	2(VU:D)	-	-	-	-
5	***Vormela peregusna***	2(VU:D)	VU	-	-	-
6	***Lutra lutra seistanica***	1(EN)	NT	I	-	-
7	***Hyaena hyaena***	1(CR)	NT	-	-	-
8	***Felis chaus***	-	LC	II	-	-
9	***Felis lybica ornata***	-	LC	II	-	-
10	***Felis margarita***	3(NT)	LC	II	-	-
11	***Caracal caracal michaelis***	1(CR)	LC	I	-	-

In order to obtain more comprehensive information on vertebrate representation in the area, –Project area and its surroundings are surveyed including the coastline on the east, south and west sides. The field survey locations are given in Figure 120.

The presence of 7 species was confirmed during site survey with the locations and given in Table 143.

Figure 120: Survey Tracks and Observation Points for Theriofauna During the Field Trip

Table 143: Mammals on The Project Territory Per the Points (Routes) Of the Survey

Point No.	N	E	Type	Type of activity
UK_Ter_1	37.375730	67.241900	***Hemiechinus auritus***	**3 footprints**
			Meriones meridianus	**Living colonies**
			Vulpes vulpes	**Footprints**
			Lepus tolai	**Footprints, 1 specimen**
			Felis lybica	**1 specimen**
UK_Ter_2	37.379488	67.249397	***Meriones meridianus***	**Living colonies**
			Vulpes vulpes	**1 specimen, footprints**
			Allactaga elater	**Two Footprints**
			Lepus tolai	**Footprints**
UK_Ter_3	37.375974	67.254911	***Lepus tolai***	**footprint of one specimen**
			Allactaga elater	**Three footprints**
			Meriones meridianus	**Living colonies**
			Vulpes vulpes	**11 chains & one scrape**
UK_Ter_4	37.371922	67,250728	***Meriones meridianus***	**Living colonies**
			Vulpes corsak turkmenicus	**Footprints at two places**
			Vulpes vulpes	**24 chains of footrprints**
			Canis aureus	**Footprints**

Point No.	N	E	Type	Type of activity
			Hemiechinus auritus	**Footprints**
UK_Ter_5	**37.363061**	**67.250516**	***Vulpes vulpes***	**Footprints**
UK_Ter_6	**37.357979**	**67.246822**		
UK_Ter_7	**37.350256**	**67.213808**	***Vulpes vulpes***	**Footprints**
UK_Ter_8	**37.354939**	**67.204657**	***Vulpes vulpes***	**1 specimen**
UK_Ter_9	**37.370852**	**67.211542**	***Meriones meridianus***	**Living colonies**

In general, the surroundings of the Project area have been greatly transformed as a result of anthropogenic activity e.g. livestock grazing, fishing, cattle burial ground which is not actively used at approximately 4 km northeast of the Project area, oil production is going on a network of highways is developed, there are agricultural fields and residential buildings. The southern part of the reservoir is used as a public beach and a number of recreation areas, which, in addition to the usual activities for such places, organize boat rides on the water (see Figure 121).

However, despite such pressure, the territory does not lose its importance as a habitat for a number of vertebrates – the presence of the tributary of Zang Canal is important for the vital activity of such animals as muskrat, reed and steppe cats, jackal, etc. Vegetation creates good shelters and living conditions for these animals. The reservoir itself is potentially a habitat for the Central Asian otter (IUCN Red List - NT). Fields and ruderal areas also create shelters, are breeding grounds, a number of mammals find food here. The sand massif is part of the Kattakum Desert, which creates a connection with its fauna. It is obvious that the reservoir itself is an important source of water supply (see Figure 121).

Only two mammal species namely, Hyaena hyaena (IUCN Red List - NT) and Vormela peregusna (IUCN Red List - VU), can be found along the border of the sands and the reservoir. However, during the field trips in summer of 2021 and in spring of 2022, no traces or burrows of these species were observed, which most likely indicates their absence in the project area.

Oil Production

Boating on the Reservoir

Canal Zang

Tamarix family thickets near the canal&lake

Kattakum desert in 2021

Agricultural fields

Kattakum Desert in 2022

Tamarisk family thickets near the canal & lake in 2022

Figure 121: The Photos of The Regarding of The Mammal Species Asssesment

In the project area, the habitats of mammals are represented by natural and anthropogenic complexes, to which different groups of mammals have adapted. Most carnivorous mammals are adapted to almost all types of deserts. The distribution of small mammals is largely dependent on the substrate and the vegetation growing on it. Thus, all habitats are inhabited by different groups of mammals.

Survey in September 2022

Mammal counts were carried out at the same points as bird counts. In view of the difficult detection of the animals themselves, the censuses were carried out mainly by fixing traces, droppings and burrows of mammals (Figure 122 and Figure 123). Night counts with light were carried out also at night on September 18, 2022.

11 species were recorded in three days, of which two - *Hemiechinus hypomelas* Brandt's Hedgehog (3 NT) and *Vulpes corsac* Corsac Fox (2 VU:D) were included in the national Red Book, which were noted on the project site (Table 144). However, it should be noted that these species have LC status in the IUCN.

According to the results of the autumn field trip, the most densely populated area for mammals is the sand zone under the power line (Table 145). The poorest area, where only species typical of the arid zone were recorded, was the reservoir (Table 146), and species that typically live near the water were not recorded here - jackal, badger, muskrat. This indicates the scarce resources of the reservoir.

In general, the species composition of mammals in the project area and the projected transmission line correspond to the species composition of mammals in the deserts of the temperate zone.

Particularly rare and endemic species of mammals are not found here. Two species of mammals listed in the Red Book of Uzbekistan are widely distributed species with a low threat status category in the national Red Book and no threat status in the IUCN Red List.

Figure 122: Route Transects for The Survey of Theriofauna

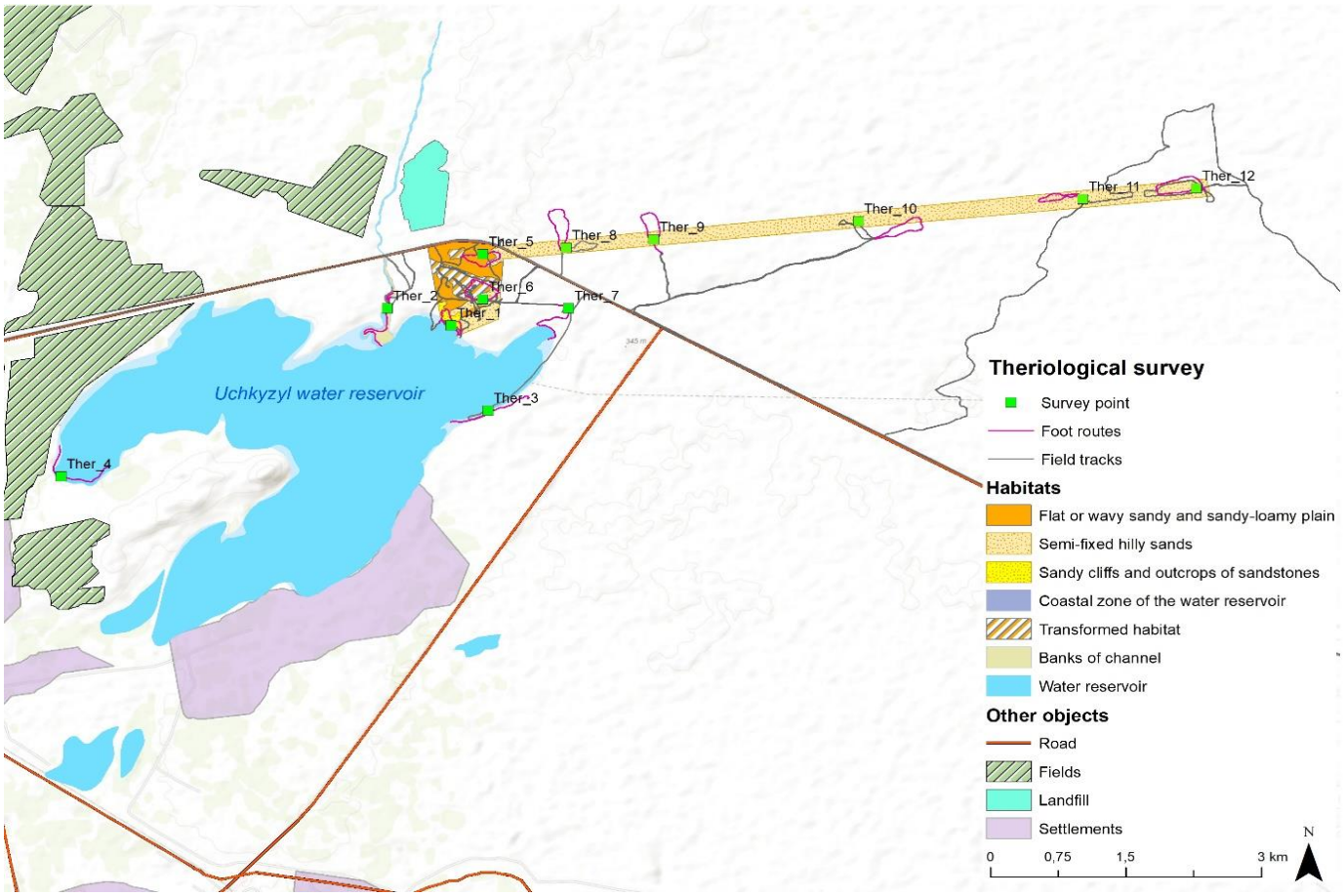


Figure 123: Location of Mammal's Survey Points

Table 144: Mammals Count on Points on The Project Area

Latin name	Common name	18.09.2022		
		Ther-5	Ther -6	Ther -7
		11.15-12.15	10.05-11.05	15.50-16.50
Hemiechinus auritus	Long-eared Hedgehog			Footprints
Hemiechinus hypomelas	Brandt's Hedgehog	Footprints		
Lepus tolai	Tolai Hare		Footprints	

Latin name	Common name	18.09.2022		
		Ther-5	Ther -6	Ther -7
		11.15-12.15	10.05-11.05	15.50-16.50
Ellobius tancrei	Zaisan Mole Vole	1-2 col/ga		
Meriones libycus	Libyan Gerbil	3-4 col/ga	2-3 col/ga	
Vulpes corsac	Corsac Fox	2 holes; Footprints		
Vulpes vulpes	Fox	1; Footprints	Footprints	Footprints

Figure 124: Corsac fox Hole at Point Ther-5

Table 145: Mammals Count on Points Under the Power Line

Latin name	Common name		20.09.2022			
		Ther -8	Ther -9	Ther -10	Ther -11	Ther -12
		15.05-16.05	12.30-13.30	11.15-12.15	9.35-10.30	8.10-9.10
Hemiechinus auritus	Long-eared Hedgehog					Footprints
Lepus tolai	Tolai Hare	Footprints	Footprints	Footprints		Footprints
Allactaga elater	Small Five-toed Jerboa					Footprints
Dipus sagitta	Northern Three-toed Jerboa					Footprints
Meriones libycus	Libyan Gerbil			5-7 col/ga		
Vulpes corsac	Corsac Fox				Footprints	
Vulpes vulpes	Fox	Footprints	Footprints	Footprints	Footprints	Footprints
Mustela nivalis	Weasel					Footprints
Felis libyca	Steppe Cat	Footprints				

Figure 125: Fox at Point Ther-12

Table 146: Mammals Count on Points on The Uchkizil Water Reservoir

Latin name	Common name	18-19.09.2022		19.09.2022	
		Ther -1	Ther -2	Ther -3	Ther -4
		8.50-9.50	13.00-14.00	9.25-10.25	10.55-11.55
Hemiechinus auritus	Long-eared Hedgehog		Footprints		
Ellobius tancrei	Zaisan Mole Vole		1-2 col/ga		
Meriones libycus	Libyan Gerbil	1-2 col/ga			
Vulpes vulpes	Fox	Footprints			
Felis libyca	Steppe Cat		Footprints		

Figure 126 Colony of Libyan Gerbil at Point Ther-1

In general, the species composition of mammals in the project area and the projected transmission line correspond to the species composition of mammals in the deserts of the temperate zone.

Particularly rare and endemic species of mammals are not found here. Two species of mammals listed in the Red Book of Uzbekistan are widely distributed species with a low threat status category in the national Red Book[35] and no threat status in the IUCN Red List[31].

9.3.5 Terrestrial Sensitive Receptors

The terrestrial sensitive receptors are given in Table 147 and the details are explaned in Section 8.5.

Table 147: Terrestrial Sensitive Receptors

Receptor	Sensitivity	Justification
Flora	Low	There is no protected plant species in the project area.
Fauna/Reptiles	High	The region is rich in reptile diversity. The project site contains reptile species that are endemic and sensitive to the region.
Fauna/Ornithofauna	Medium	Project area is located nearly 10 km from two international bird area. Therefore, Uchkizil can potentially also attract them due to the water surface, food and

Receptor	Sensitivity	Justification
		as a recreation area. Nesting biotope is absent on the open banks of the Uchkizil Reservoir which intersects with the Project area, therefore, it is not expected to be nesting of water birds in the project area.
Fauna/Mammals	Medium	The determinated species both of potential and observed are exposed over large areas in Uzbekistan. The poorest area, where only species typical of the arid zone were recorded, was the reservoir and species that typically live near the water were not recorded here - jackal, badger, muskrat. This indicates the scarce resources of the reservoir**.**
Ecosystem Services	Medium	There are ecosystem services used by the local communities such as grazing domestic animals, usage as recreation.

9.4 Aquatic Ecology

This report presents the results of a one-time expeditionary hydrobiological survey (July 15, 2021 and 18, 19 September 2022) of the Uchkizil Reservoir at one station, where 4 hydrobiological Measurement were taken (phytoplankton, zooplankton, periphyton, zoobenthos and additionally macrophytes).

The main task of this study is to summarize hydrobiological information on the composition and structure of aquatic biocenoses, which makes it possible to directly assess the state of aquatic biota as an element of aquatic ecosystems influenced by both seasonal and anthropogenic factors (pollution, flow regulation, etc.), to assess water quality and pollution based on the biological response of aquatic biocenoses.

9.4.1 Baseline Conditions

Uchkizil Reservoir is located 14 km from Termez city, in the Surkhandarya River basin, and belongs to the group of inflowing reservoirs. Uchkizil Reservoir is located in Surkhandarya river basin, it was built in 1960, in the middle of massif of non-irrigated, water-scarce lands and occupies natural depression, full capacity 160 mln $m^{3,}$ which useful 80 mln m^3. The area of the reservoir is 10 km^2, length 5.5 km^2, maximum width 3.5 km, maximum depth 37 m, average depth 16.0 m [29]. The reservoir is connected to the Surkhandarya River through a supply canal.

Maximum water temperature at the surface is 27.8º (June) and up to 25º at the bottom, the temperature difference reaches 10º or more. The minimum is 6.3º (February). At the same time, the temperature difference between the surface and natural water layers does not exceed 0.3º. In spring, summer and autumn, there is direct stratification throughout the reservoir, without noticeable formation of a temperature thermocline.[17].

Hydrogeochemistry - The quantity of dissolved oxygen in the water ranges from 68.0 to 121.0% of saturation. The active water reaction (pH) is 7.68-8.21. Free carbon dioxide is detected only in deep waters in spring, summer and autumn (2.64-5.28 mg/l). Permanganate water acidity varies within small limits from season to season, which is explained by the low content of organic matter in the river. Extremely high values of acidity (2.12-5.54 mg O_2/l) were recorded in spring.

The water of the Uchkizil Reservoir belongs to sulphate-calcium class II of type II. The sum of ions is 683.4-949.6 mg/l. Total water hardness 7.8-8.9 mg/l.

Aquatic organisms - Water bodies of Surkhandarya basin are poor in zooplankton. Protozoa, rotifers and crustaceans are found in mid- and downstream ponds. Zoobenthos of Surkhandarya is represented by 50 forms of organisms. Insects are dominated by the larvae of dipterans (17 species), larvae of caddisflies (10), mayflies (8), dragonflies (4), bristleworms and water mites (1 species each). Stony riverbeds are predominantly inhabited by blue-green and diatom algae. In the middle and lower reaches of the rivers, green and grey algae are the most common. In general, the benthic invertebrate fauna of the mountainous part of the basin's rivers is the most diverse - 35 species, in the foothills - 17 species, and in the plain part - 14 species. The populations of river bottoms form different communities depending on the nature of the substrate; speed of flow [36] [37].

Currently, the use of biotic indices for the determination of surface water quality and biomonitoring is of current importance in connection with the recommendations of the European Water Framework Directive [38]. Assessment of the status and dynamics of the ecological quality of surface waters is based on the ecological status of the biotic index values.

This report presents the results of one-time expedition hydrobiological survey of the Uchizil reservoir at one station (see Figure 127) where 4 hydrobiological Measurement (phytoplankton, zooplankton, periphyton, zoobenthos and additionally macrophytes) were collected.

This report presents the results of an expeditionary hydrobiological survey (September 18-19, 2022) of the Uchkizil reservoir at 4 stations/points, where 24 hydrobiological samples were taken (phytoplankton, zooplankton, periphyton, zoobenthos and additionally macrophytes) (See Figure 128)

Figure 127: Hydrobiological Sample Sampling Location in 2021

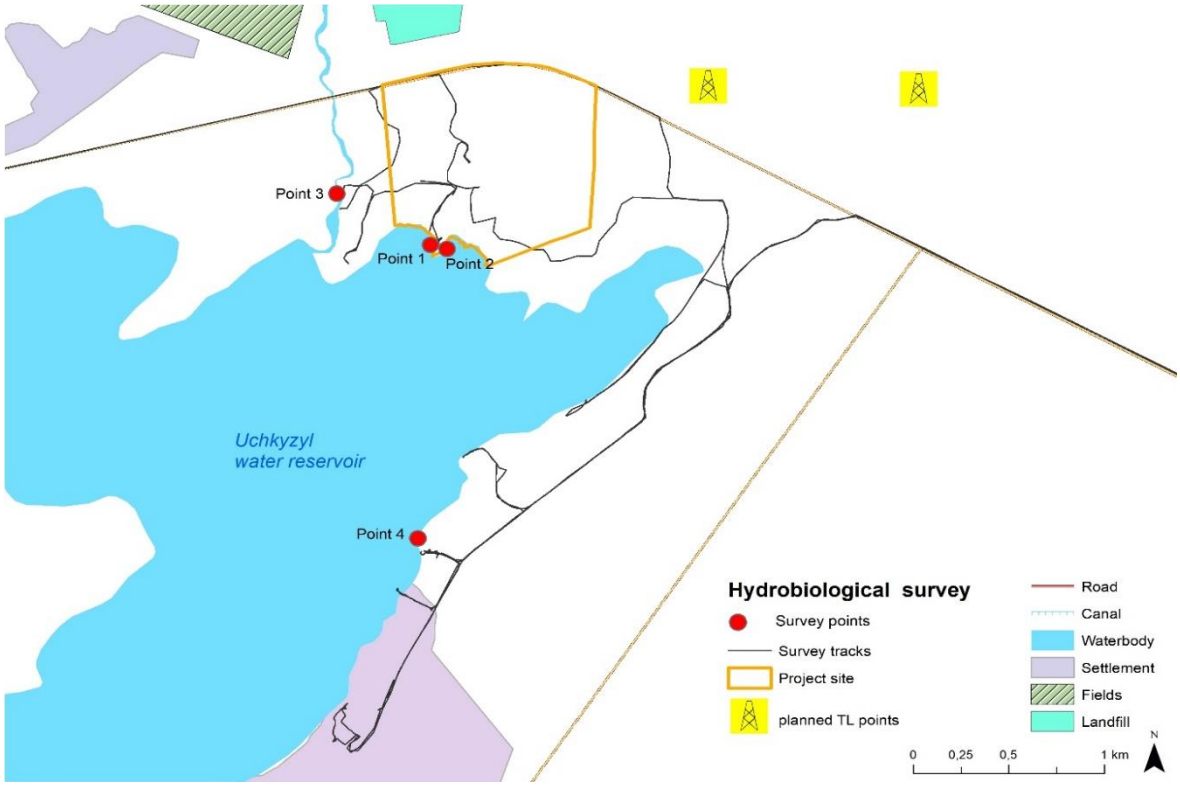


Figure 128: Hydrobiological Sample Sampling Location in 2022

The main objective of this study is to summarize hydrobiological information on the composition and structure of aquatic biocenoses, which allows directly assessing the condition of aquatic biota as an element of aquatic ecosystems under the influence of both seasonal and anthropogenic factors (pollution, flow regulation, etc.), assessing water quality and pollution by biological response of aquatic biocenoses.

The final conclusion about water quality was made on the basis of formal saprobiotic indices, as well as considering changes in species composition, structure, presence of characteristic indicator species in the dominant complex of organisms, their ecological and geographical characteristics and ecological state of aquatic biocenoses. Various visual signs of contamination of water mass and bottom sediments, morphological diversity of aquatic biocenoses or their monotony were also considered.

Characteristic factor determining the processes of formation and development of aquatic biocenoses is sedimentation of suspended solids brought with water flow, siltation of water body bowl during water release for agricultural needs, etc.

At the time of sampling visual observations, the water was greenish-blue in colour, with a slight odour of hydrogen sulphide, under the upper sandstone and clay layer of black silt deposits.

Table 148: Hydrobiological Sampling Point Data for The Surveyed Area of The Uchkizil Reservoir In 2021

Sampling date & time	Sample log number	Station name and location	Weather conditions during sampling	Distance from shore, depth, m	Transparency, m, water colour	Water temperature	Soil	Vegetation	Number of Measurement collected
15/07/2021	No.1	Uchkizil Reservoir	Air temperature 35.7 oC, slightly windy, sunny	Distance from shore is 12 m (from water brim); Sampling depth is 70-90 cm	Light ripples Transparency: slightly turbid, visibility to bottom. Chromaticity: blue at depth Nature of suspended solids: sand particles, silt particles. Contamination of water surface: domestic and other rubbish, fragments of aquatic vegetation	31.4°C	Grey to dark grey layered silt with hydrogen sulphide odour, detritus, coarse sand, clay inclusions (household and other waste is present in the water and on the bottom)	Rupia, sea naiad, pierced-leaf pondweed, crested pondweed, chara	Phytoplankton: 500 ml Zooplankton: filtered 30 l and quality sampled with a 5 m d=10 cm zooplankton net; Periphyton: sampled from macrophytes; Zoobenthos: sampled with a scraper (1x) from the bottom of the pond and macrophytes.

Table 149: Hydrobiological Sampling Point Data for The Surveyed Area of The Uchkizil Reservoir in 2022

Date selection time	Point number	Point location, coordinates	Depth, m	Transparency, m	Water temperature	Priming Vegetation	Selected indicators
18.09. 2022 9 [20]	# 1	37° 22'24.8" N 67° 14'46.62"E	1.0	Transparent to the bottom 1.0	25°	Stones, pebbles, coarse-grained sand, clay, light gray calcareous silt; abundant overgrowth of the bottom of the reservoir with macrophytes: pondweed curly, comb, urut, hara	Phytoplankton - 500 ml; Zooplankton - qualities. selection with a grid of 10 meters' d \u003d 14 cm; Periphyton - selected from macrophytes; Zoobenthos - selected with a scraper (2x) from the bottom of the reservoir and macrophytes.
18.09. 2022 10 [10]	#2 Ridge to the left of the 1st point	37° 22'24.06"N 67°14'53.76"E	1.0	Transparent to the bottom 1.0	25,5°	Stones, pebbles, coarse-grained sand, under it gray clay and dark gray layered silt, detritus; abundant overgrowth of the bottom of the reservoir with macrophytes: pondweed curly, comb, urut, hara	Phytoplankton - 500 ml; Zooplankton - profiletro Vali through a network of 30 l; Periphyton - macrophytes, stones, clay; Zoobenthos - macrophytes were mowed with a scraper 2x along the bottom
18.09. 2022 12 [30]	# 3	Channel, drop. in the reservoir Uchkizil 37° 22'34.73"N 67°14'30.07"E	0.25 cm; samples were taken throughout the channel	Slightly cloudy with a whitish tinge	26°	Stones, pebbles, coarse sand, gray clay underneath; fringes and strands of thread mixed with sand and clay are noted on individual stones	Phytoplankton - 500 ml; Zooplankton - profilero Vali through a network of 30 l; Periphyton - stones, pebbles with a white coating; Zoobenthos - 2x scraper on the pebble bottom
19.09. 2022 9 [25]	# 4 (vol.5 on ichthyo-fauna for 2021)	37° 1'31.45"N 67°14'41.32"E	1.0	Transparent to the bottom 1.0	24,5°	Pebbles, coarse-grained sand, clay, light gray calcareous silt, and under it dark silt; abundant overgrowth of the bottom of the reservoir with macrophytes: pondweed curly, comb, urut, hara	Phytoplankton - 500 ml; Zooplankton - stretched with a net of 5 m and a profiler Vali 10 l; Periphyton - macrophytes, stones, clay; Zoobenthos - macrophytes were mowed with a scraper 2x along the bottom

During the period of hydrobiological studies in 2022 at sampling stations, the depth, water transparency (1 = to the bottom), water temperature in the surface and near-bottom horizons are determined, the nature of bottom sediments, the presence of thickets of higher aquatic vegetation are noted.

No current, slight ripples in the water. At the time of sampling, the water moved 20-25 m from the coast. Water temperature in the morning at 11.00 is 31.4oC, clear to the bottom, 0.90 cm over the Secchi disk. The bottom is clay-sandy with moderate silt and silty-sandy with plant detritus. The bottom is 90-95% densely covered with pondweed (Potamogeton pectinatus L., P. crispus L.), Myriophyllum spicatum up to 80%, Ceratophylum demersum L.), Haroviae up to 50% and separate spots with Najas marina L. and Carex sedges along the bank (see Figure 129).

Figure 129: Taller Aquatic Vegetation Covering the Bottom of The Surveyed Section of The Uchkizil Reservoir

9.4.2 Survey Methodology

The survey objects were aquatic biocenoses (ichthyofauna, phytoplankton, zooplankton, periphyton and macrozoobenthos) of the Uchkizil Reservoir in Surkhandarya province.

Hydrobiologist - Zuri Mustafayeva worked on the project area on July 15, 2021. Ichthyologists Ulugbek Mirzaev and Askar Kuvatov worked in this area from 22 to 25 July 2021 Mustafayeva Zuri (Phytoplankton and periphyton) worked in this area from 18 to 19 September 2022.

To determinaton of the hydrobiological state of aquatic ecosystems, it was determined of the species composition and trophic relationships in water bodies, and indicator species in biomonitoring, the ecological status of water bodies and potential productive capacity of water bodies.

For the determination of surface water quality and biomonitoring biotic indices are used with the recommendations of the European Water Framework Directive (Directive 2000/60/EC). Assessment of the status and dynamics of the ecological quality of surface waters was based on the ecological

status of the biotic indices values. This report presents the results of one-time expedition hydrobiological survey of the Uchizil reservoir at one station where 4 hydrobiological Measurement (phytoplankton, zooplankton, periphyton, zoobenthos and additionally macrophytes) were collected.

Fish species were netted and inspected visually from 1º nets (net mesh: 30 to 55 mm), each of which were 100 meters in length and 3 in width. The species were defined in line with L.S. Berg [39], The taxonomic list of fish was provided in accordance with U. T. Mirzaev, A.Q. Kuvatov [40].

For the determination of the benthic organisms, the scraper was used to secure proper zoobenthos research in the shoreline. The quantitative probe has been sampled from the shoreline of the Uchkizil water reservoirs from the depth of 0.4-0.5 m. The soil was run through the gauze mesh (№ 36) and fixed with 4% formaline. During the sampling of the thick macrofite growth and filamentous algae, the scraper was dipped into the middle and stirred. This allows to collect good Measurement. In cases where sampling had to be done in a loamy soil, the scraper was immersed to a depth of 10 cm. The live organisms are extracted 2-3 times on average rather than the fixed. Should the immediate sorting be impossible or prompt lad delivery unfeasable, the sample was placed in the glass or polyethelen container and fixed in the 70% spirit or 4% phormaline. Once in the lab, the fixated sample was washed and rinsed – live organisms are extracted under the binocular. The rinsed sample was checked in the Petrie dish under the binoculars and the organisms were extracted by tweezers and placed in the penicillin dish with 4% formaline solution. The lab research has been conducted with МБС-10 and MC-300X microscopes, electronic scale, as per the guidelines [41].[42], detectors were used to identify the species [43] [44].

To determination of the phytoplanktonic organisms, batometry is the most reliable sampling method. Bathometry-sampled probes are used for both the quantitative and qualitative probe characterizartion.

Other measurements taken during the bottomline sampling are depth, lucidity, water and air temperature. Macrophytes Measurement have also been collected to define the quantitative and qualitative composition of plants.

Analysis of species, quantitiy, biomass

The lab analysis is about recalculating quantitiy indicators by 1 m^2 identifying dominant and subdominant species, assessing water quality abd the environmental conditions of the bottom biocenose with the help of formal approaches/indexes, absolute biological characteristics and visual data which is always given in the log.

Quantity recalculation by 1 m²

A standard table created by G.P. Bulgakov can generally be used to recalculate the quantities by 1 m. One scraper (1x) counts as one sample 800 m². The Table 150 contains relative abundance values for zoobenthos. This allows for a better insight into the composition and structure of benthos communities – dominant (5-9 points) and subdominant (3 points) organisms.

Table 150: Recalculation of Benthos Sample Organisms By 1 M², G.P. Bulgakov's Methodology [41]

Abundance point	Encounter frequency	No. of organisms discovered in a sample:							pcs/m²
		1x	1,5x	2x	2,5x	3x	4x	5x	
1	Sporadic	-	-	1	1	1	1-2	1-3	до 6
2	Very rarely	1	1-2	2	2	2-3	3-4	4-5	7-12
3	Rarely	2-5	3-7	3-10	3-13	4-15	5-20	6-25	13-62
5	Not so rarely	6-10	8-15	11-20	14-25	16-30	21-40	26-50	63-125
7	Frequently	11-20	16-30	21-40	26-50	31-60	41-80	51-100	126-250
9	Very frequently	>20	>30	>40	>50	>60	>80	>100	>250

Zoobenthos and water quality was assessed with the help of Bulgakov's Modified Biotic Index (MBI) [41]. MBI range makes up 10 points that are correlated with water qualities same as Woodiwis points (see Table 151).

Table 151: Correspondence Between MBI And Water Quality

Water class	Water quality	MBI values	State of biocenose (expected/ expert evaluation
I	Very clean	10	Background (standard)
II	Clean	9-7	Background (good)
III	Moderately dirty	6-5	Satisfactory
IV	Dirtied	4	Unsatisfactory
V	Dirty	3-2	Bad
VI	Very dirty	1-0	Unacceptable

Each species of flatworms, oligachoetes (save for the Nais), each type of leeches, shellfish, crustaceas, stoneflys, mayflys, beetles, dragonflies, beetles, ticks, double-winged larvae (except for chironomids and small flies), caddis flies is considered a Woodivis group in MBI.

Phytoplankton sampling has been delivered in line with the widely accepted algologic methodology [45] [46] [47] while definers are used to identify the typical composition of microweeds [48].

Sampled material has been doused in 40% phormaline and Lugole solution, has been labeled (smple No., date, station, water area, sample volume). Sedimentation has been used in the laboratory environment as the sedimentation rate of plankton cells comes to 1 cm/3 hrs [49] Measurement are kept in the darkened place for 5-10 days, and are later syphoned out. Probe gets to be compacted in 2 stages: from 0.5 liter to 0.1 liter (100 ml), and after 5 days in wait, the solution is syphoned out until it is 10 ml.

Goriyaev chamber is used to calculate the No. of the seaweed. The recalculation of the total count is done as per the following formula:

$N=n\times v1/v2\times W$,

Where;

N –Number of cells in 1 cm^3 of water;

n – Number of cells in a 1 mm^3 chamber;

v1 – Sample concentrate (cm^3);

v2 – Chamber volume (cm^3);

W – Sample volume (cm^3).

Zoo plankton Measurement were made through the Jedy conic net (d=10 cm, cell №68) and have been processed in line with the methodology [49].They were fixated with 40% phormaline, increasing the concentration of up to 4% and labeling as per the notes in the field log. Materials were made ready for storage right after identification and processing. Triocular and binocular microscopes are used to identify the zoo plankton species [50]. Unified water qualities research methodology was used to define the indicator values of zoo plankton saprobity.

To periphyton analysis, fouling was scraped with a scraper, scalpel, and tweezers mainly from thalloms of higher aquatic vegetation, namely, pondweeds (Potamogeton pectinatus L., P. crispus L.), urticate (Myriophyllum spicatum L.), and algae (Chara) that covered almost all bottom of the study area (see Figure 130).

Figure 130: Macrophytes: Potamogeton crispus L., P. pectinatus L. and Chara sp., from the thalloms of which the periphyton of the Uchkizil Reservoir was sampled

A small amount of selected material together with water was placed in a 0.5 L wide-necked jar with a lid and plenty of air. The periphyton sample was preserved with 40% formalin. In the laboratory, the selected sample was placed in a Petri dish and the material was disassembled using a soldering needle and tweezers before processing and analysis. A small amount of material was then placed on a slide, covered with a coverslip, and analyzed (microbial identification) using a Meiji microscope.

Identification of the species composition of microalgae was performed according to the qualifiers of freshwater algae according to the analyzed group of hydrobionts and other generally accepted qualifiers [51].

The indicator organisms method of Pantle and Buck, modified by Sladecek (Pantle and Buck, 1955; Sladecek, 1970), was used to estimate the saprobic index (IS) (organic pollution) of water. This method considers the frequency of occurrence (abundance) of hydrobionts h and their indicator importance S (saprobic valence). The indicator value of S and the saprobicity zone are determined for each species according to the saprobicity lists of the organisms of the CEA [52].

Mass (dominant) species, forming the main complex, are considered species whose abundance is 5-9 points; subdominant species are those whose abundance is 3 points; single species are those whose abundance is 1-2 points.

Organisms of clean water - xenosaprobic zone species-indicators IS is in the range 0-0.50; organisms of slightly polluted water - oligosaprobic - 0.51-1.50; organisms of moderately polluted water - β - mesosaprobic - 1.51-2.50; α- -mesosaprobic - 2.51-3.50; organisms of dirty water - polysaprobic - 3.51-4.00.

Conclusions about water quality by indicators of periphyton were made taking into account the information about species composition and diversity, frequency of species occurrence, saprobity of leading forms and saprobity index, as well as the biotic periphyton index (BPI) [53] and the values with BPI are given in Table 152. IS (saprobic index or SI) values 3.00-3.50 is usually defined as polluted, bad condition.

Table 152: Quality and Environmental Classifier of The Surface Waters. IS values and BPI as per Talskih [53]

Water category	Water quality	IS value	BPI value	Environmental condition (desired/ expert assesment)
I	Very clean	< 1,0	10-9	Background (reference value) – AB (F)
II	Pure	1,1–1,5	8-7	Background (good) – AB
III	Moderately polluted	1,6–2,5	6-5	Satisfactory – AB
IV	Polluted	2,6–3,5	4	Unsatisfactory – AB-Ab
V	Dirty	3,6–4,0	3-2	Bad – AB
VI	Very dirty	> 4,0	1-0	Invalid – ab

The proposed assessment system mainly taking into consideration the sequence of loss from the periphyton composition of individual indicator species, higher taxa and groups of organisms, which are demanding on water quality, changes in the functional structure of the periphyton (change in the ratio of producers, consumers and reducers) as the pollution load increases (see Table 152).

In addition, the table shows the characteristics of the ecological invariant states of biocenoses, which are encoded in the form of letter symbols: AB (F) - a background ecological state in which biocenoses are in a state of metabolic and ecological progress and are represented by a complex of species reflecting the natural (undisturbed) gene pool of the region; AB - satisfactory ecological state, characterized by metabolic and ecological progress of biocenoses; AB-Ab - a transitional ecological state associated with a noticeable change in the taxonomic and functional structure of biocenoses; Ab - unsatisfactory ecological state, pronounced degradation of the ecological structure of the original biocenoses; ab - absolutely unacceptable ecological state, complete degradation of biocenoses [53].

Meaning of alphabetic characters: A - the state of metabolic progress of biocenoses (active metabolism of aquatic biocenoses); a - the state of metabolic regression of biocenoses (inhibition of the metabolism of aquatic biocenoses); B - the state of ecological progress of biocenoses (complication of

the ecological structure of aquatic biocenoses); b - the state of ecological regression of biocenoses (simplification of the ecological structure of aquatic biocenoses).

The above assessment methods using IS and BPI indices are considered as basic indicators and their application reflects the true environmental picture.

9.4.3 Aquatic Ecological Surveys

9.4.3.1 Ichthyofauna

The formation of the ichthyofauna of the Uchkizil Reservoir is inextricably linked to the ichthyofauna of the Surkhandarya River[54].

According to recent data, there are 20 fish species in Uchkizil reservoir, of which 9 are native and 11 are acclimatised or accidentally introduced (see Table 153). *Abramis brama* and *Alburnus chalcoides aralensis*, are the most numerous in the reservoir*. Alburnus chalcoides aralensis* makes up about 50% of the total fish catch, bream from 19 to 27%, pikeperch up to 19-22% [17]. Thus, the ichthyofauna of the Uchkizil Reservoir was formed from the aboriginal fish species of the Surkhandarya river and is represented by: Varicorhinus, *Cyprinus carpio, Luciobarbus capito conocephalus & Barbus brachycephalus brachephalus, Leuciscus lehmani, Pelecus cultratus, Silurus glanis, Capoetobrama kuschakewitschi, Aspius aspius, Rutilus rutilus bucharensis, Gobio gobio lepidolaeraus, Aspius cobitis taenia, Paracobitis longicauda, two species of Alburnoides & Gambusia affinis[55]*.

The fish samples are collected from the locations given in Figure 131.

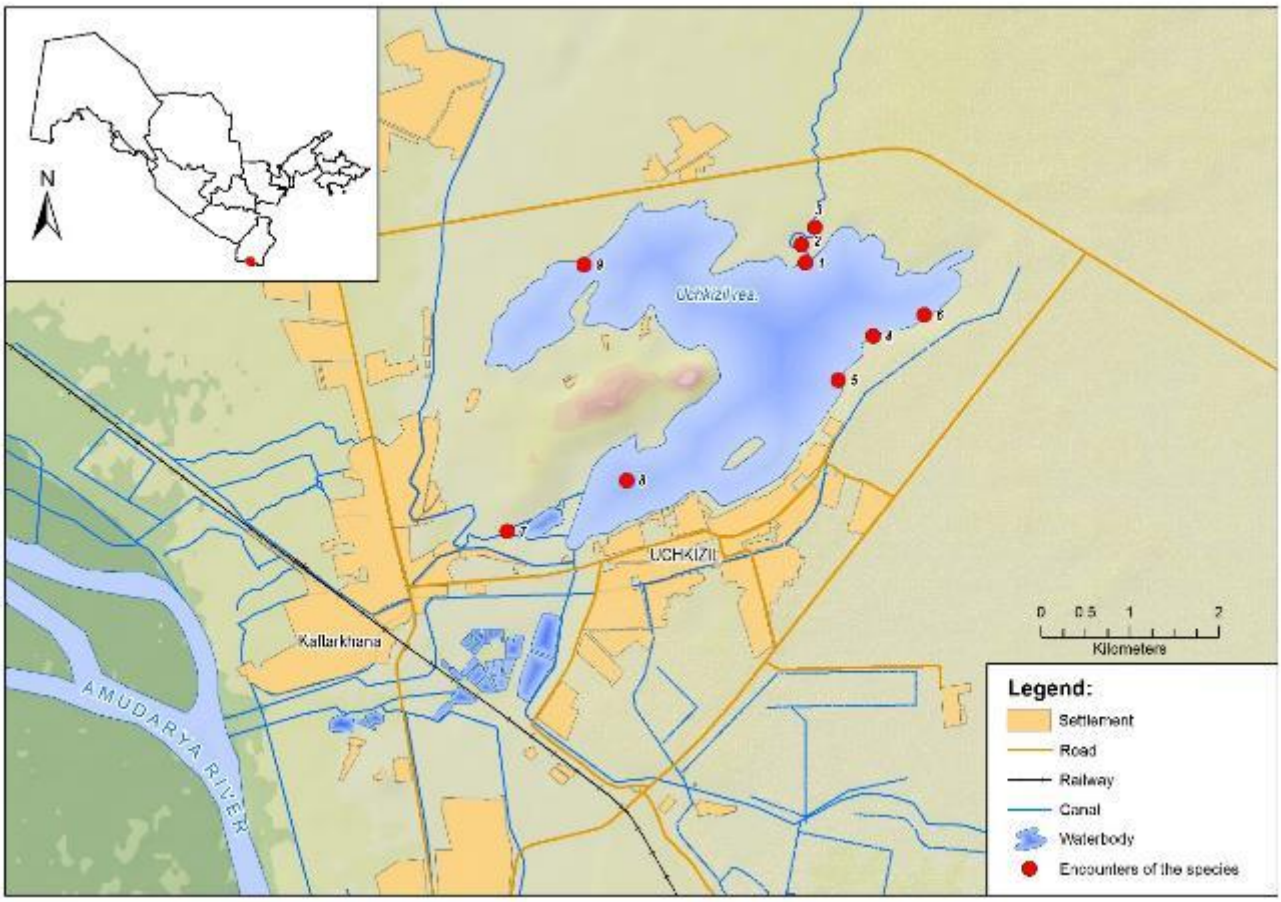


Figure 131: Fish Sampling Points at The Uchkizil Water Reservoir

Table 153: The Species Composition of The Fish Fauna of the Uchkizil reservoir

No.	Species	Local species	Alien species	Endemism	Conservation status			Commercial species
					UzRDB	IUCN	CITES	
Cyprinidae								
1	***Rutilus aralensis* (Berg, 1916)**	+	-	+	-	-	-	-
2	***Rhodeus ocellatus* (Kner, 1866)**	-	+	-	-	-	-	-
3	***Ctenopharyngodon idella* (Valenciennes, 1844)**	-	+	-	-	-	-	+
4	***Gobio lepidolaemus* (Kessler, 1872)**	+	-	+	-	-	-	-

No.	Species	Local species	Alien species	Endemism	Conservation status			Commercial species
					UzRDB	IUCN	CITES	
5	***Pseudorasbora parva* (Temminck et Schlegel, 1846)**	-	+	-	-	-	-	-
6	***Luciobarbus conocephalus* (Kessler, 1872)**	+	-	+	+	-	-	-
7	***Alburnus chalcoides aralensis* (Berg, 1923)**	+	-	+	-	-	-	+
8	***Alburnoides bipunctatus eichwaldi* (Filippi, 1863)**	+	-	-	-	-	-	-
9	***Alburnoides teaniatus* (Kessler, 1874)**	+	-	-	-	-	-	-
10	***Abramis brama orientalis* (Berg, 1949)**	-	+	-	-	-	-	+
11	***Carassius gibelio* (Bloch, 1782)**	-	+	-	-	-	-	+
12	***Cyprinus carpio* (Linnaeus, 1758)**	+	-	-	-	-	-	+
13	***Hypophthalmichthys molitrix* (Valenciennes, 1844)**	-	+	-	-	-	-	+
14	***Aristichthys nobilis* (Richardson, 1844)**	-	+	-	-	-	-	+
Cobitidae								
15	***Sabanejewia aurata aralensis* Kessler, 1877**	+	-	+	+	-	-	-
Siluridae								
16	***Silurus glanis* (Linnaeus, 1758)**	+	-	-	-	-	-	-
Poecilidae								
17	***Gambusia holbrooki* (Girard, 1859)**	-	+	-	-	-	-	-
Percidae								
18	***Sander lucioperca* (Linnaeus, 1758)**	-	+	-	-	-	-	+

No.	Species	Local species	Alien species	Endemism	Conservation status			Commercial species
					UzRDB	IUCN	CITES	
Gobiidae								
19	***Rhinogobius brunneus* (Temminck et Schlegek, 1845)**	-	+	-	-	-	-	-
Channidae								
20	***Channa argus* (Cantor, 1842)**	-	+	-	-	-	-	-
	Total:	9	11	5	2	0	0	8

The following locations were covered during the field visit and fish caught coordinates with the species are given in Table 154.

Table 154: Fish Caught at The Monitoring Points of Uchkizil Water Reservoir

Point No.	Coordinates	Identified species
UK-Ich_1	37°22'14.23"N, 67°14'25.32"E	Sander lucioperca (2 in), Rhinogobius brunneus (5 in), Rutilus aralensis (1 in), Carassius gibelio (3 in), Alburnus chalcoides aralensis (2 in).
UK-Ich_2	37°22'20.70"N, 67°14'23.24"E	Sander lucioperca (5 in), Rhinogobius brunneus (6 in).
UK-Ich_3	37°22'27.16"N, 67°14'29.25"E	Sander lucioperca (4 in), Alburnus chalcoides aralensis (8 in), Rhodeus ocellatus (7 in).
UK-Ich_4	37°21'47.84"N, 67°14'56.82"E	Rhinogobius brunneus (8 in), Rutilus aralensis (2 in), Alburnus chalcoides aralensis (6 in), Abramis brama orientalis (8 in), Carassius gibelio (3 in), Cyprinus carpio (1 in).
UK-Ich_5	37°21'31.45"N, 67°14'41.32"E	Rhinogobius brunneus (1 in), Rutilus aralensis (3 in), Alburnus chalcoides aralensis (3 in), Abramis brama orientalis (3 in), Carassius gibelio (4 in), Cyprinus carpio (1 in).
UK-Ich_6	37°21'55.97"N, 67°15'20.05"E	Rhinogobius brunneus (2 in), Rutilus aralensis (1 in), Alburnus chalcoides aralensis (4 in), Abramis brama orientalis (4 in), Carassius gibelio (3 in), Cyprinus carpio (3 in), Sander lucioperca (4 in).
UK-Ich_7	37°20'33.99"N, 67°12'10.99"E	Rhodeus ocellatus (12 in), Gobio lepidolaemus (5 in), Pseudorasbora parva (6 in), Sabanejewia aurata aralensis (3 in), Gambusia holbrooki (7 in), Rhinogobius brunneus (3 in), Alburnoides teaniatus (35 in).
UK-Ich_8	37°20'53.35"N, 67°13'5.19"E	Rhinogobius brunneus (2 in), Rutilus aralensis (1 in), Alburnus chalcoides aralensis (2 in), Abramis brama orientalis (5 in), Carassius gibelio (4 in), Cyprinus carpio (2 in), Sander lucioperca (3 in).
UK-Ich_9	37°22'11.96"N, 67°12'43.75"E	Gambusia holbrooki (10 in), Rhinogobius brunneus (9 in), Rutilus aralensis (1 in), Alburnus chalcoides aralensis (3 in),

Point No.	Coordinates	Identified species
		Abramis brama orientalis (2 in), Carassius gibelio (1 in), Sander lucioperca (2 in), Cyprinus carpio (2 in).

Two types of fish on a Red Book of the republic of Uzbekistan were found in the Uchkizil water reservoir - Luciobarbus conocephalus and Sabanejewia aurata aralensis. Accordingly, five fish species are endemic.

Cyprinidae make up the majority of fish species in the Uchkizil water reservoir (see Figure 132). All in all, fish species can be subdivided into 3 groups: Commercial fishing, non-commercial and protected species.

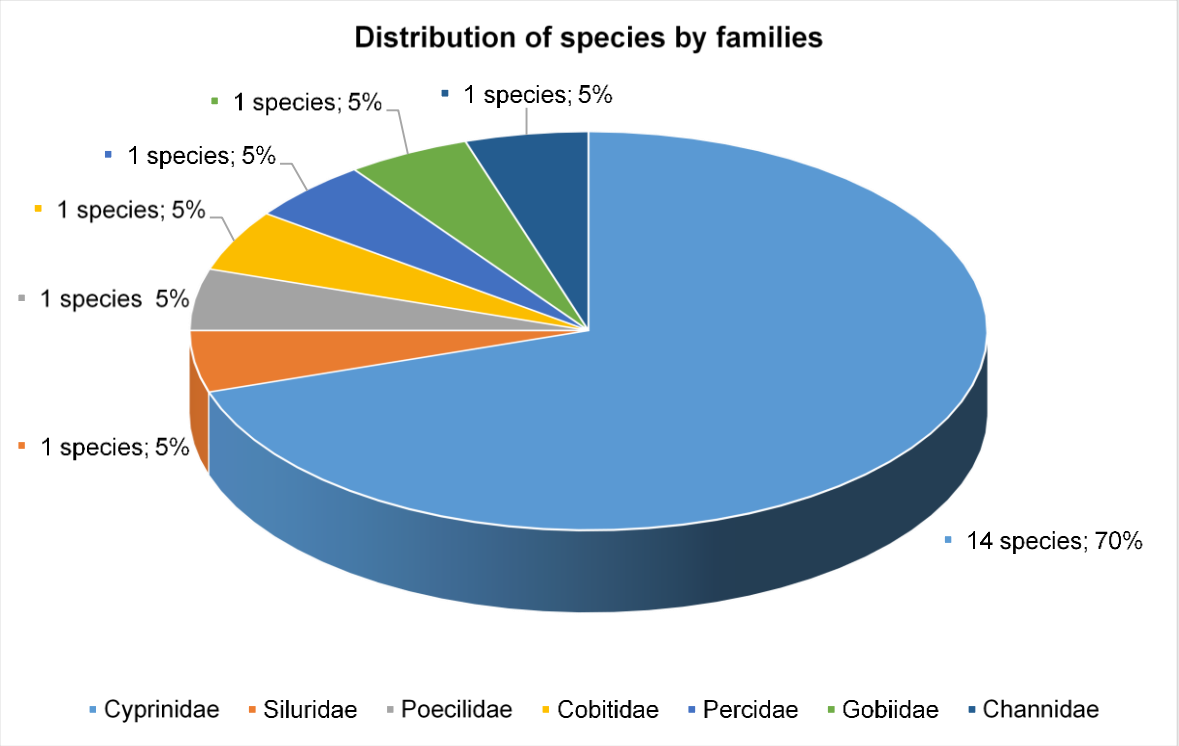


Figure 132: Distribution of Fish Species by Families in The Uchkizil Water Reservoir

Commercial fish species are *Ctenopharyngodon Idella, Alburnus chalcoides aralensis, Abramis brama orientalis, Carassius gibelio, Cyprinus carpio, Hypophthalmichthys molitrix, Aristichthys nobilis, Rutilus aralensis, Siluris glanis, Sander lucioperca, Channa argus.*

Non-commercial types are *Rhodeus ocellatus, Gobio lepidolaemus, Pseudorasbora parva, Alburnoides bipunctatus eichwaldi, Alburnoides teaniatus, Gambusia holbrooki*, found in the Zang canal. *Rhinogobius brunneus* found along the shoreline of the water reservoir and are dominant species.

2 Protected species are in the Red Book of the RUz [35] were known in the reservoir:

- *Luciobarbus conocephalus* are currently in the Red Book of the RUz [35], as the "2 (VU:D): Vulnerable endemic species"
- *Sabanejewia aurata aralensis* are in the Red Book of the RUz (2019), as the "3 (NT): Close to the vulnerable aral endemic species. Is on the Red list (LC)" [35].

The aforementioned 2 species - *Luciobarbus conocephalus* and *Sabanejewia aurata aralensis* are not in the CITES convention list [32].

Uchkizil water reservoir is not a native or relict one with unique fauna. The current fish fauna of the water reservoir has been formed by that of the Surkhandarya river. Consequently, irrespective of the damage as a result of construction, all fish type can be recovered. Some of the reservoir fish are on the Red Book of the RUz even though the water reservoir is not their natural habitat – they propagate through the river and form the fauna of the water reservoir. Although no fish farms present in the Uchkizil Reservoir, the reservoir is used by fisherman to supply water for fish breeding pools located in nearby villages.

It is recommended that screens are installed to prevent entrainment of fishes into water intakes. Recommended screen materials include stainless steel, galvanized steel, aluminum, brass, bronze, or monel metal. Stainless steel is preferred since corrosion is greatly reduced. And also, the screen mesh size should be determined in accordance with the fish species body shapes and sizes. In addition, it should be monitored whether these screens used during the operation period are useful.

Survey in September 2022

Work on the collection of field material was carried out in the Uchkizil reservoir and the canal that supplies water to the reservoir during the period September 18-19, 2022.

Ichthyological samples were collected with nets of various sizes and a muzzle (trap), then measured visually.

Materials for assessing the condition of fish stocks being caught were collected from 10 nets (mesh: from 20 mm to 55 mm, in the Uchkizil reservoir), each of which was 100 meters long and 3 meters wide (the nets were installed 3 times) (Figure 133). A muzzle (trap) and 1 net - meshes: 15mm were installed in the incoming channel (Figure 134).

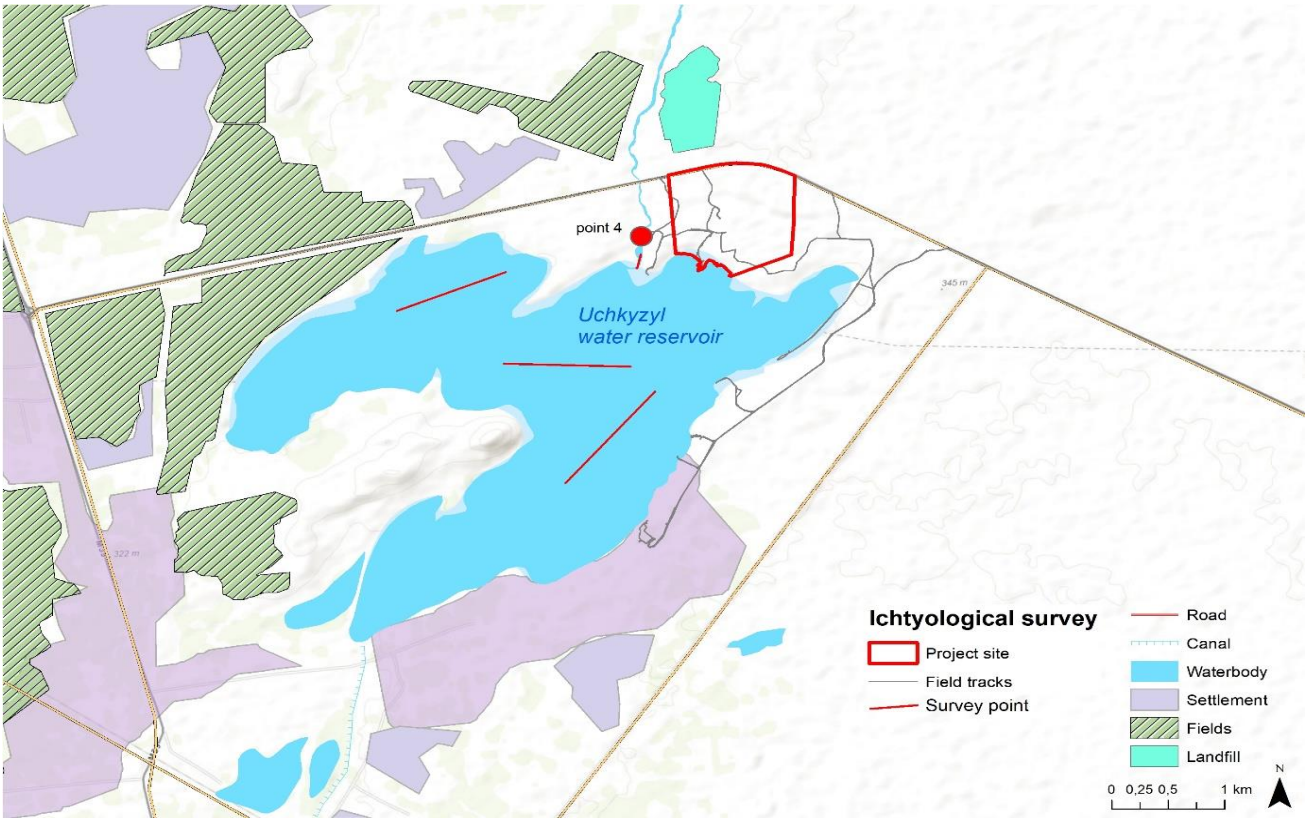


Figure 133: Points of Collection of Ichthyological Samples at The Uchkizil Reservoir In 2022

Figure 134: Ichthyological Sampling Points at The Mouth Section of The Canal Entering the Uchkizil Reservoir

Table 155: Commercial Fish (According to Experimental Catches, 18-19.09.2022)

Type of fish	Catch weight, kg	Mass of the species in the catch, kg	Overall length (TL), min - max , cm	Weight (Q), min-max, gr
Abramis brama orientalis	**44.713**	20.4	15.0-36.0	30-555
Carassius gibelio		1.75 _	24.6-33.0	253-696
Alburnus chalcoides aralensis		5.4	15-23.6	60-95
Cyprinus carpio		1.24	43.5	1240
Hypophthalmichthys molitrix		0.927	13.0-20.7	40-95
Rutilus aralensis		10.0	13.0-29.0	29-320
Sander lucioperca		3.031	36.5 -48.9	320-783
Silurus glanis		1.25	50.0	1250
Varicorhynus capoeta heratensis natio steindachneri		0.715	18.8-25.8	90-170

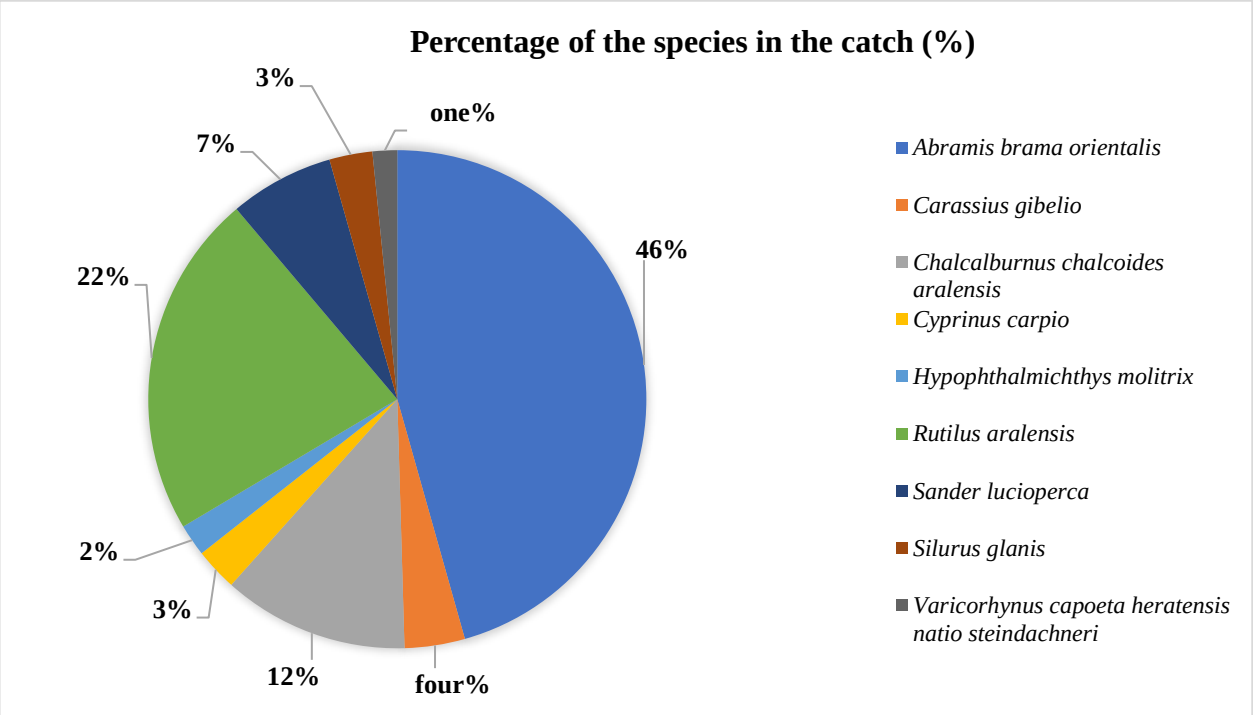


Figure 135: Comparative Diagram of The Percentage of Commercial Fish Species in Catches

In total, 9 commercial and 8 low-value, weed fish species were identified in the catches (see Table 155 and Table 156). *Abramis brama orientalis* , *Rutilus aralensis* and *Alburnus chalcoides aralensis* were massive and numerous in catches in the reservoir . At the same time , *Abramis brama orientalis* makes up about 46% of the total fish catch, *Rutilus aralensis* - 22%, *Alburnus chalcoides aralensis* reaches 12%.

Table 156: Low -Value and Weedy Fish Species Along the Canal Supplied to The Uchkizil Reservoir, September 18-19, 2022

Type of fish	Fishing weight, g	Weight of the species in the catch, g	Overall length (TL), min - max , cm	Weight (Q), min-max, gr
Capoetobrama kuschakewitschi	**596.384**	eighteen	134	eighteen
Gambusia hoolbroki		60.5	1.0-3.5 _ _	0.7-3.94
Hemiculter leucisculus		3.5	21-25	90-120
Opsariichthys bidens		425	10.0-18.6	20-73
Pseudorasbora parva		44.3	4.0-8.2	3.75-12.2
Rhodeus ocellatus		32.5	5 , 0-8 , 0	2 , 6-5.7 _
Rhinogobius sp.		10.5	1.5-3.5	0.41-1.36
Sabanejewia aurata aralensis		2.084	4.7	2.084

Table 157: Species Composition of The Ichthyofauna In the Uchkizil Reservoir

No.	Species	Local species	Alien species	Endemism	Conservation status			commercial species
					UzRDB	IUCN	CITES	
Cyprinidae								
1	*Rutilus aralensis* (Berg, 1916)	+	-	+	-	-	-	-
2	*Rhodeus _ ocellatus* (Kner , 1866)	-	+	-	-	-	-	-
3	*Hemiculter leucisculus* (Basilewsky, 1855)	-	+	-	-	-	-	-

No.	Species	Local species	Alien species	Endemism	Conservation status			commercial species
					UzRDB	IUCN	CITES	
4	*Pseudorasbora parva* (Temminck et Schlegel, 1846)	-	+	-	-	-	-	-
5	*Alburnus chalcoides aralensis* (Berg, 1923)	+	-	+	-	-	-	+
6	*Capoetobrama kuschakewitschi* (Kessler, 1872) *	+	-	+	+	-	-	-
7	*Abramis brama orientalis* (Berg, 1949)	-	+	-	-	-	-	+
8	*Carassius gibelio* (Bloch , 1782)	-	+	-	-	-	-	+
9	*Cyprinus carpio* (Linnaeus, 1758)	+	-	-	-	-	-	+
10	*Hypophthalmichthys molitrix* (Valenciennes, 1844)	-	+	-	-	-	-	+
11	*Varicorhinus capoeta heratensis* natio *steindachneri* (Kessler, 1872)							
12	*Opsariichthys bidens* (Günther, 1873)							
Cobitidae								
13	*Sabanejewia aurata aralensis* _ (Kessler, 1877) *	+	-	+	+	-	-	-
Siluridae								
14	*Silurus glanis* (Linnaeus, 1758)	+	-	-	-	-	-	-

No.	Species	Local species	Alien species	Endemism	Conservation status			commercial species
					UzRDB	IUCN	CITES	
Poecilidae								
15	*Gambusia holbrooki* (Girard, 1859)	-	+	-	-	-	-	-
Percidae - perch family								
16	*Sander lucioperca* (Linnaeus, 1758)	-	+	-	-	-	-	+
Gobiidae								
17	*Rhinogobius brunneus* (Temminck et Schlegek, 1845)	-	+	-	-	-	-	-
	Total :	**6**	**9**	**four**	**2**	**0**	**0**	**6**

The basis of the ichthyofauna of the Uchkizil reservoir is 12 species of the carp family.

Based on the results obtained and the values, the fish species encountered can be divided into 3 groups: commercial (economically significant and sports-amateur), non-commercial (low-value and weed) and protected fish species.

In the canal that enters the Uchkizil reservoir, 2 species of fish (*Capoetobrama kuschakewitschi* and *Sabanejewia aurata aralensis)* included in the Red Book of the Republic of Uzbekistan. Also 4 species of fish are endemic.

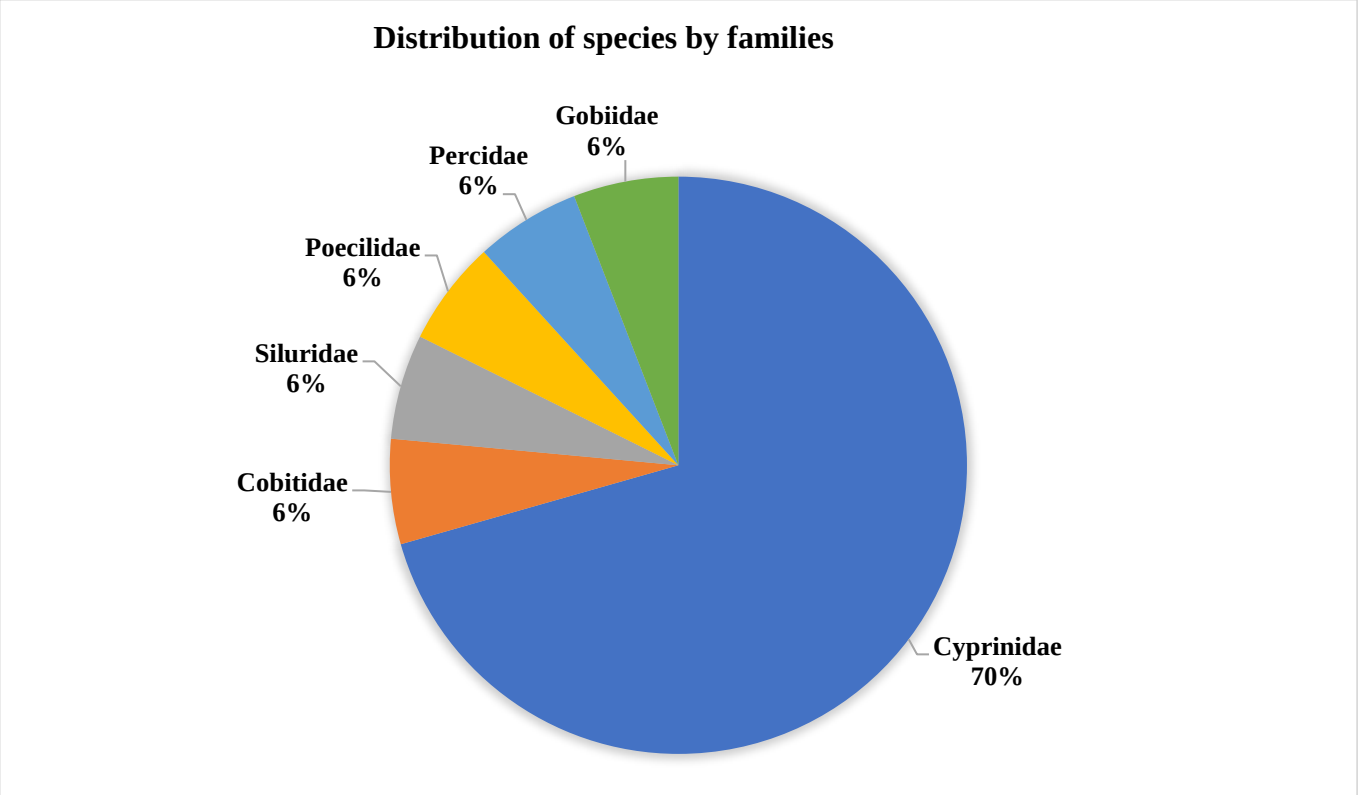


Figure 136: Comparative Diagram of The Percentage Distribution of Fish Species in The Uchkizil Reservoir by Families

Commercial (fished) species:

Alburnus chalcoides aralensis - according to the literature data in 1970-1980 was in first place in terms of catching. However, it is now rare;

Abramis brama orientalis is the main fishery for anglers and fish farms located in the reservoir. Widely distributed in all parts of the reservoir;

Carassius gibelio - rare;

Cyprinus carpio - in the process of catching fish, a small number of this species and only small sizes were obtained;

Hypophthalmichthys molitrix– fry of this fish species are brought into the reservoir every year. Often found along the coast and among the dense thickets of the reservoir;

Rutilus aralensis - often caught by amateur anglers;

Siluris glanis - this species is often caught by amateur anglers, but is rare;

Sander lucioperca is the main fishery for anglers and fish farms located in the reservoir. It is widely distributed in all parts of the reservoir. The number of this species is relatively stable compared to other species.

Varicorhynus capoeta heratensis natio *steindachneri* - often caught by amateur anglers . Fishermen often confuse it with the Red Book species - *Luciobarbus conocephalus.*

Non-commercial species:

Rhodeus ocellatus, *Pseudorasbora parva, Gambusia holbrooki* are mainly found in the outlet channel of the reservoir;

Rhinogobius brunneus is found in all coastal parts of the reservoir, completely dominates over other fish species in terms of quantity.

Protected fish species:

2 fish species noted in the reservoir are listed in the Red Book of the Republic of Uzbekistan (2019). [35]

1. - *Capoetobrama kuschakewitschi* - currently listed in the Red Book of the Republic of Uzbekistan (2019), as "2 (VU:D): Vulnerable , declining, Turkestan endemic relict species" [35] Listed on the IUCN Red List Endangered [EN]." [31]

2. – *S abanejewia aralensis* – listed in the Red Data Book of the Republic of Uzbekistan (2019), as "3 (NT): Close to endangered Aral endemic subspecies. Listed on the IUCN Red List [LC]." [35][31]

The above 2 protected species - *Capoetobrama kuschakewitschi* (Kessler, 1872) and *Sabanejewia aurata aralensis*) are not listed in the "Convention on International Trade in Endangered Species of Wild Fauna and Flora" (CITES). [32]

In the reservoir there are two species (*Capoetobrama kuschakewitschi and Sabanejewia aurata aralensis*) listed in the Red Book of the Republic of Uzbekistan, however, this reservoir is not the main habitat for them, these species penetrate from the river through the channel and form the ichthyofauna of the reservoir. The Uchkizil reservoir is not a native or relic reservoir with unique ichthyofauna. The modern ichthyofauna of the reservoir is formed mainly by the ichthyofauna of the Surkhandarya River

The state of commercial stocks at the time of collecting field material.

During the day, 44.713 kg of fish were caught. The bulk of the catch was made up of species - *Abramis brama orientalis* (length 15 - 23 cm, weight 45-140 grams, the number of samples caught - 139, which is 40% of the total mass) ,

Rutilus aralensis (length from 13-25.3 cm, weight from 70 grams to 150 grams, the number of caught samples is 8 3, which is 22% of the total mass).

In third and fourth places are *Alburnus chalcoides aralensis* - 12% and *Sander lucioperca* - 7%. The remaining fish made up a small number of the total share of the monitoring catch.

Every year, fry of herbivorous fish weighing 50-60 grams (*Hypophthalmichthys molitrix, Aristichthys nobilis, Ctenopharyngodon idella*) are stocked in the reservoir. Despite this, the daily catch rate of these fish species was very small (*Aristichthys nobilis* , *Ctenopharyngodon idella* were found only in small numbers caught by local fishermen).

9.4.3.2 Benthic Organizm

Macrozoobenthos (bentos - depth is the community of visible invertebrates (body size above 2 mm/ >2 mm), that inhabit the sea bottom (benthal), aquatic vegetation (phytal), as well as other substratum, including different hydrotechnical structures. Zoobenthos is represented by: worms (planaria, oligachoete, leech, nematodes), gastropods (gastropod, bivalves), crustacean (amphipods, isopods, denocodes, etc.), arachnids, maggots (chironimids, heledes, ephemeral flies, plecopterans, tricoptherans, dragonflies, etc.). Functionally speaking zoobenthos is an important part of heterotrophic components and the living bodies thereof are consuments.

The type and quantity development of benthaly characterize contamination level of the soil and bottom waters. The phytal zone population are characterized by the large water quantities.

The composition of zoobentos communities is relatively homogenuous so long as they remain within the conditions they were developed in. Bottom communities within clear waters and well-aired areas are characterized by a variety of species, which is indicative of the normal water system. Polluted waters may contain groups of animals that are more susceptible to pollutants. This leads to the violations of special and trophic structure of zoobenthos which eventually degrades bottom-level biozenos.

Uchkizil benthos are characterized by a set of freshwater and saline organisms. Bottomline fauna make up the basis of the benthos, such as the phytophilious fauna and are represented by oligochaetes of Tubificidae family, chyronimids for the moderately dirty waters.

Species wise Zoobenthos was quite limited in July 2021. Physa fontinalis make up the most of bentofauna at the zoobentos probing point, as well as representatives of Chironomus, and Cricotopus, plus oligochets: Nais elinguis, Paranais litoralis and representatives of Tubificidae (see Table 158).

Table 158: Zoobentos Species of The Uchkizil Water Reservoir

Species	S	Abundancy point
Ephemeptera		
Caenis macrura Stephens	**α**	**3**
Chironomidae		
Cricotopus gr. bicinctus Meigen	**β-α**	**3**
Tanytarsus gr. Gregarious Kieffer	**β-α**	**3**
Tanytarsus gr. Lobatifrons Kieffer	**α**	**5**
Tanytarsus mancus V.D. Wulp.	**α**	**5**
Chironomus plumosus Linnaeus	**ρ**	**3**
Oligochaeta		
Nais elinguis O.F. Müller	**β-α**	**3**
Nais pseudoptusa Piguet	**β-α**	**3**
Nais barbata O.F. Muller	**β-α**	**3**
Paranais litoralis O.F. Müller	**β-α**	**3**
Branchiura sowerbyi Beddard	**ρ**	**2**
Limnodrilus udekemianus Claparede	**ρ**	**5**

Species	S	Abundancy point
Limnodrilus hoffmeisteri f. typica Claparede	**ρ**	**5**
Euilyodrilus hammoniensis (Michaelsen)	**ρ**	**9**
Tubifex tubifex O.F. Muller	**ρ**	**3**
Total:		**15**

Table 158 and Table 159 show that zoobentos sampling revealed the following 15 zoobentos types, of which: 1 type of dayflys, 9 species of Oligochaete, two-wingers from the 5 species of Chironomidae family.

Table 159: Zoobentos Properties at The Uchkizil Water Reservoir

Taxonomic group	Species	Q-ty m^2	Biomass g/m^2	Saprobity of species (S)	Saprobity of water reservoir
Ephemeroptera	**Caenis macrura Stephens**	**25**	**0.0875**	**α**	
Diptera	**Cricotopus gr. bicinctus Meigen**	**25**	**0.0575**	**β-α**	
	Tanytarsus gr. Gregarious Kieffer	**25**	**0.0625**	**α**	
	Tanytarsus gr. Lobatifrons Kieffer	**63**	**0.1250**	**α**	
	Tanytarsus mancus V.D. Wulp.	**63**	**0.1313**	**α**	
	Chironomus plumosus Linnaeus	**25**	**0.0286**	**ρ**	**3.23**
Oligochaeta	**Nais elinguis O.F. Müller**	**38**	**0.0041**	**β-α**	
	Nais pseudoptusa Piguet	**50**	**0.0050**	**β-α**	
	Nais barbata O.F. Muller	**25**	**0.0025**	**β-α**	
	Paranais litoralis Müller	**25**	**0.0035**	**β-α**	
	Branchiura sowerbyi Beddard	**13**	**0.0390**	**ρ**	
	Limnodrilus udekemianus Claparede	**75**	**0.0011**	**ρ**	

Taxonomic group	Species	Q-ty m²	Biomass g/m²	Saprobity of species (S)	Saprobity of water reservoir
	Limnodrilus hoffmeisteri f. typica Claparede	**100**	**0.0160**	**ρ**	
	Euilyodrilus hammoniensis (Michaelsen)	**675**	**2.7000**	**ρ**	
	Tubifex tubifex O.F. Muller	**38**	**0.3675**	**ρ**	
3 group	**15**	**1265**	**3.6311**	**α**	

Table 160: Q-ty and Biomass of The Taxonomic Zoobenthos Groups of The Researched Uchkizil Water Reservoir

Date	Reservoir name	Taxonomic group	No. of species in a group	Q-ty Pcs./m²	Biomass g/m²
15.07.2021	**Uchkizil water reservoir**	**Ephemeroptera**	**1**	**25**	**0.0875**
		Diptera	**5**	**201**	**0.4049**
		Oligochaeta	**9**	**1039**	**3.1577**
		3	**15**	**1265**	**3.6311**

Table 159 shows that zoobentos Measurement in the Uchkizil water reservoir equals β-α- and α- of the area, i.e. saprobe indicators (S) within the 3.00 to 3.50 range. Which means that the quality of water in zoobentos equal category Ш-IV and IV (moderately dirtied waters).

The α- mesasaprobic zone is characterized by the presence of amino and amido acids in the water, the conditions of the hydroenvironment tend to turn into a semi-anaerobic regime, there is little oxygen dissolved in the water, which can cause freezing at the bottom and at night due to the cessation of photosynthesis, the presence of hydrogen sulfide in significant amounts is noted (layered gray and dark gray, or even black silts with the smell of hydrogen sulfide), the nature of the biochemical processes is reductive-oxidative.

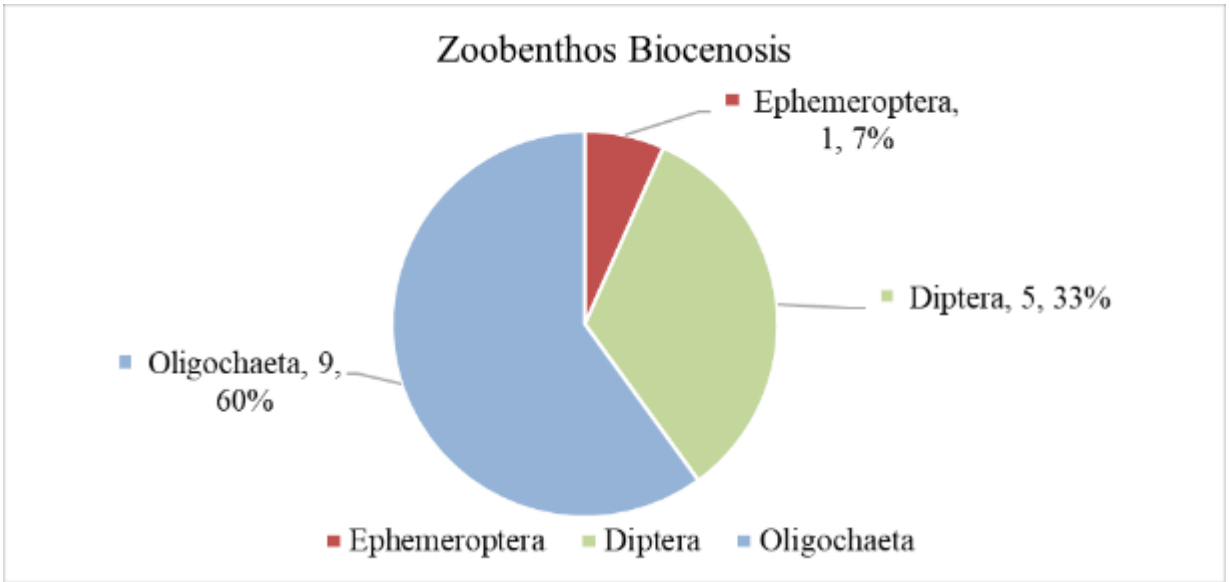


Figure 137: Taxonomic Properties of Zoobenthos Biocenosis

The overall quantity of zoobenthos bodies sampled in the shoreline area of the Uchkizil water reservoir came to – 1265 pcs/m^2, while the biomass – 3.6311 g/m^2.

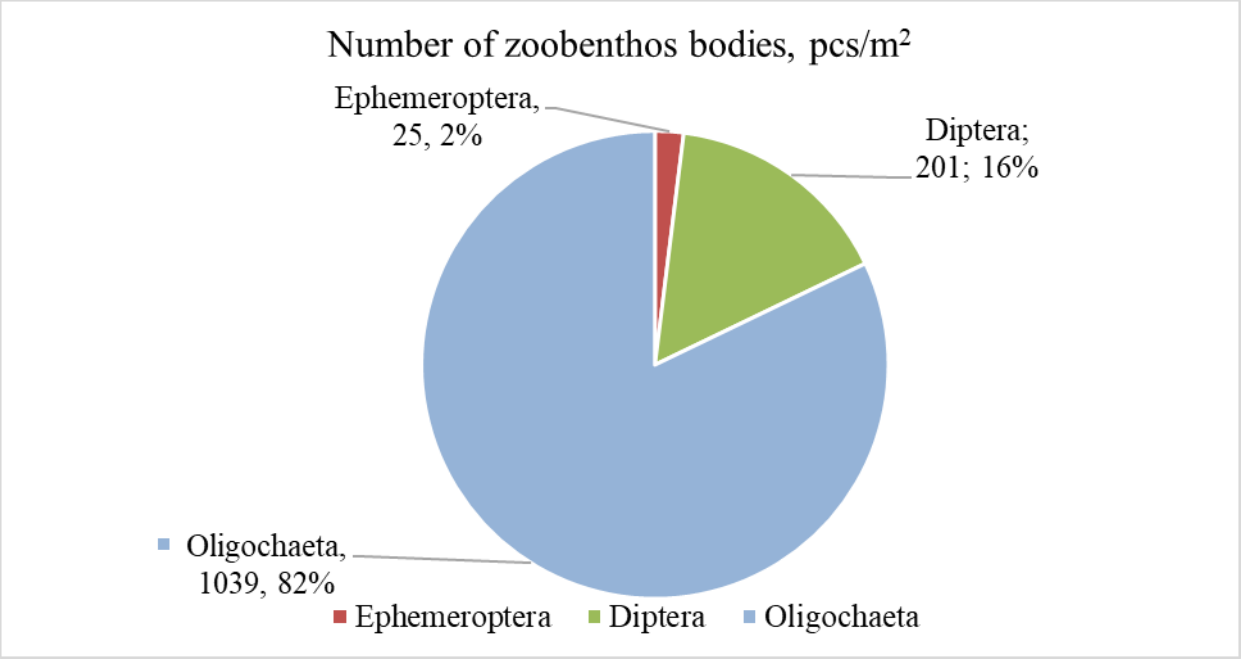


Figure 138: Abundance of Zoobenthos Organisms by Taxonomic Groups

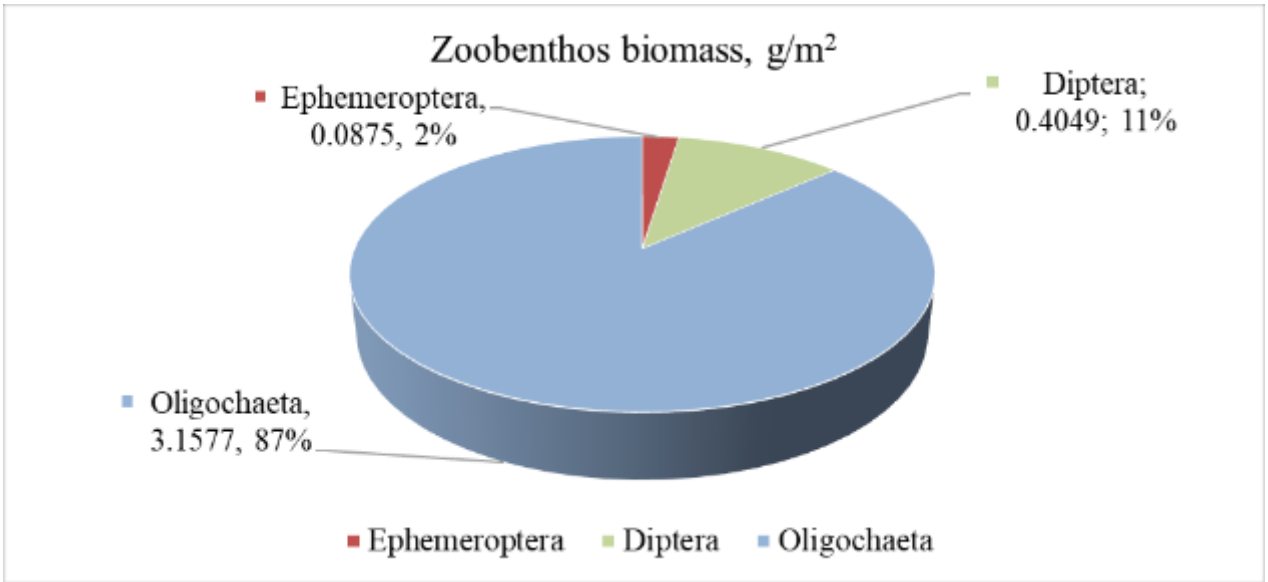


Figure 139: Biomass of Zoobenthos Organisms by Taxonomic Groups

Among the discovered organisms of zoobenthos, the dominant species are small-bristle worms of the family. Tubificidae, in particular Euilyodrilus hammoniensis.

The ecological character of the fauna develops in accordance with the peculiarities of the aquatic environment, which in the surveyed section of the reservoir include:

- Increased mineralization, which is evidenced by the salt crust on the coast, as well as the presence of such macrophytes as charovaceae, rupee and sea naiad;
- Unstable hydrological state of the reservoir: at the time of sampling, the water moved from the initial level of seasonal filling by more than 20-25 meters;

The biocenose contains organisms belonging to the psammophilis populating silty and sandy sediments of the stagnating pools, as well as those, preferring acidified mineral muds: *Euilyodrilus hammoniensis* Michaelsen, *Limnodrilus hoffmeisteri f. typica* Claparede, *Limnodrilus udekemianus* Claparede, *Chironomus plumosus*.

Survey in September 2022

The composition of zoobenthic communities is relatively constant as long as they are in the conditions in which they were formed. In fairly clean waters, benthic communities in well-aerated areas are characterized by high species diversity, which indicates the normal state of the aquatic ecosystem. In polluted waters, groups of animals that are most sensitive to individual pollutants fall out. There is a change/violation of the species and trophic structure of the zoobenthos, sometimes catastrophic, leading to the degradation of the original bottom biocenoses.

In September 2022, a hydrobiological survey of the Uchkizil reservoir was carried out, within which 4 zoobenthos samples were taken. After washing the collected soils and macrophytes, the residue with zoobenthos organisms was disassembled on the spot, then fixed with 4% formalin, labeled, and delivered to the laboratory in this form for further analysis. Quantitative samples were taken mainly from the coastal zone of the Uchkizil reservoir in areas with a muddy bottom from a depth of 0.5-0.70 m.

Taxonomic characteristics of zoobenthos biocenoses. The zoobenthos of the Uchkizil reservoir is characterized by a complex of freshwater and brackish-water species of organisms. The basis is made up of true benthic fauna, represented mainly by phytophilic fauna, in thickets of higher aquatic vegetation, shrimps, chironomid larvae, characteristic of moderately polluted and mineralized waters.

The zoobenthos of the Uchkizil reservoir is very uniform in terms of species in 2022, the basis of the benthic fauna at the above zoobenthos sampling points, the bottom sediments of which are mainly gray silts, fine-grained sand and pebbles and inclusions of clay, are mollusks, mainly *Corbiculla fluminalis* (shell valves), to a lesser extent, mayfly larvae of the genus *Beatis,* Diptera, mostly chironomid larvae: from the genera *Chironomus*, *Cricotopus* .

In July 2021, mollusks, mainly *Physa fontinalis*, diptera, chironomid larvae: several members of the genera *Chironomus* and *Cricotopus*, and oligochaetes: *Nais elinguis, Paranais litoralis* and representatives of the family.

Table 161: Species Composition of Zoobenthic Organisms in The Studied Area of The Uchkizil Reservoir

Species	**S**	**Species abundance score**				
		No. 1	**No. 2**	**Number 3**	**No. 4**	**No. 5**
Trichoptera						
Hydropsyche gracilis	α			one		
Hydroptila femoralis	β - α			5		
Ephemeptera						
Baetis buceratus	α			3		
Diptera (Chironomidae)						
Orthocladius sp.	β			3		
Cricotopus gr. bicinctus Meigen	β-α			3		
Cricotopus sp. trifascia	α			3		
Rheotanytarsus sp. 3	β - α			3		
Cryptochironomus gr. defectus	α			3		
Chironomus plumosus Linnaeus	p			3		
Tanypus punctipennis	-			3		
Mollusca						

Species	S	Species abundance score				
		No. 1	No. 2	Number 3	No. 4	No. 5
Trichoptera						
Hydropsyche gracilis	α			one		
Hydroptila femoralis	β - α			5		
Corbicula fluminalis	α	*				
Crustacea (Decapoda)						
Macrobrachium nipponense asper	α	5	3		3	3
Hydracarina						
Hygrobates calliger	β - α			**3**		
Total species:		**2**	**1**	**11**	**1**	**1**

Table 162 Qualitative characteristics of zoobenthos species of the Uchkizil

Date	No. samples	Taxonomics which group	View	Number of species ind/m ^{2}	Biomass of the species g/m ^{2}	Saprobity kind (S)	Saprobity of the sampling point in the reservoir
09/18/2022	No. 1	Mollusca	Corbicula fluminalis*	-	-	α	3.0
		Crustacea (Decapoda)	Macrobrachium nipponense asper	113	2.88	α	
		2	***2***	***113***	***2.88***	***α***	***3.0***
09/18/2022	No. 2	Crustacea (Decapoda)	Macrobrachium nipponense asper	56	2.3981	α	3.0
		one	***one***	***56***	***2.3981***	***α***	***3.0***
09/18/2022	Channel flowing into Uchkizil	Ephemeroptea	Baetis buceratus	31	0.0 1 5	α	2.55
		Trichoptera	Hydropsyche gracilis	6	0.0913	α	

			Hydroptila femoralis	125	0.075	β-α	
		Diptera (Chironomid)	Orthocladius sp.	50	0.0105	β	
			Cricotopus gr. bicinctus Meigen	50	0.1438 _	β-α	
			Cricotopus sp. trifascia	44	0.1313 _	α	
			Rheotanytarsus sp.	31	0.0543 _	β - α	
			Cryptochironomus gr. defectus	19	0.0438 _	α	
			Chironomus plumosus Linnaeus	25	0.0 3 8 8	p	
			Tanypus punctipennis	25	0.0053	-	
		Hydracarina	Hygrobates calliger	19	0.0001	β - α	
		four	***eleven***	***425***	***0.5654***	β-α	
1 09.09.2022 _	No. 4	Crustacea (Decapoda)	Macrobrachium nipponense asper	56	2.4363	α	3.0
		one	***one***	***56***	***2.4363***	α	3.0
1 09.09.2022 _	No. 5 (channel mouth, collection from the trap)	Crustacea (Decapoda)	Macrobrachium nipponense asper	18 ***(qty)***	27.4152 ***(weight)***	α	3.0

Table 163: Abundance and Biomass of Taxonomic Groups of Zoobenthos of The Uchkizil Reservoir

Date	Sample number	Taxonomic group	Number of species in the group	Population ind/m ²	Biomass g/m ²
09/18/2022	No. 1	Mollusca	1	0	0

		Crustacea (Decapoda)	1	113	2.88
		2	2	113	2.88
09/18/2022	No. 2	Crustacea (Decapoda)	1	56	2.3981
		1	1	56	2.3981
09/19/2022	Canal flowing into the reservoir Uchkizil No. 3	Ephemeroptera	1	31	0.0 1 5
		Trichoptera	2	131	0.0988
		Diptera (Chironomidae)	7	244	0.4515
		Hydracarina	1	19	0.0001
		4	11	425	0.5654
09/19/2022	No. 4	Crustacea (Decapoda)	1	56	2.4363
		1	1	56	2.4363
09/19/2022	No. 5 (channel mouth, collection from the trap)	Crustacea (Decapoda)	1	18 (qty)	27.4152 (weight)
		1	1	18 (qty)	27.4152 (weight)

Analysis of the results of zoobenthos research. As can be seen from Table 161 and Table 162 when sampling zoobenthos in the coastal zone of the Uchkizil reservoir, 12 species of zoobenthos organisms were found: mayflies - 1 species, caddisflies - 1 species, Diptera from the fam. Chironomidae - 7 species, molluscs - 1 species, crustaceans - 1 species, water mites - 1 species.

The canal flowing into the Uchkizil reservoir in terms of zoobenthos corresponds to the β-α-mesasaprobic zone, i.e. saprobity values (S) range between 2.5 and 3.00. Which, in turn, means that the water quality corresponds to III - IV class: a transitional state from moderately polluted waters to polluted waters.

The β-α-mesasaprobic zone is characterized by the presence of nitrogen compounds in the water in the form of nitrates and nitrites, among other things, amino- and amido-acids can be noted, due to which the hydroenvironment conditions tend to switch to a semi-anaerobic regime, there is not so much oxygen dissolved in water , as in the β-mesasaprobic zone, therefore, deaths at the bottom and at night due to the cessation of photosynthesis are noted much more often, the presence of hydrogen sulfide in large quantities (stratified gray and dark gray silts with the smell of hydrogen sulfide), the nature of biochemical processes is reductive-oxidative.

The β-α-mesasaprobic zone is characterized by the presence of nitrogen compounds in the water in the form of nitrates and nitrites, among other things, amino- and amido-acids can be noted, due to which the hydroenvironment conditions tend to switch to a semi-anaerobic regime, there is not so much oxygen dissolved in water , as in the β-mesasaprobic zone, therefore, deaths at the bottom and at night due to the cessation of photosynthesis are noted much more often, the presence of hydrogen sulfide in large quantities (stratified gray and dark gray silts with the smell of hydrogen sulfide), the nature of biochemical processes is reductive-oxidative.

Thus, according to Table 163, According to the indicators of zoobenthos, the sampling sites numbered 1, 2, 4 and 5 (the canal mouth) at the Uchkizil reservoir correspond to the α-mesasaprobic zone, i.e. saprobity values (S) range between 3.00 and 3.50. Which, in turn, means that the water quality corresponds to class IV - polluted water.

The α-mesasaprobic zone is characterized by the presence of amino- and amido acids in the water, the conditions of the hydro-environment tend to switch to a semi-anaerobic regime, there is little oxygen dissolved in the water, which can cause death at the bottom and at night due to the cessation of photosynthesis, the presence of hydrogen sulfide in large quantities was noted (layered gray and dark gray, or even black silts with the smell of hydrogen sulfide), the nature of biochemical processes is reductive-oxidative.

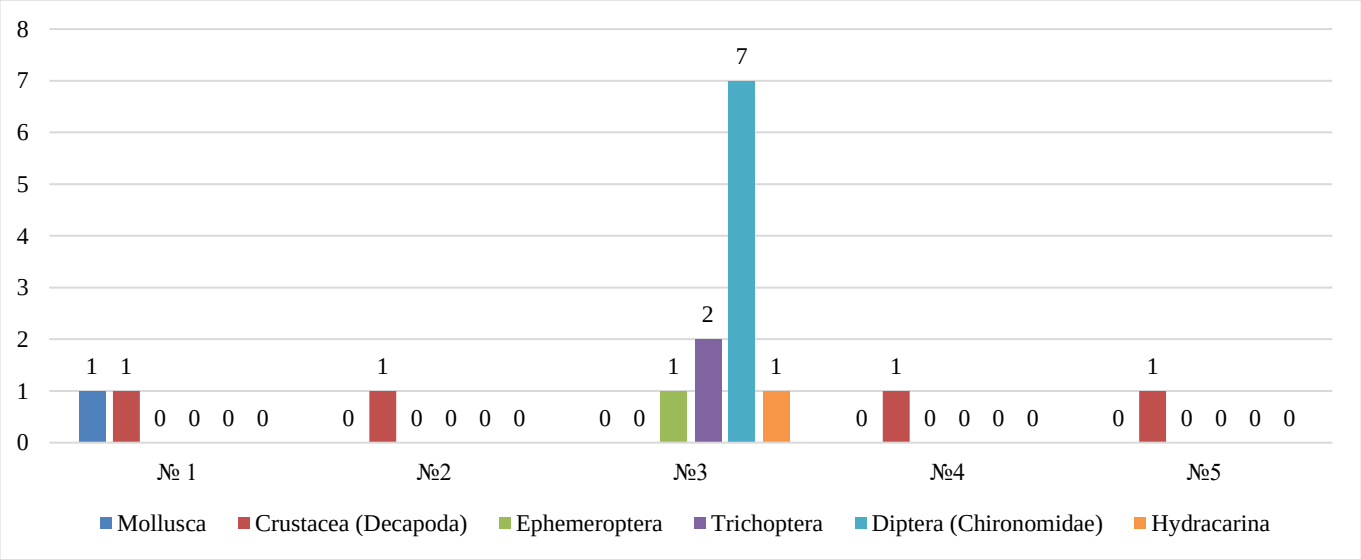


Figure 140: Taxonomic Characteristics of Zoobenthos Biocenoses

The total number and biomass of zoobenthos organisms selected in the coastal zone of the Uchkizil reservoir was:

Sample No. 1 - 113 specimens / m ^{2,} and biomass - 2.88 g / m$^{2.}$

Sample No. 2 - 56 specimens / m ^{2,} and biomass - 2.3981 g / m$^{2.}$

Sample No. 3 - 425 ind./m^2, and biomass - 0.5654 g/m$^{2.}$

Sample No. 4 - 56 specimens / m ^{2,} and biomass - 2.4363 g / m$^{2.}$

Sample No. 5 (channel mouth, these traps) - 18 pieces, and biomass - 27.4152 g.

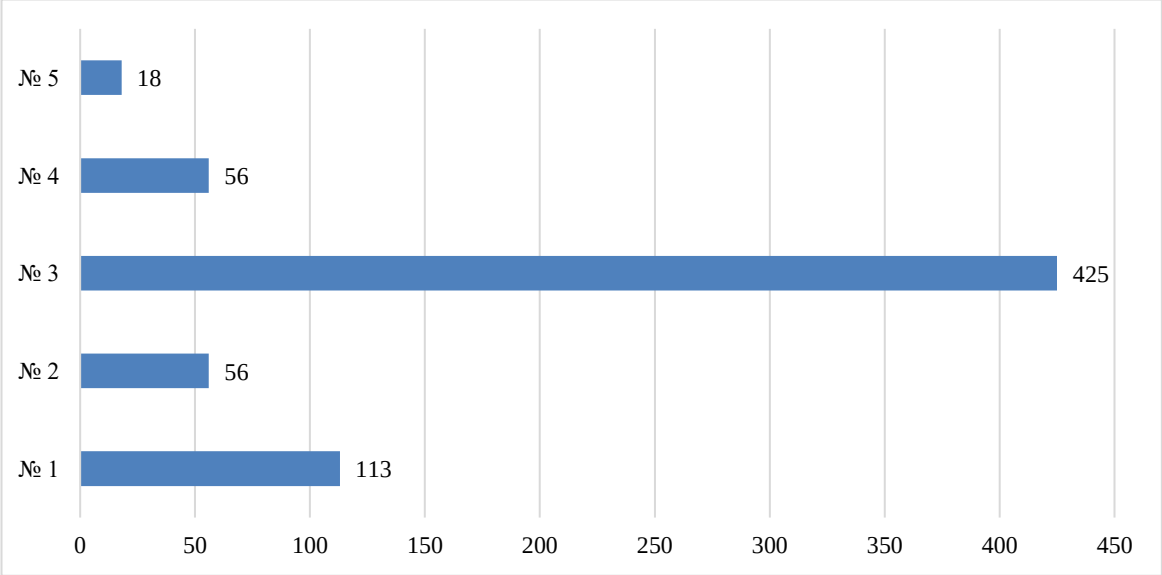


Figure 141: Number of Zoobenthic Organisms by Taxonomic Groups

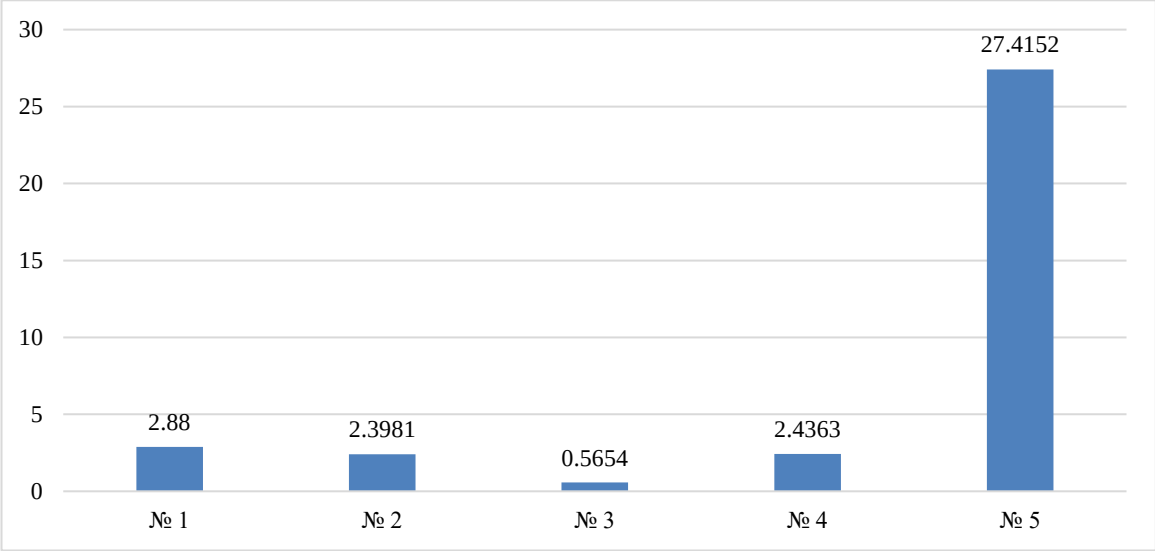


Figure 142 Biomass of Zoobenthic Organisms by Taxonomic Groups

9.4.3.3 Phytoplanktonic Organisms

Phytoplanktons are the microscopic bodies freely travelling in the water thickness or participating in the photosynthesis. They are considered one of the key water ecosystem elements as they participate in water reservoir productivity and shaping the water quality.

As a result of the analysis the phito plankton sample contains 77 seaweed varieties, of which Cyanophyta are 17 Bacillariophyta – 34, Chlorophyta – 13, Chrysophyta – 3, Dinophyta – 8, as well as 1 Cryptophyta and Xanthophyta respectively. The dominant set of phito plankton communities was represented in the first place by producents, namely blue and green, diatomic and green ones. Other families of microweeds appear to contain insignificant quantity and quality indicators. Taxonomic

composition and the quantitative development of the phito plankton community at the researched area of the Uchkizil water reservoir for July 2021 can be found in Table 164 and Table 165.

Table 164: Taxonomic Composition of The Phito plankton Of the Uchkizil Reservoir

Taxone/Sample No.	1
Cyanophyta	**17**
Bacillariophyta	**34**
Cryptophyta	**1**
Chrysophyta	**3**
Dinophyta	**8**
Chlorophyta	**13**
Xanthophyta	**1**
No. of microweeds	**77**

In the phytoplankton sample, a moderate development of blue-green (Cyanophyta) algae was noted, a total of 17 species (22.08%), forms and varieties of algae were noted. Blue-green colonial and filamentous β- mesosaprobic forms from the genera Synechococcus, Microcystis, Merismopedia, Gloeocapsa, Coelosphaeria, Anabaenopsis, O scillatoria, Phormidium, Lyngbya are represented. The number of blue-green algae in the sample corresponded to 8800.00 x 10 3 cells / l, and the biomass was 248,588 mg / l (see Table 165).

Diatoms (Bacillariophyta), in terms of taxonomic diversity (34 species), occupy one of the dominant positions in phytoplankton (44.16%) of the studied area and are represented by both planktonic o-, o - β - and representatives of phytobenthos β -mesosaprobic species from the genera Cyclotella, Fragilaria, Synedra, Eunotia, Cymbella, Amphora, Navicula, Nitzschia, certain types kotoryhpredpochitayut eutrophic water (Eunotiaarcus Ehr., E. gracilis (Ehr.) Rabenh., Mastogloia Smithiiv. amphicephala Hofm., Synedratabulata (Ag.) Kutz., Cymbellaobtusiuscula (Kutz.) Grun. Et al.) The number of diatoms in the sample was 562.5 00 * 10 3 cells / l, the abiomass was 382.225 mg / l (see Table 164).

Golden (Chrysophyta) algae are represented by the genera Dinopryon , Chromulina , their number in the sample was 150.00 * 10 3 cells / l, and the biomass, respectively, was 50.075 mg / l; dinophytes (Dinophyta) are represented by the genera Glenodinium , Peridinium , Ceratium , the number was 87.50 * 10 3 cells / l., and the biomass, respectively, - 118.713 mg / l; yellow-green (Xanthophyta) originally presented Tribonema , number amounted to 206.250 x 103 cells / L, respectively, and the biomass -. 185,213 mg / l (see Table 164).

Table 165: Phitoplankton Quality at The Uchkizil Reservoir

Taxone	№ 1
Cyanophyta	8800,00 248.588
Bacillariophyta	562,500 382.225

Taxone	№ 1
Cryptophyta	12,500 12.575
Chrysophyta	150,00 50.075
Dinophyta	87,500 118.713
Chlorophyta	368,750 129.475
Xanthophyta	206,250 185.213
q-ty (kl*10³) / biomass (mg/l)	10217,500 1126,924

The diagrams in Figure 143 and Figure 144 show the percentage ratio of taxonomic diversity and quantitative development of phytoplankton microalgae in the sample of the Uchkizil reservoir, July 15, 2021.

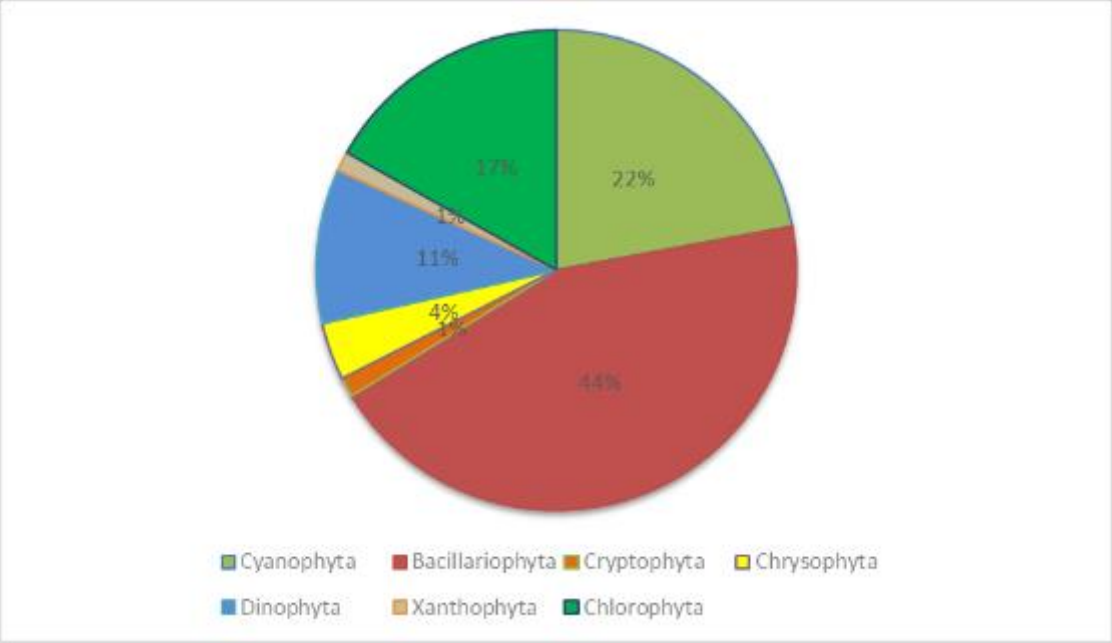


Figure 143: Percentage of Phytoplankton Taxa in The Uchkizil Reservoir

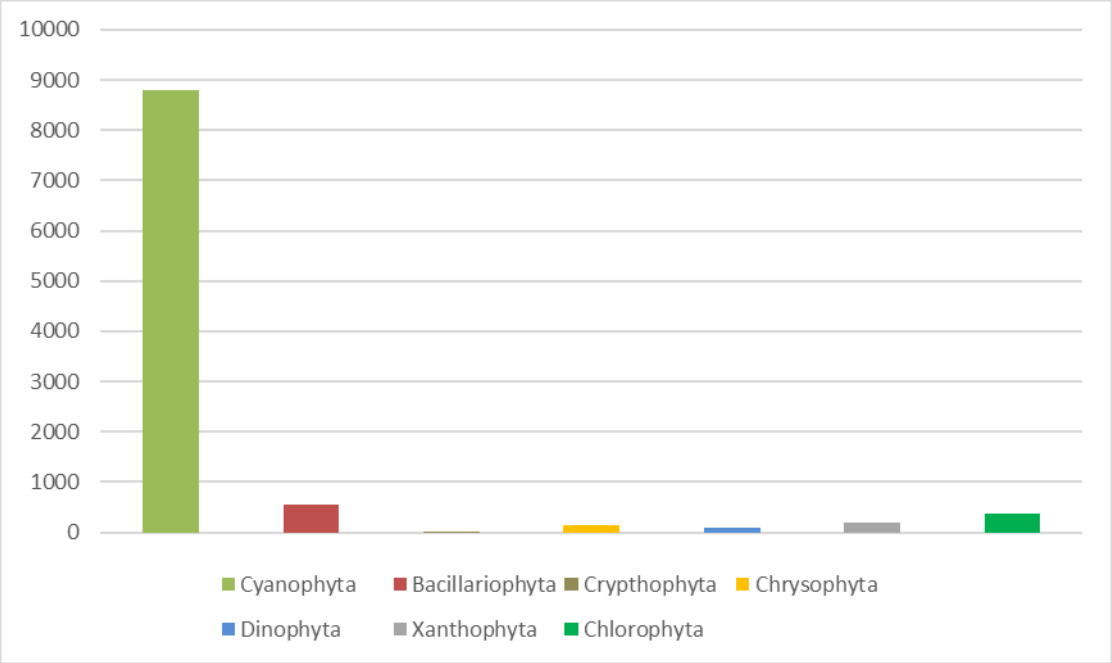


Figure 144: Quantity of Phytoplankton in The Uchkizil Reservoir

Based on the results obtained, it can be noted that the dominant phytoplankton complex of the investigated section of the Uchkizil Reservoir is represented mainly by widespread freshwater o- β - and freshwater-brackish β- mesosaprobic forms of diatoms, blue-green, green, dinophytic, golden and yellow-green algae. The ecological state in terms of the indicator corresponds to AB - a satisfactory ecological state, characterized by metabolic and ecological progress of biocenoses.

Survey in September 2022

Phytoplankton are microscopic plant organisms that float freely in the water column and carry out photosynthesis, and are one of the most important elements of aquatic ecosystems involved in the formation of water quality and reservoir productivity.

The most reliable method of sampling phytoplankton is considered to be the bathymetric method. Samples taken with a bathometer are used both" for quantitative accounting and for qualitative characteristics of the sample.

In 4 studied samples of phytoplankton, 105 species were found species, varieties and forms of algae, of which blue-green (Cyanophyta) - 21 species, diatoms (Bacillariophyta) - 55 species, green (Chlorophyta) - 21 species, dinophyta (Dinophyta) - 5 species and 1 species each of cryptophytes (Cryptophyta), euglenophyta (Euglenophyta) and yellow-green (Xanthophyta) algae.

The dominant complex of phytoplankton communities was represented primarily by producers, among which blue-green, diatoms and green algae reach the greatest development and diversity. Microalgae from other departments in the samples were found with low indicators of qualitative and quantitative development. The taxonomic composition and quantitative development of the phytoplankton community in the studied areas of the Uchkizil reservoir and the canal supplying water for September 2022 are presented in Table 166 and Table 167.

Table 166: Taxonomic Structure of Phytoplankton in The Studied Areas of The Uchkizil Reservoir

Tax a / # samples	# 1	# 2	# 3	# 4
Cyanophyta	14	8	5	16
Bacillariophyta	27	13	34	31
Cryptophyta	1	1	-	1
Euglenophyta	1	-	-	1
Dinophyta	3	1	-	5
Chlorophyta	15	7	5	14
Xanthophyta	-	1	-	-
Number of microalgae species	**61**	**31**	**44**	**69**

In samples of phytoplankton, a moderate development of blue-green (Cyanophyta) algae was noted, in total 21 species (20.00%), forms and varieties of algae were noted. Represented by blue-green colonial and filamentous β-mesosaprobic forms from from genus Synechococcus, Microcystis, Merismopedia, Gloeocapsa, Oscillatoria, Phormidium, Lyngbya. The number of blue-green algae in the samples ranged from 2868.750 * 103 to 7525.00 * 103 cells / l, and the biomass, respectively, was 82.200 mg / l - 248.588 mg / l .

Diatoms (Bacillariophyta) in terms of taxonomic diversity (55 species) occupy one of the dominant positions in phytoplankton (52.38%) of the studied area and are represented by both planktonic o-, o-β-, and representatives of phytobenthos β-mesosaprobic species from genus *Cyclotella, Fragilaria, Synedra, Cymbella, Amphora, Navicula, Nitzschia,* individual species of which prefer eutrophic waters (*Eunotia arcus* Ehr., *E. praerupta v. Musciocola* Boye P., *Mastogloia Smithii v. amphicephala* Hofm., *Synedra tabulata* (Ag.) Kutz., *Cymbella obtusiuscula* (Kutz.) Grun. and etc.). The number of diatoms in the samples ranged from 293.750 * 10^3 to 1175.00 * 10^3 cells / l, and the biomass, respectively, was 150.394 mg / l - 2526.591 mg / l.

In phytoplankton samples, a weak-moderate development of both quantitative and qualitative composition of green (Chlorophyta) algae is observed, a total of 21 species or 20.00% of the total number of species of algae. Represented by green single specimens of widespread β-mesosaprobic species from genus *Chlorococcum, Chlorella, Chlamidomonas, Carteria, Dictyosphaerium, Cosmarium* and others. The number of green algae in the samples ranged from 112.500 * 10^3 to 300.00 * 10^3 cells / l, and the biomass, respectively, was 43.013 mg / l - 1 45.344 mg / l (Table 1.3.3.3.2).

Dinophyta (Dinophyta) represented by genera Glenodinium, Peridinium, the largest number of which was observed in sample # 4 (5 ichthyological point) and amounted to 84.375*103 cells/l., and the biomass, respectively, was 112.869 mg/l; yellow-green (Xanthophyta) represented by genus Tribonema, the abundance was 18.750*103 cells/l., and the biomass, respectively, was 10.613 mg/l. Euglena and cryptophyte algae were singly noted in samples ## 1, 2, 4 and constituted a small number and biomass. These groups of organisms were practically absent in sample # 3 (channel).

*Table 167: Quantitative Development of Phytoplankton in The Studied Areas of The Reservoir. Uchkizil (numerator - abundance (cl * 10 ^{3}) / denominator - biomass (mg / l)*

TAXA	# 1	# 2	# 3	# 4
Cyanophyta	4818.750 183.538	4225.00 132.850	2868.750 82.200	7525.00 245.475
Bacillariophyta	881.250 416.625	293.750 150.394	487.500 515.798	1175.00 2526.591
Cryptophyta	12,500 12.575	6.250 6.288	-	12,500 12.575
Euglenophyta	12,500 11.150	-	-	18,750 16.725
Dinophyta	25.00 35.725	12,500 27.950	-	84.375 112.869
Chlorophyta	300.00 145.344	156.250 43.013	112,500 49.206	281.250 112.691
Xanthophyta	-	18,750 10.613	-	-
number (cell*103) / biomass (mg/l)	**6050.00** **804.957**	**4712.500** **371.108**	**3468.750** **647.204**	**9096.880** **3026.926**

The diagrams of Figure 145 and Figure 146 show the quantitative development and percentage ratio of the taxonomic diversity of phytoplankton microalgae in samples from the Uchkizil reservoir, 18-19.09.2022.

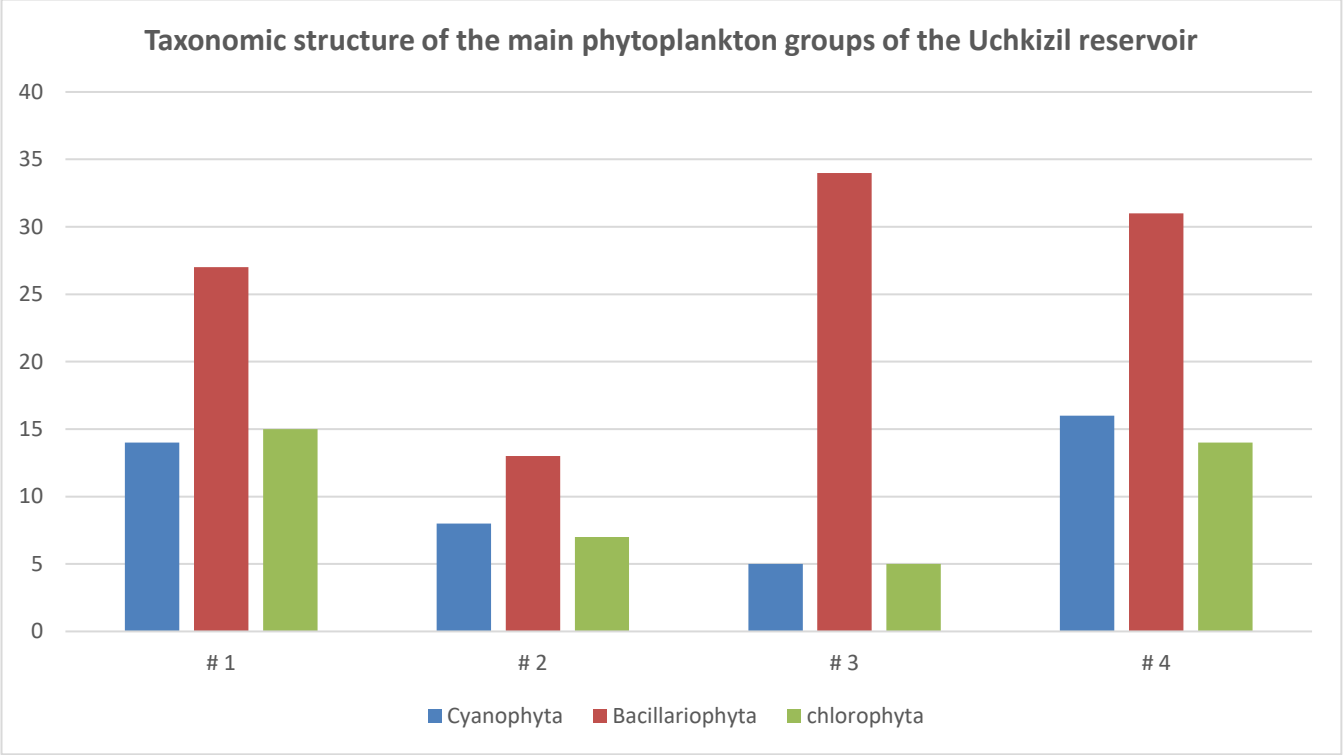


Figure 145: The Main Qualitative Composition of Phytoplankton in The Studied Areas of The Uchkizil Reservoir

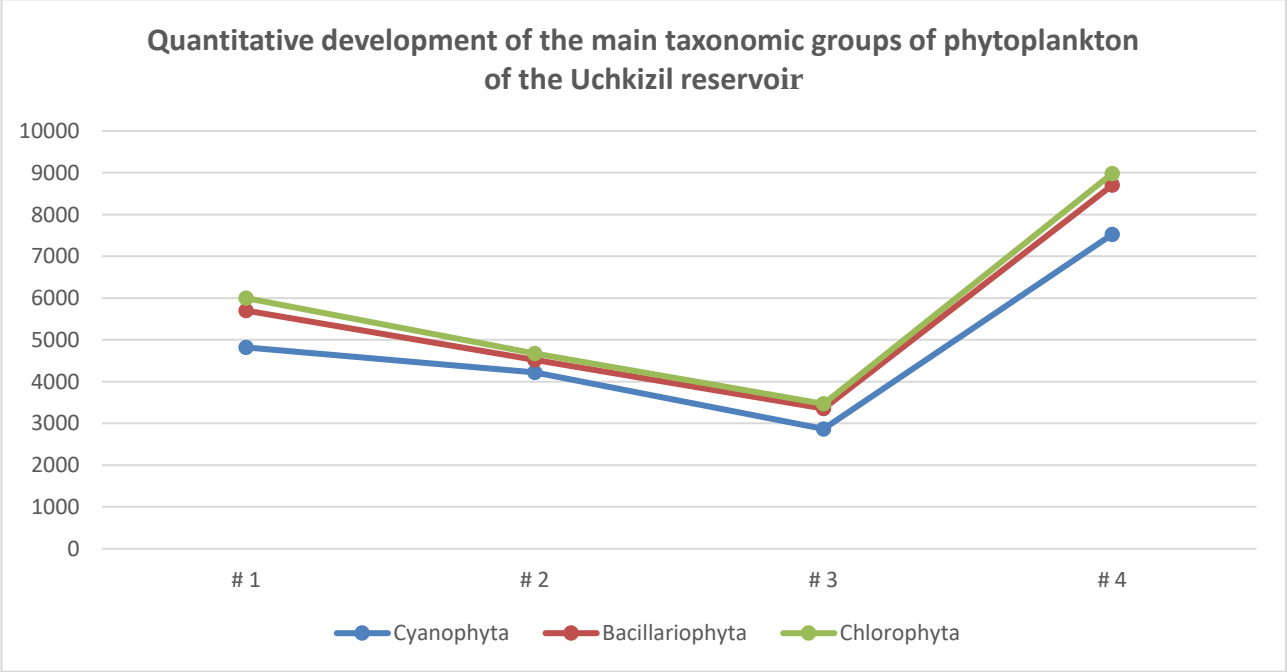


Figure 146: Diagram of The Quantitative (Abundance) Development of Phytoplankton Microalgae in Samples of The Uchkizil Reservoir

As can be seen from the diagrams in Figure 146 the smallest number of phytoplankton development was observed at point # 3 - a channel that supplies water to the reservoir. The greatest quantitative development of the phytoplankton community was observed at point # 4 (5 in terms of ichthyofauna), and a good catch of fish is also observed here.

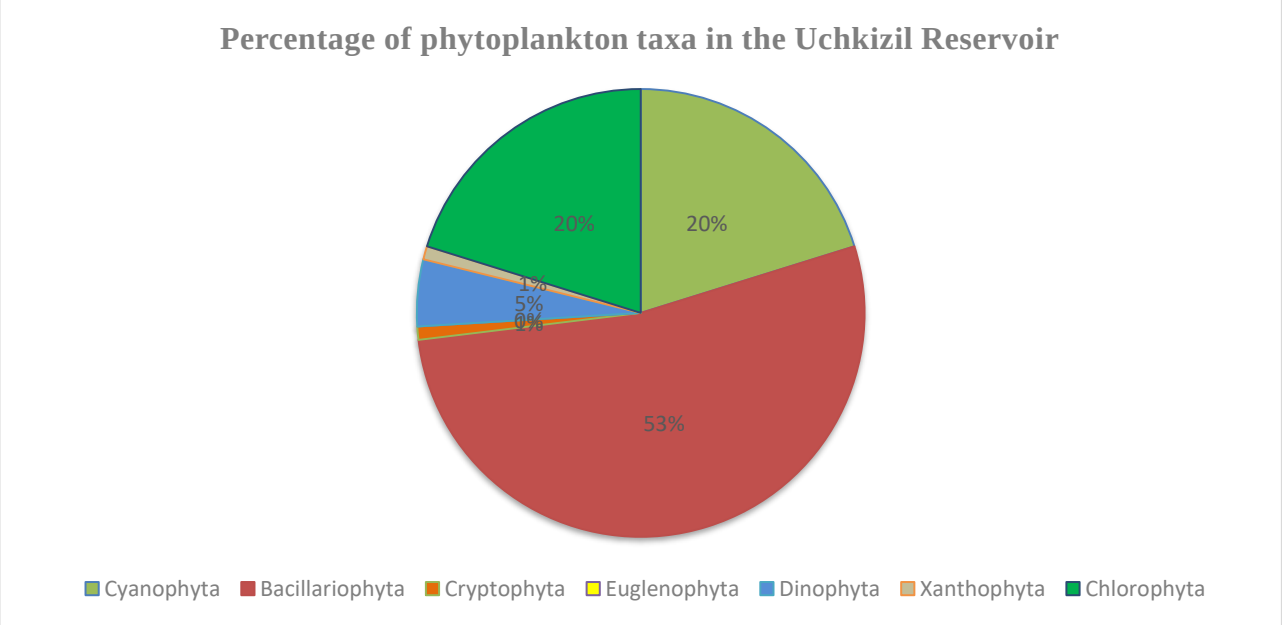


Figure 147: Diagram of The Percentage of Taxa (Groups) Of Microalgae Taxa (Groups) Of Microalgae Hytoplankton In Samples of The Uchkizil Reservoir

9.4.3.4 Zooplankton

Zooplankton is a community (group) of aquatic invertebrate organisms inhabiting the body of water and leading to float freely, independent of the solid substrate as a support member, lifestyle (colorless flagellates, rotifers (Rotatoria), cladocerans (order C ladocera) and copepods copepod (order Copepoda) consuming phytoplankton, bacteria and detritus, it itself is the most important component in the diet of fish and carnivorous invertebrates. mass develop microalgae

The quantitative assessment of zooplankton development has been conducted on the following scale (Chinov, 2007) to make sure the zooplankton biomass (mg/m3) meets the water body trophicity values: "poorly developed" – from 1-400 (ultraoligotrophite), "poorish development" – from 400-1000 (oligatrophite), "average" - from 1000-2000 (mesotrophic) and "abundantly developed" - 2000-4000 and more (eutrophic) (see Table 168).

Table 168: Concentration of Phosphorous, Bio and Ichthyomass Of Zooplankton In Water Bodies

Water body type	Phosphorous, mg/m³	Zooplanktone biomass, g/m³	Ichtiomass, g/m²
Ultraoligotrophite	**3**	**0.5**	**1.25**
Oligatrophite	**1-10**	**0.5-1**	**1.25-2.5**
Mesotrophic	**4-40**	**1-4**	**2.5-10**
Eutrophic	**200-400**	**4-16**	**10-40**
Hypereutrophic	**400**	**16**	**40**

In July 2021, 1 zooplankton sample was taken from the Uchkizil reservoir. Table 169 shows the species composition of zooplankton, saprobity indices for the identified species and the mass rate of their detection in each sample. 7 species of zooplankton were found: 2 species of cladocera (Cladocera) - Diaphanosomalacustris and Chydorussphaericus, 4 species of copepods (Copepoda) - Thermocyclopsvermifer dominated en masse; also found mature female cyclops Mesocyclopsaequatorialissimilis, Harpacticoidagen harpacticides. sp., immature individuals of Diaptomidaegen. sp. and 1 species of rotifers.

The level of saprobity - organic pollution of water (see Table 169) for zooplankton species from the Uchkizil Reservoir ranged from 1.5-1.75, which corresponds to the β- saprobic zone - slightly-moderate organic pollution of water: the presence of organic and mineral compounds with signs of oxygen oxidation.

Table 169: Zooplankton Species, Mass Propagation and Saprobity Index as Well as Quantitative Characteristics of Zooplankton Species in Uchkizill Reservoir

No. and station name	Zooplankton specie	Propagation (h)	Saprobity (s)
№ 1	**Rotifera:**		
	Euchlanis dilatata	**1**	**β-o – 1,5**
	Cladocera:		
	Diaphanosoma lacustris	**7**	**β-o – 1,55**
	Chydorus sphaericus	**3**	**β-o – 1,75**
	Copepoda:		
	***Thermocyclops vermifer,* Lindberg, 1935**	**9**	**β-o – 1,7**
	***Mesocyclops aequatorialis similis* Van de Velde, 1935**	**5**	**β-o – 1,65**
	Harpacticoida gen. sp.	**3**	**-**
	Diaptomidae gen. sp.	**3**	**-**

Quantitative zooplankton development Uchkizilskom reservoir was negligible: v. Total number - 7033 copies / m 3 and the total biomass - 143.02 mg / m 3 due to equal contributions to the development of quantitative Cladocera and Copepoda (see Table 170).

Table 170: Number of Species, Overall Number (Pcs. /M3) and Biomass (Mg/M³) Of 3 Zooplankton Taxonomic Groups of The Uchkizil Water Reservoir

Station No. and name	Taxonomic group	No. species per group	No. of species, pcs. m^3	Biomass, mg/m^3
№ 1	**Rotifera**	**1**	**33**	**0.02**
	Cladocera	**2**	**1200**	**68**
	Copepoda	**4**	**5800**	**75**
	Total:	**7**	**7033**	**143.02**

The level of trophicity of the Uchkizil reservoir, determined by the biomass of zooplankton, corresponds to the "oligotrophic" level and shows the lack of nutrients (nitrogen and phosphorus) in the reservoir, which affects the quantitative indicators of zooplankton.

In the summer sample of the investigated section of the Uchkizil reservoir, 7 species of zooplankton were found, which indicates the average biodiversity of the reservoir.

The species found in the sample are widespread, thermophilic species - indicators of moderately polluted waters, the indicator of indicator significance for organic pollution by decay products corresponds to the β- saprobic zone - a zone of slightly-moderate organic pollution. The level of biomass of zooplankton in the reservoir was 143.02 g / m^3, which characterizes waters with an insufficient amount of nutrients (the level of water trophicity), and poor development of zooplankton organisms (clean or unpolluted).

Survey in September 2022

Zooplankton is a "floating" component of aquatic ecosystems, consisting of animals that are able to move over short distances using their motor organs. Representatives of zooplankton differ significantly in size: nanoplankton (unicellular protozoa: foraminifera, radiolarians, ciliates - 100 nm), microzooplankton (annelids: rotifers up to 50 microns) and mesoplankton (0.2-20 mm) Copepoda - copepods and Cladocera of crustaceans - copepods - copepods and cladocera - crustaceans). Zooplankton (colorless flagellates, ciliates, rotifers, cladocerans and copepods), consuming phytoplankton, bacteria and detritus, is itself the most important component in the diet of fish and predatory invertebrates, that is, hydrobiological studies of aquatic biocenoses make it possible to determine and predict the formation of the natural food supply of a reservoir. Also, zooplankton serves as a good indicator of pollution of water bodies, both in a comparative analysis of the species composition and quantitative development in areas of water bodies with varying degrees of anthropogenic impact, and in monitoring changes in the species composition over a long time interval. Its composition, structure and level of development determine the direction and intensity of the flow of matter and energy in watercourses and reservoirs. Many planktonic animals make vertical migrations, which contributes to the transfer of matter to the depths to the surface. Changes in the environment can affect the change in species composition, the ratio of taxonomic groups, and the quantitative indicators of zooplankton.

A quantitative assessment of the development of zooplankton in the ponds was carried out according to the following conditional scale of the correspondence of the zooplankton biomass (mg/m^3) to the trophic level of the reservoir: "very poor development" - from 1-400 (ultraoligotrophic), "poor development" - from 400 -1000 (oligotrophic), "medium development" - from 1000-2000 (mesotrophic) and "abundant development" - 2000-4000 and above (eutrophic).

Table 171: Phosphorus Concentration, Zooplankton Biomass and Ichthyomass In Water Bodies Of Different Trophic Levels

Type of reservoir	Phosphorus concentration, mg / m ^{3}	biomass zooplankton, g/m ^{3}	Ichthyomass, g/m ^{2}
Ultra-oligotrophic	3	0.5	1.25
Oligotrophic	1-10	0.5-1	1.25-2.5
Mesotrophic	4-40	1-4	2.5-10
eutrophic	200-400	4-16	10-40
hypereutrophic	400	16	40

In the studied areas of points 1,2,3,4 of the Uzkyzyl reservoir in September 2022, only 4 species of microcrustaceans from the group of copepods Copepoda were found - 3 species: kalanoid *Diaptomus blanci*, 189, cyclops *Eucyclops macruroides* and the harpocicide *Cletocamptus cf. _ deitersi* and 1 species of Cladocera: *Diaphanosoma orghidani*. The discovered species of zooplankton are also representatives of the coastal (littoral zone) *Eucyclops macruroides, Cletocamptus cf. _ deitersi* and pelagic *Diaphanosoma orghidani* and *Diaptomus blanci.*

No Rotifera rotifers were found in zooplankton samples; they were probably eaten by cyclops (thus, in July 2021, the rotifer *Euchlanis dilatata*). In addition, in the zooplankton community in July 2021, cyclops *Thermocyclops* and *Mesocyclops*, *Diaptomus blanci calanid*, Cletocamptus *harpocticid cf. deitersi* and 2 species of cladoceran: *Diaphanosoma orghidani* and *Chydorus sphaericus* (total 7 species).

That is, compared to last year (July 2021), in September 2022, there is a depletion of the species composition, which is possibly associated with the annual dynamics of species diversity species saprobity indices are given in Table 172.

Table 172: Species composition of zooplankton, mass and saprobity index and quantitative characteristics of zooplankton species of the Uchkizil reservoir

Date	**Station number**	**Species composition**	**In bulk type (h)**	**Saprob-type (s)**	**Numerical. ind.m^3 Biomass, mg/m ^{3}**
18.09. 20 22	#1	*Diapt omus blanci Guerne* & Richard , 1896	9	β - 1.65	1456 68.2
		Eucyclops macruroides Liljeborg, 1901	5	o-β - 1.4	140 1.26
		Nauplii	9	-	1316 6.5
		Diaphanosoma orghidani Nigrea, 1982	3	o-β - 1.4	28

Date	Station number	Species composition	In bulk type (h)	Saprob-type (s)	Numerical. ind.m³ Biomass, mg/m ³
19.09. 2022					2.38
	#2	*Diapt omus blanci Guerne* & Richard , 1896	7	β - 1.65	2505 137.1
		Eucyclops macruroides Liljeborg, 1901	7	o-β - 1.4	6346 132.4
		Nauplii	9	-	13360 53.44
		Cletocamptus cf. deitersi Richard, 1897	3	-	167 0.8
	#3	*Diapt omus blanci Guerne* & Richard , 1896	3	β - 1.65	167 fifteen
		Eucyclops macruroides Liljeborg, 1901	7	o-β - 1.4	1837 37.1
		Nauplii	7	-	5511 22.0
		Cletocamptus cf. deitersi Richard, 1897	3	-	334 1.67
	#4	*Diapt omus blanci Guerne* & Richard , 1896	3	β - 1.65	177 9.5
		Eucyclops macruroides Liljeborg, 1901	5	o-β - 1.4	394 4.4
		Nauplii	5	-	315 1.6

The quantitative development of zooplankton at the studied points 1,3,4 was very insignificant and corresponded to the status of "ultraoligotrophic" (biomass less than 100 mg/m^3); the number and

biomass averaged 3892 ind./m.cub. and 56 mg/m.cu. respectively. The development of zooplankton biomass corresponded to the "oligotrophic" status only at station 2 (biomass over 100 mg/m^3); at the same time, the number of zooplankton was 22378 ind./m^3, and the biomass was 323.8 mg / m^3.

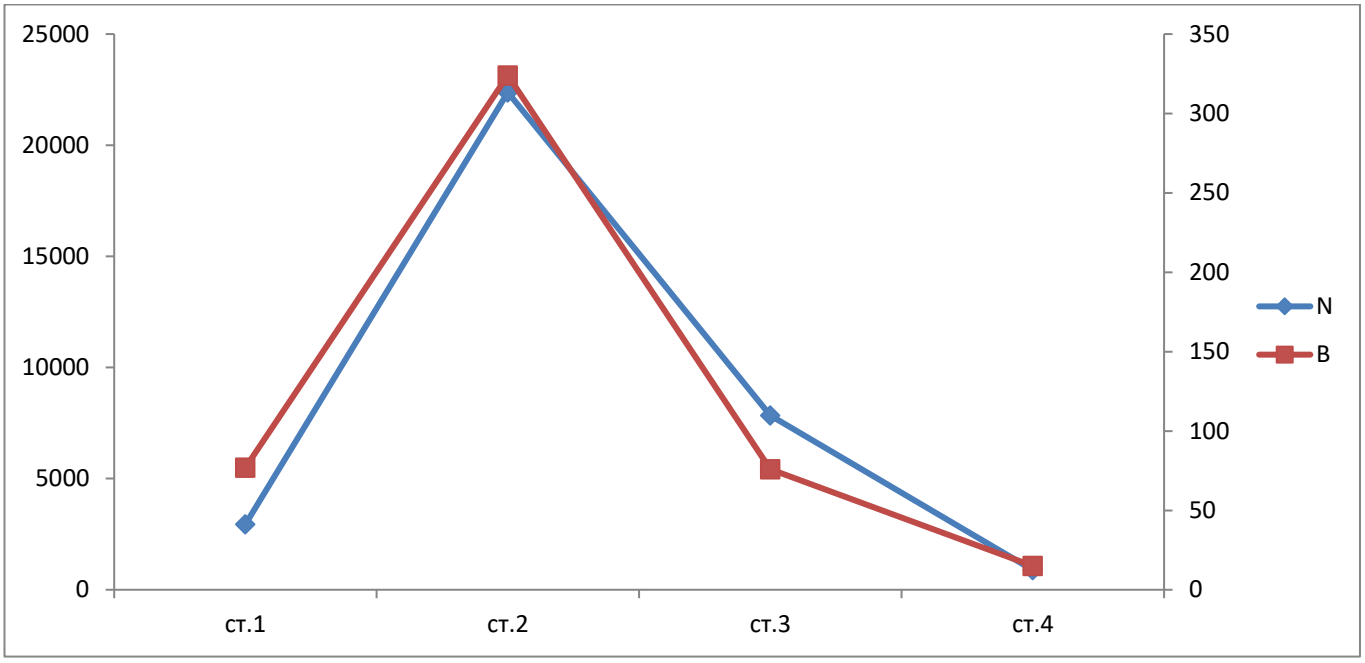


Figure 148 Biomass (B, mg/m^3) and Abundance (N, ind./m^3) of Zooplankton at The Studied Stations of The Uchkizil Reservoir

Table 173 Number of Species, Abundance (ind./m^3) and Biomass (mg/m^3) of Taxonomic Groups of Zooplankton in The Uchkizil Reservoir

Point number	Taxonomic group	Quantity species in the group	Number, ind. m ^{3}	Biomass, mg/m ^{3}
# 1	Rotifera	0	0	0
	Cladocera	1	28	2.38
	Copepoda	2	2912	74.7
	total	3	2940	77.18
# 2	Rotifera	0	0	0
	Cladocera	0	0	0
	Copepoda	3	22378	323.8
	total	3	22378	323.8

# 3	Rotifera	0	0	0
	Cladocera	0	0	0
	Copepoda	3	7849	75.8
	total	3	7849	75.8
# 4	Rotifera	0	0	0
	Cladocera	0	0	0
	Copepoda	2	887	15.15
	total	2	887	15.15

The saprobity index, determined by the indicator values of zooplankton species , for the studied stations of the Uchkizil reservoir was in the range of 1.48-1.53 and corresponded, mainly (v. 1, 2 and 4), to the β -mesosaprobic zone of organic water pollution; for point 3, the saprobity index corresponds to the "oligosaprobic zone"(see Table 174). The β mesosaprobic zone of organic water pollution is characterized by the presence of many organisms with autotrophic nutrition. Although the species diversity of aquatic communities can be high, the abundance and biomass of organisms are not very high. The content of oxygen and carbon dioxide in this zone fluctuates depending on the time of day: during the day there is an excess of oxygen and a deficiency of carbon dioxide, at night - vice versa. Quite a lot of detritus, due to the overgrowth of the coastal zone with submerged plants.

Table 174: Indices of Saprobity and Indices of Species Diversity of Zooplankton of The Uchkizil Reservoir

Sample number	Saprobic index	Dominance Index	Community Structure
# 1	1.53	0.88	*Diaptomus blanci _*
# 2	1.53	0.42	*Eucyclops macruroides*
# 3	1.48	0.47	*Eucyclops macruroides*
# 4	1.53	0.63	*Eucyclops macruroides*

The structure of the community in the studied areas of the reservoir is represented by microcrustacean copepods: cyclops *Eucyclops macruroides* and the calanid *Diaptomus blanci*. The community dominance index from 0.42-0.88 indicates that the biomass is distributed in the community between 1-2 species, which characterizes the community as more or less stable. Kalanids (*Diaptomus blanci)* are *coarse* filter feeders. Cyclops (*Eucyclops macruroides*) *are* microcrustaceans with a mixed type of food filter feeder + predator (ciliates) and the dominance of these species in the community in the studied areas indicates the presence of detritus (undecomposed organic matter) in sufficient quantities, which they help to quickly mineralize. Cladocera (*Diaphanosoma orghidani*) are thin filter feeders that are present in waters with a high content of phosphorus and nitrogen (with increased trophicity).

The natural factors that determine the trophicity of reservoirs include natural and climatic factors in which the reservoir is located. Since in Uzbekistan both soils and waters (snow origin) are very poor in nutrients, trophicity, or water bloom, is a rare phenomenon for reservoirs, especially since submerged aquatic plants are strong competitors for nutrients. In addition, the increase in the trophic

content of reservoirs is influenced by anthropogenic factors associated with the economic use of the reservoir and the catchment area, as well as with the factors of fisheries development of the reservoir. In the Uchkizil reservoir, anthropogenic impact is limited to tourism and recreation.

9.4.3.5 Periphyton

Periphyton (fouling) - communities of organisms that live on a variety of underwater (living or dead) substrates, outside the specific bottom layer of water and is one of the most complex communities in aquatic ecosystems.

Periphyton fouling includes representatives of three main functional groups of organisms: autotrophic organisms - producers - algae;

- heterotrophic organisms - consumers: protozoa, rotifers, ciliates, crustaceans, cyclops, daphnia, sponges, bryozoans, worms, bivalve molluscs and others; - decomposers - filamentous, coccoid, rod-shaped, zooglea and other bacteria, fungi.

Periphyton, as an integral part of aquatic ecosystems, undergoes various changes along with it, due to various natural and anthropogenic factors, which is expressed in the spatial and temporal successions of periphytic communities.

Outwardly, the fouling of periphyton looked mainly as brown and clay deposits, films and layers, slimy to the touch formations, from light gray to brownish-green interspersed with clay on the stems and leaves of macrophytes (

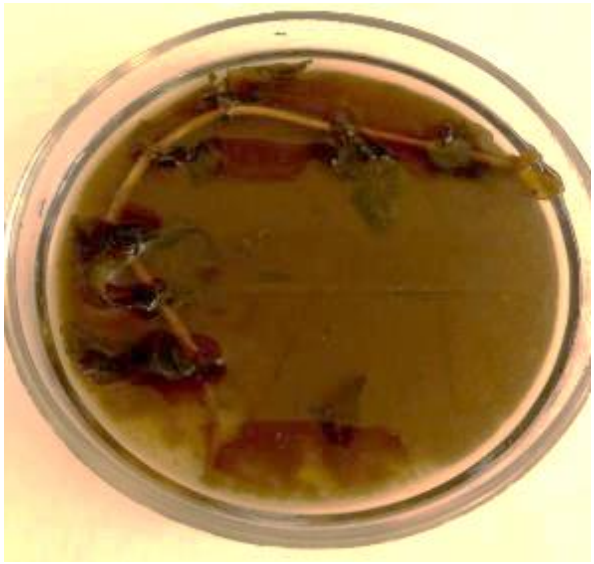


Figure 149: Uchkizil Reservoir, External Appearance of Periphyton

In total, 119 species of aquatic organisms were found in the selected summer sample of periphyton, of which 110 species from the producer group (microalgae), 7 species from the consumer group, and 2 species from the reducers group.

The dominant group in the Measurement consisted of producers are 110 species, varieties and forms of microalgae, of which blue-green (Cyanophyta) - 28 species, diatoms (Bacillariophyta) - 64 species, green (Chlorophyta) - 11 species, (Dinophyta) - 4 species, yellow- green (Xanthophyta) - 2 species and cryptophyte (Cryptophyta) - 1 species (see Table 175).

Table 175: Taxonomic Structure of The Periphyton Of the Investigated Section of The Uchkizil Water Reservoir

Taxon / Sample No.	1
Cyanophyta	**28**
Bacillariophyta	**64**
Cryptophyta	**1**
Dinophyta	**4**
Xanthophyta	**2**
Chlorophyta	**11**
Number of microalgae species	**110**

In total, the periphyton sample showed good development of 28 species of blue-green (Cyanophyta) algae, or 25.45% of the total amount of algae. Blue-green are represented mainly by widespread freshwater and freshwater-brackish-water colonial and filamentous forms from the genera Synechococcus, Merismopedia, Microcystis, Gloeocapsa, Anabaenopsis, Oscillatoria, Phormidium, Lyngbya, Spirulina, etc.

The common species in the Measurement were: Synechococcus aeruginosa, Merismopedia glauca, Microcystis aeruginosa, Gloeocapsa alpina., Anabaenopsis Raciborskii, Oscillatoria amphibia, Osc.geminata, Osc.planctonica, Osc.formosa, Phormidium ambiguum, Ph. papillaterminatum, Lyngbya Kuetzingii, L. limnetica, etc.

Diatoms (Bacillariophyta), in terms of taxonomic diversity, occupy a dominant position in the periphyton of 64 species (58.18%) and are represented as widespread planktonic freshwater-brackish-water species of o-β-mesosaprobic conditions of algae of the genera Cyclotella, Fragilaria, Synedra, and phytobenthos b-, ba-mesosaprobic species from the genera Achnanthes, Denticula, Cymbella, Cocconeis, Eunotia, Mastogloia, Gomphonema, Gyrosigma, Navicula, Nitzschia, Cymatopleura. of which are simultaneously characteristic of eutrophied water bodies, as well as species characteristic of biotopes with accumulation of plant detritus (Synedra ulna, S. tabulata., Amphora veneta, Cymbella obtusiuscula., Navicula cryptocephala, Mastogloia Smithii, Amphicephala, Nitzschia vermicularis, N. obtusa, etc.

Periphytic communities of gray color, well developed and in various combinations formed the leading complex of algae.

Green algae (Chlorophyta) in the investigated section of the Uchkizil Reservoir developed moderately, 11 species were recorded here, which accounted for 10% of the total number of species. Presented are green, mainly planktonic β-mesosaprobic chlorococcal, protococcal and desmidian algae from the genus Chlorococcum, Chlorella, Oocystis, Cosmarium, Scenedesmus, Tetraedron and filamentous yellow-green algae of the genera Vaucheria, Tribonema (see Table 177).

In the Measurement of periphyton, protozoa from the consumer group were also noted (amoeba, Rotifera: Cephalodella gibba, Chilodonella uncinata, Colurella uncinata, Rotaria, chironomid larvae, roundworms Nematoda gen.sp. and others.). It should be noted that organisms from the group of decomposers were also found in the Measurement. (Bacterium sp, Sphaerotilus dichotomus), fungus. The species composition of the periphyton organisms is presented in the Table 177.

As can be seen from Table 176, the indicators of the water quality class, the saprobity index and the ecological state of water masses in terms of periphyton correspond to class III (moderately polluted

waters), IS - 1.90, the ecological state - AB, a satisfactory ecological state, characterized by metabolic and ecological progress of biocenoses.

Table 176 presents a comparative characteristic of the species composition of phytoplankton and periphyton communities in the surveyed section of the Uchkizil reservoir.

Table 176: Saprobity Index, Biotic Periphyton Index, Water Quality Class, Ecological State of The Periphyton Of the Investigated Section of The Uchkizil Water Reservoir

Sample No.	1
SI	1.90
BPI	6
Water quality class	III
Ecological condition	AB

Table 177: Species Composition of Phytoplankton and Periphyton Communities in The Surveyed Section of The Uchkizil Reservoir

Taxa / indicators	S	Phytoplankton	Periphyton
CYANOPHYTA			
1.Synechococcus aeruginosa Nag.	o-b	D	D
2.Merismopedia glauca (Ehr.) Nag.	b	D	D
3.Merismopedia tenuissima Lemm.	b-a	-	C
4.M.elegans A.Br.	b	C	C
5.Microcystis aeruginosa Woron.	b-o	D	D
6.Aphanothece stagnina (Spreng.) B.-Peters. et Geitl. Emend.	o-b	-	C
7.Gloeocapsa alpina Nag.end. Brend	b	C	D
8.Gl. alpina f.lignicola (Rabenh.) Hollerb.	b	-	+
9.Gl. mimima (Kütz.) Hellerb.	b	+	+
10.Gl. turgida (Kütz.) Hellerb.	o-b	-	+
11.Coelosphaerium Kuetzingiana Kütz.	b	C	+
12.Anabaena Bergii	b	-	+
13.Anabaenopsis Raciborskii Wolosz.	b	C	D
14.Schizothrix sp.	b	-	C
15.Oscillatoria amphibia Ag	b	C	C
16.Osc.brevis Ag.	b	C	-
17.Osc.formosa Bory	a	-	C
18.Osc.geminata (Menegh.) Gom.	b	D	D
19.Osc.limosa Ag.	b-a	-	C
20.Osc.spirulinoides Woronich.	b-a	-	C
21.Osc.planctonica Wolosz.	o- b	D	D

Taxa / indicators	S	Phytoplankton	Periphyton
22.Spirulina major Kütz.	b	D	D
23.Sp.laxa Smith.	b	-	C
24.Phormidium ambiguum Gom.	b	-	C
25.Ph.papillaterminatum Kissel.	b	D	D
26.Lyngbya Kuetzingii (Kütz.) Schmidle	b	D	D
27.L.limnetica Lemm.	b	D	D
28.L.martensiana Menegh.	b	C	D
BACILLARIOPHITA			
1.Cyclotella kuetzingiana Thw.	b	C	+
2.C.meneghiniana Kütz	b-a	+	C
3.C.caspia Grun.	a-b	C	-
4.Fragilaria crotonensis Kitt.	o-b	C	C
5.Fr.capucina Desm.	o-b	+	D
6.Fr.construens (Ehr.) Grun.	b	-	D
7.Synedra acus Kütz.	o-b	-	C
8.S.capitata Ehr.	b	+	+
9.S.minuscula Grun.	a-b	+	C
10.S.tabulata (Ag.) Kütz.	b	-	+
11.S.tabulata v.parva (Kütz.) Grun.	b	+	C
12.S.tabulata v.fasciculata (Kütz.) Grun.	b	+	+
13.S.ulna (Nitzsch.) Ehr.	b	+	+
14.Eunotia arcus Ehr.	o-b	C	D
15.E.gracilis (Ehr.) Rabenh.	o-b	-	C
16.Cocconeis placentula Ehr.	o-b	-	+
17.C.placentula v.euglypta (Herib.et Perag) Cl.	b	-	+
18.Achnanthes hungarica	b	-	+
19.Ach.affinis Grun.	o	-	C
20.Ach.minutissima Kütz.	o-b	-	C
21.Mastogloia Smithii Thw.	b-a	-	+
22.M.Smithii v.amphicephala	b-a	+	+
23.Denticula tenue Kütz.	o	+	+
24.Diploneis Smithii v.pumilla (Grun.) Hust.	b	+	+
25.Navicula atomus (Nag.) Grun.	b	-	+
26.N.anglica Ralf.	b	C	D
27.N.bacillum Ehr.	b-a	-	+
28. N.cryptocephala Kütz.	a-b	+	C

Taxa / indicators	S	Phytoplankton	Periphyton
29.N.cryptocephala v. intermedia Grun.	b	+	+
30.N.cryptocephala v.veneta (Kütz.) Grun.	a-b	-	C
31.N.cincta (Ehr.) Kütz.	a-b	-	+
32.N.exiqua (Greg.) O.Mull.	b	C	D
33.N.kolbei Poretzky et Anissimova	b-a	C	C
34.N.Gregaris Donk.	b-a	-	D
35.N.hungarica Grun.	b	-	+
36.N.microcephala Grun.	o-b	-	C
37.N.pupula Kütz.	b	+	+
38.N.protracta v.subcapitata Woronichin	b-a	C	D
39.Pinnularia.viridis (Nitzsch.) Ehr.	b	+	+
40. Gyrosigma scalproides (Rabenh.) Cl.	b	+	C
41.G.Spenceri (W.S.) Cl.	b	-	C
42.Tropidoneis Lepidoptera Grun.	b	-	+
43.Amphora veneta Kütz.	b-a	+	C
44.Amp.coffeaformis Ag.	b-a	-	+
45.Cymbella cistula (HEMP.) Grun.	b	+	C
46.C.obtusiuscula (Kütz.) Grun.	a-b	+	C
47.C.pusilla Grun.	a-b	-	+
48.C.tumida (Breb.) V.H.	b	-	+
49.Gomphonema olivaceum (Lyng.) Kütz.	b	+	D
50.G.olivaceum v.calcareum (Ehr.) Kütz.	b	-	C
51.G.parvulum (Kütz.) Grun.	b	-	C
52.Nitzschia amphibia Grun.	b-a	+	-
53.N.apiculata (Greg.) Grun.	a-b	+	+
54.N.capitellata Hust.	b	+	D
55.N.filiformis (W.Sm.) Hust.	b	-	C
56.N.holsatica Hust.	b	+	+
57.N.hungarica Grun.	a	-	+
58.N.obtusa W.Sm.	b	-	C
59.N.palea (Kütz.) Grun.	a	-	+
60. N.paleacea Grun.	b	-	C
61. N.tryblionella Hantzsch.	a-b	+	+
62.N.tryblionella v.levidensis (W.Sm.) Grun.	a-b	-	C
63. N.vermicularis Hust.	b	+	+
64.Cymatopleura solea (Breb.) W.Sm.	b-a	+	+

Taxa / indicators	S	Phytoplankton	Periphyton
CHRYSOPHYTA			
1.Dinopryon soliale Ehr.	o	C	-
2.D.divergens Imhof.	o	C	-
3.Chromulina sp.	b	+	-
CRYPTOPHYTA			
Cryptomonas sp. (curvata Ehr.)	b	+	+
DINOPHYTA			
1.Glenodinium borgei (Lemm.) Schiller	b-o	+	+
2.Gl.quadridens (Stein.) Snhiller	b-o	+	-
3.Gl.Penardii Lemm.	b	+	-
4.Gymnodinium aeruginosa	b	-	+
5.Peridinium caudatum (O.F.M.)	b	+	+
6.P.biceps Stein	b-o	+	+
7.P.biceps f.tabulatum (O.F.M.)	b-o	+	-
8.P.pusillum (Penard.) Lemm.	b	+	-
9.Ceratium hirundinella (O.Mull.) Schrank	o-b	+	-
XANTHOPHYTA			
1.Vaucheria geminate Klebs.	b	-	C
2.Tribonema sp.	b	C	D
CHLOROPHYTA			
1.Kirchneriella lunaris	b-o	+	-
2.Chlorococcum sp. (humicola?)	b	+	+
3.Ch.turgida	b	-	+
4.Chlorella sp.	b-a	+	+
5.Oocystis natans Lemm.	b	+	+
6.Oocystis sp. (marssonii?)	b	-	+
7.Chlamidomonas sp.	b	+	-
8.Ch.ovale	b	+	-
9.Carteria Klebsi	b-a	C	-
10.Dunaliella sp.	b-a	+	-
11.Cosmarium formulosum Hofm.	b	+	C
12.C.granatum Ralfs.	b	+	+
13.C.ornatum	b	-	+
14.Scenedesmus quadricauda (Turp.) Breb.	b	-	+
15.Sc.perforatus Chodat	b	-	+
16.Tetraedron minimum Hansg.	b	+	+

Taxa / indicators	S	Phytoplankton	Periphyton
17.Dictyosphaerium ehrenbergianum Naeg.	**b**	**+**	**-**
18.algae sp.	**b**	**C**	**-**
Total		**77**	**110**
Consumers:			
1.Amoeba proteus	**b-a**	**-**	**+**
2.Colurella uncinata	**b-a**	**+**	**+**
3.Chilodonella uncinata	**b-a**	**-**	**+**
4.Cephalodella gibba	**b**	**-**	**+**
5.Lecane ovalis	**b**	**+**	
6.Rotaria rotatoria	**a-b**	**+**	**+**
7.Nematoda gen.sp.	**a**	**+**	**C**
8.Chironomidae gen.sp.	**a**	**+**	**+**
Deconsumers:			
Bacterium sp.	**a**	**-**	**+**
Pelonema subtilissima	**a-b**	**-**	**-**
Sphaerotilus dichotomus	**a-b**	**-**	**+**
Legend: S - saprobity of organisms; + - single occurrence; C - subdominants; D - dominants			

Based on the results obtained on the indicators of summer periphyton, the following conclusions can be drawn:

dominant algological complex of phytoplankton and periphyton communities is most diversely represented, first of all, by producers: diatoms, blue-green and green algae. Dinophytic, golden, cryptophytic, and yellow-green algae were observed with a low abundance.

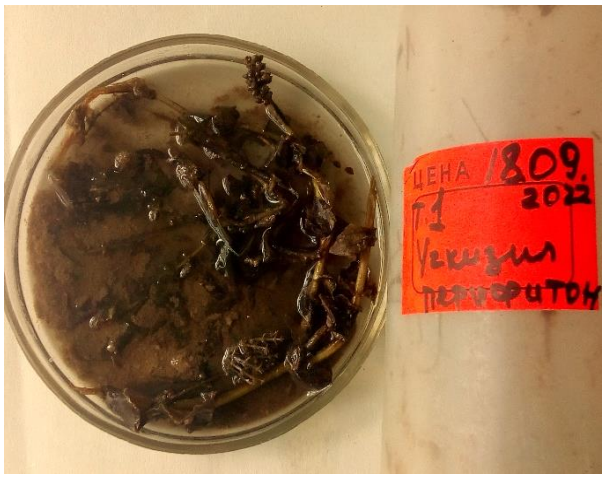
Aquatic biocenoses of the reservoir investigated area are mainly represented by o-b-, b-, b-a-mesosaprobic species of organisms.

The water quality corresponds mainly to class III (moderately polluted waters), which is associated with pollution and a slight increase in mineralization. The values of the biotic periphyton index (BPI) are mainly 6 points, IS - 1.90, ecological state - AB (satisfactory ecological state, characterized by metabolic and ecological progress of biocenoses).

Survey in September 2022

Periphyton, as an integral part of aquatic ecosystems, undergoes various changes along with it, due to various natural and anthropogenic factors, which is expressed in spatial and temporal successions of periphyton communities.

Outwardly, periphyton fouling looked mainly as brown and clay deposits, films and stratifications, slimy to the touch formations, from light gray to brownish-green mixed with clay on the stems and leaves of macrophytes (See Figure 150)



Point.1

Point.2

Point.3

Point.4

Figure 150: Appearance of Periphyton in Samples: ## 1,2,4 - Uchkizil Reservoir, #.3 - Channel Flowing into The Reservoir

In total, 156 species of aquatic organisms were found in the selected summer sample of periphyton, of which 140 species from the group of producers (microalgae), 13 species from the group of consumers and 3 species from the group of decomposers. - In total, 156 species of aquatic organisms were found in the selected summer sample of periphyton, of which 140 species from the group of producers (microalgae), 13 species from the group of consumers and 3 species from the group of decomposers.

The dominant group in the samples were producers - 1 40 species , varieties and forms of microalgae, of which blue-green (Cyanophyta) - 2 9 species , diatoms (Bacillariophyta) - 81 species , green (Chlorophyta) - 22 species , (Dinophyta) - 5 species , and 1 species each of Euglenophyta (Euglenophyta), yellow-green (Xanthophyta) and cryptophyte (Cryptophyta) algae.

Table 178: Taxonomic Structure of The Periphyton of The Studied Areas of The Uchkizil Reservoir

Taxa / # samples	**# 1**	**# 2**	**# 3**	**# 4**
Cyanophyta	21	23	10	26
Bacillariophyta	49	40	53	56
Cry p top hyta	-	1	-	-
Euglenophyta	1	-	-	1
Dinophyta	3	-	-	5
Chlorophyta	13	7	8	12
Xanthophyta	-	1	-	-
Number of microalgae species	**87**	**71**	**72**	**100**

In total, in 4 samples of periphyton, a good development of blue-green (Cyanophyta) algae 29 species or 20.72% of the total number of algae was noted. Represented by blue-green mainly widespread freshwater and freshwater-brackish water colonial and filamentous forms from genus *Synechococcus, Merismopedia, Microcystis, Gloeocapsa, Gomphosphaeria, Aphanothce*, *Cyanothrix, Pleurocapsa*, *Anabaena*, *Oscillatoria, Phormidium, Lyngbya, Spirulina* and etc.

Massive species in the samples were: *Synechococcus aeruginosa* Nag., *Merismopedia glauca* (Ehr.) Nag., *Microcystis aeruginosa* Woron, *Gloeocapsa alpina* Nag.end. brand., *gl. turgida* (Kütz.) Hollerb., *Cyanothrix Gardneri* (Fremy) I. Kissel., *Oscillatoria amphibia* Ag., *Osc. geminata* (Menegh.) Gom. , *Osc.planctonica* Wolosz., *Osc.formosa* Ag. , *Phormidium ambiguum* Gom., *Ph.papillaterminatum* Kissel., *Lyngbya Kuetzingii* (Kütz.) Schmidle, *L. limnetica* Lemm. and others.

Diatoms algae (Bacillariophyta) taxonomic diversity occupy dominant position in periphytone 81 species (57.86%) and presented they how widespread _ _ planktonic freshwater - brackish water kinds o-β- mesosaprobic conditions algae from genus to *With yclotella, Diatoma, Fragilaria, Melosira, Synedra* , so and phytobenthos b-, ba- mesosaprobic types from childbirth *Achnanthes, Denticula, Cymbella, Cocconeis, Eunotia, Mastogloia, Gomphonema, Navicula, Rhopalodia, Nitzschia, Cymatopleura,* from which simultaneously characteristic for eutrophic reservoirs , and So same types , characteristic for biotopes co cluster vegetable detritus (*Synedra ulna* (Nitzsch.) Ehr., *S.tabulata* (Ag.) Kütz., *Amphora veneta* Kütz. , *Cymbella obtusiuscula* (Kütz.) Grun., *Navicula cryptocephala* with her variations , *Mastogloia Smithii v. amphicephala* Grun., *Hantzschia amphioxys* (Ehr.) Grun., *Nitzschia sigmoidea* (Ehr.) W.Sm., *N.obtusa* W.Sm., *N.hungarica* Grun. and others _

Greens algae (Chlorophyta) in the studied areas of the Uchkizil reservoir developed moderately well, 22 species were noted here, which accounted for 15.72% of the total number of species. Represented by green mainly planktonic β - mesosaprobic chlorococcal, protococcal and desmid algae from genus *Chlorococcum, Chlorella, Oocystis, Cosmarium, Scenedesmus,* and filamentous *Cladophora glomerata, Spirogyra* (channel) and yellow-green algae of the genus *Tribonema*

In samples of periphyton, protozoa from the group of consumers (*amoeba,* rotifers: *Chilodonella uncinata*, *Colurella uncinata*, *Lecane ovalis* Lepadella sp, *Rotaria,* Nematoda roundworms gen. sp. and

etc.). It should be noted that in sample # 1, organisms from the decomposer group (*Bacterium sp. Pelonema subtilissima*), mushrooms. The species composition of periphyton organisms is presented in Table 179.

Table 179: Saprobic Index (SI), Biotic Periphyton Index (BPI), Water Quality Class, Ecological State of The Periphyton In the Uchkizil Reservoir

Sample number	**1**	**2**	**3**	**4**
SI	2.00	1.89	1.95	1.96
BPI	6	6	6	6
Water quality class	III	III	III	III
Ecological state	AB	AB	AB	AB

Periphytic community's gray colors, developed Good and in various combined formed leading complex algae.

As can be seen fromTable 179, the indicators of the water quality class, the saprobity index and the ecological state of the water masses according to the periphyton indicators correspond to class III (moderately polluted waters), SI - 1.89-2.00, BPI - 6 points, ecological state - AB, which corresponds to a satisfactory ecological state, characterized by the metabolic and ecological progress of biocenoses. Table 180 presents a comparative characteristic of the species composition of phytoplankton and periphyton communities in the surveyed areas of the Uchkizil reservoir and the canal flowing into it.

Table 180: Species Composition of Phytoplankton and Periphyton Communities in The Surveyed Areas of The Uchkizil Reservoir

Taxa	**S**	**Phytoplankton**				**Periphyton**			
CYANOPHYTA									
1.Synechococcus aeruginosa Nag.	o-b	C	C	-	C	C	+	-	D
2.Merismopedia glauca (Ehr.) Nag.	b	C	C	C	C	+	C	C	D
3.Merismopedia tenuissima Lemm.	b-a	+	-	C	C	+	C	C	D
4.M.elegans A.Br.	b	C	+	-	C	+	C	C	D
5.Microcystis aeruginosa Woron.	b-o	D	D	D	D	D	D	D	D
6.M. pulverea (Wood) Forti emend. Elenk.	b	-	C	-	-	-	C	D	C
7.Aphanothece stagnina (Spreng.) B.-Peters. et Geitl. Emend.	o-b	-	-	-	+	+	+	-	+
8.Pleurocapsa minor Hans.emend. Geitl.	b	C	-	-	-	C	+	+	C

Taxa	S	Phytoplankton				Periphyton			
9.Gloeocapsa alpina Nag.end. Brend	b	C	C	-	C	D	C	+	D
10.Gl.mimima (Kütz.) Hellerb.	b	C	-	-	C	C	C	-	C
11.Gl.minor (Kütz.) Hellerb.	b	-	-	-	-	-	+	-	-
12.Gl. turgida (Kütz.) Hellerb.	o-b	C	+	-	C	D	C	-	C
13.Coelosphaerium Kuetzingiana Kütz.	b	-	-	-	-	+	-	-	C
14.Anabaena affinis Lemm.	b	-	-	-	+	-	-	-	C
15.Cyanothrix Gardneri (Fremy) I.Kissel.	b	-	-	-	-	-	+	-	D
16.Oscillatoria amphibia Ag	b	-	-	-	C	C	+	-	D
17.Osc.irriqua (Kütz.) Gom.	b-a	C	-	-	-	C	C	-	D
18.Osc.formosa Bory	a	C	-	-	-	C	-	+	D
19.Osc.limosa Ag.	b-a	-	-	-	C	C	C	-	+
20.Osc.planctonica Wolosz.	o-b	-	-	-	D	C	C	-	D
21.Osc.terebriformis (Ag.) Elenk.	a-b	-	-	-	-	-	C	-	-
22.Spirulina major Kütz.	b	-	-	-	-	-	-	-	C
23.Sp.laxa Smith.	b	-	-	-	-	-	-	-	+
24.Phormidium ambiguum Gom.	b	-	-	-	-	C	+	-	-
25.Ph. papillaterminatum Kissel.	b	C	C	-	D	C	C	-	D
26.Ph. uncinatum (Ag.) Gom.	b-a	-	-	-	C	C	C	-	C
27.Lyngbya Kuetzingii (Kütz.) Schmidle	b	C	-	C	D	+	C	C	D
28.L.limnetica Lemm.	b	C	-	D	-	-	-	+	D
29.Borzia sp. (Cohn.)	b	-	-	-	-	+	+	-	C
BACILLARIOPHITA									
1.Melosira moniliformis (O. Müll.) Ag.	b	+	-	+	-	-	-	D	-

Taxa	S	Phytoplankton				Periphyton			
2.Cyclotella sp. (ocellata?)	o-b	C	+	+	C	D	C	-	D
3.C.kuetzingiana Thw	b	D	C	+	C	D	C	C	D
4.C.meneghiniana Kütz	b-a	C	+	+	C	+	-	-	D
5.Coscinodiscus sp.	b	-	-	-	-	-	-	+	-
6.Diatoma elongatum v. tenue (Ag.) V.H.	o-b	+	-	C	-	+	D	D	-
7.Fragilaria crotonensis Kitt.	o-b	+	+	C	D	D	D	C	D
8.Fr.capucina Desm.	o-b	+	+	+	C	D	D	C	D
9.Frconstruens (Ehr.) Grun.	b	-	-	+	-	-	-	C	D
10.Synedra acus Kütz.	o-b	+	+	+	+	D	C	C	C
11.S. pulchella (Ralfs.) Kütz.	b	-	+	-	-	-	-	+	-
12.S.minuscula Grun.	a-b	-	+	+	+	C	C	C	D
13.S.tabulata (Ag.) Kütz.	b	+	+	-	+	C	-	D	+
14.S. tabulata v. parva (Kütz.) Grun.	b	-	+	-	-	-	+	C	-
15.S. ulna (Nitzsch.) Ehr.	b	+	+	+	+	C	+	D	C
16. S.ulna v.amphirhynchys (Ehr.) Grun.	b	-	-	+	+	D	C	D	C
17.S.Vaucheria Kütz.	b	+	-	+	-	+	+	C	-
18.Eunotia arcus Ehr.	o-b	-	+	-	+	C	D	-	C
19.E.praerupta v.musciocola Boye P.	o-b	-	-	-	-	+	+	-	+
20.Cocconeis pediculus Ehr.	o-b	-	-	-	-	+	+	C	+
21.C.placentula Ehr.	b	-	-	-	-	-	C	+	+
22.Achnanthes sp.	o-b	-	-	-	-	C	C	C	D
23.Ach.affinis Grun.	o	+	-	-	-	D	C	C	D
24.Ach.minutissima Kütz.	o-b	-	-	-	-	D	D	-	+

Taxa	S	Phytoplankton				Periphyton			
25.Rhoicosphenia curvata (Kütz.) Grun.	b	-	-	-	-	-	+	D	-
26.Mastogloia Smithii Thw.	b-a	-	-	-	C	-	-	-	C
27.M.Smithii v.amphicephala Grun.	b-a	-	-	+	D	C	-	+	D
28.M. elliptica (Ag.) Cl.	a	--	-	-	-	-	-	-	+
29.M.Grevillei W.Sm.	a	-	-	-	-	-	-	-	D
30.M. pumila (Grun.) Cl.	a	-	-	-	C	+	-	+	D
31.Stauroneis sp.	o-b	-	-	-	-	-	-	+	-
32.Diploneis Smithii v. pumilla (Grun.) Hust.	b	+	-	-	-	+	+	+	C
33.Navicula sp.	b	-	-	+	-	-	+	-	+
34.N.bacillum Ehr.	b-a	-	-	-	-	-	-	+	+
35. N.cryptocephala Kütz.	a-b	+	-	+	+	D	C	C	D
36.N.cryptocephala v. intermedia Grun.	b	+	-	+	-	D	C	C	D
37.N. cryptocephala v.veneta (Kütz.) Grun.	a-b	-	-	-	-	D	C	+	D
38.N. exiqua (Greg.) O.Mull.	b	D	+	D	D	D	D	C	D
39.N.kolbei Poretzky et Anissimova	b-a	-	-	-	-	-	+	-	+
40.N.gracilis Ehr.	b-o	+	-	+	-	-	-	C	+
41.N.Gregaris Donk.	b-a	-	-	-	-	-	-	-	+
42.N.microcephala Grun.	o-b	-	-	+	+	C	+	C	D
43.N.pupula Kütz.	b	+	-	-	-	D	C	C	D
44.N.pygmaea Kütz.	a	+	-	-	-	-	+	-	+
45.N.protracta v.subcapitata Woronichin	b-a	C	-	-	C	D	D	+	D
46.N.rhynchocephala Kütz.	a	-	-	+	-	-	+	-	+
47.N.viridula Kütz.	a	-	-	-	-	-	+	D	+

Taxa	S	Phytoplankton				Periphyton			
48.Pinnularia.viridis (Nitzsch.) Ehr.	b	-	-	+	+	-	-	+	-
49.P. microstauron (Ehr.) Cl.	b	-	-	-	+	-	-	+	-
50.Caloneis silicula (Ehr.) Cl.	o-b	-	-	-	-	-	-	-	+
51.Amphora veneta Kütz.	b-a	+	-	+	+	+	-	-	+
52.Amp.coffeaformis Ag.	b-a	-	-	-	-	+	-	-	C
53.Amp.ovalis Kütz.	b-o	-	-	-	+	+	-	-	+
54.Amp.ovalis v.pediculus Kütz.	b-o	-	-	-	-	+	-	-	C
55. A.commutata Grun.	a	-	-	-	+	-	-	-	-
56.Cymbella cistula (Hemp.) Grun.	b	-	-	-	+	C	-	-	D
57.C.affinis Kütz.	b-o	-	-	+	-	-	+	-	-
58.C. obtusiuscula (Kütz.) Grun.	a-b	-	+	-	-	+	+	-	+
59.C. tumida (Breb.) V.H.	b	-	-	-	-	-	C	+	-
60.C.ventricosa v.ovata Grun.	o-b	-	-	-	-	-	-	+	-
61.C.ventricosa v.hankensis Skv.	o-b	+	-	-	-	-	-	+	-
62.Gomphonema olivaceum (Lyng.) Kütz.	b	-	-	-	-	+	-	+	D
63.G. olivaceum v. calcareum (Ehr.) Kütz.	b	-	-	+	-	D	D	+	D
64.C. angustatum (Kütz.) Rabenh.	b-o	-	-	-	-	+	+	-	-
65.G. parvulum (Kütz.) Grun.	b	-	-	-	-	+	-	C	+
66.Rhopalodia gibba (Ehr.) O.Mull.	o	-	-	-	D	C	+	-	D
67.Hantzschia amphioxys (Ehr.) Grun.	b-a	+	-	+	-	-	-	C	-
68.H.virgata (Roper) Grun.	a-b	-	-	+	-	-	-	C	-
69.Nitzschia acicularis W.Sm.	b-a	-	-	+	-	-	-	+	-
70.N.capitellata Hust.	b	-	-	+	-	+	-	-	+

Taxa	S	Phytoplankton				Periphyton			
71.N.Lorenziana v.incurta Grun.	b	-	-	+	-	-	-	-	-
72.N.linearis W.Sm.	b	-	-	+	-	-	-	-	-
73.N.intermedia Hantzsch.	b	-	-	-	+	-	-	+	-
74.N.frustulum v.asiatica Hust.	b	-	-	-	-	-	-	+	-
75.N.filiformis (W.Sm.) Hust.	b	-	-	-	-	+	-	+	-
76.N.holsatica Hust.	b	+	-	-	+	C	+	D	D
77.N.hungarica Grun.	a	-	-	+	-	+	-	+	-
78.N.obtusa W.Sm.	b	+	-	+	+	C	-	-	D
79.N. palea (Kütz.) Grun.	a	-	-	-	+	C	+	+	D
80.N.paleacea Grun.	b	-	-	-	-	-	-	+	-
81.N.sigma (Kütz.) W.Sm.	b	-	-	-	+	+	-	-	-
82.N. sigmoidea (Ehr.) W.Sm.	b	-	-	-	-	+	-	-	+
83.Cymatopleura solea (Breb.) W.Sm.	b-a	-	-	-	-	+	-	-	-
84.C.solea v.apiculata (W.Sm.) Ralfs	b-a	-	-	-	-	+	-	-	-
CRYPTOPHYTA									
1.Cryptomonas sp. (curvata Ehr.?)	b	+	+	-	+	-	+	-	-
EUGLENOPHYTA									
1.Thracellomonas sp.	b	+	-	-	+	+	-	-	+
DINOPHYTA									
1.Glenodinium borgei (Lemm.) Schiller	b-o	+	-	-	+	+	-	-	+
2.Gl. quadridens (Stein.) Snhiller	b-o	-	-	-	C	-	-	-	+
3.Peridinium biceps Stein	b-o	-	-	-	+	-	-	-	+
4.P.biceps f.tabulatum (O.F.M.)	b-o	+	+	-	+	C	-	-	+

Taxa	S	Phytoplankton				Periphyton			
5.P. pusillum (Penard.) Lemm.	b	+	-	-	+	+	-	-	+
XANTHOPHYTA									
1.Tribonema sp.	b	-	C	-	-	-	D	-	-
CHLOROPHYTA									
1.Ankistrodesmus falcatus (Corda) Ralfs.	b	+	-	-	-	+	-	-	-
2.Ank.acicularis	b	+	-	-	+	-	-	-	-
3.Chlorococcum sp. (humicola?)	b	-	-	-	C	C	-	+	C
4.Ch.turgida	b	+	-	-	+	-	-	-	+
5.Chlorella sp.	b-a	C	+	+	+	C	+	-	-
6.Oocystis natans Lemm.	b	-	-	+	+	+	-	-	-
7.Oocystis sp. (marssonii?)	b	+	+	-	+	+	+	-	-
8.Chlamidomonas sp.	b	+	-	-	+	-	-	-	+
9.Ch.ovale	b	+	+	-	+	+	-	-	+
10.Ch.ehrenbergii	b	+	+	-	-	-	-	-	-
11.Carteria Klebsi	b-a	+	+	-	+	-	-	-	-
12.Cosmarium formulosum Hofm.	b	+	-	+	-	+	+	C	+
13.C.granatum Ralfs.	b	+	-	-	-	+	+	+	+
14.C.ornatum	b	-	-	-	-	+	-	-	+
15.C.venustum	b	-	-	-	-	+	+	+	-
16.Scenedesmus quadricauda (Turp.) Breb.	b	-	-	+	+	+	-	+	+
17.Sc.perforatus Chodat	b	-	-	-	-	-	-	-	+
18.Sc.obliguus	b	+	-	-	-	C	+	-	+
19.Sc.opoliensis	b	-	-	-	+	+	-	-	-

Taxa	S	Phytoplankton				Periphyton			
Lagerheimia genevensis	b	-	-	-	+	-	-	-	-
21.Coelastrum microporum	b	-	-	-	-	-	-	-	+
22.Staurastrum punctulatum	b	-	-	-	-	-	+	-	-
23.Dictyosphaerium ehrenbergianum Naeg.	b	+	-	-	-	-	-	-	-
24.Microcoleus sp.	b	-	-	-	-	-	-	-	C
25.algae sp.	b	+	+	-	+	-	-	-	-
26.Geminella interrupta	b	C	-	C	-	-	-	C	-
27.Palmella	b	-	C	-	C	-	-	-	-
28.Cladophora glomerata (L.)Kütz.	b	-	-	-	-	-	-	D	-
29.Spirogyra sp.	b	-	-	-	-	-	-	+	-
Total species of microalgae		**61**	**31**	**44**	**69**	**87**	**71**	**72**	**100**
Consumers:									
1.Amoeba proteus	b-a	**-**	**+**	**-**	**+**	**+**	**-**	**-**	**+**
2.Ciliata sp.	b-a	**+**	**-**	**-**	**-**	C	+	C	**+**
3.Colurella uncinata	b-a	**-**	**-**	**-**	**-**	**-**	**-**	**+**	**-**
4.Cyclops sp.	b	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**+**
5.Ostracoda sp.	b	**-**	**-**	**-**	**+**	**+**	**-**	**-**	**-**
6.Uronema sp.	b-a	**-**	**-**	**-**	**-**	**-**	**-**	**+**	**-**
7.Lecane ovalis	b	**-**	**+**	**-**	**-**	**+**	**+**	**-**	**-**
8. Euchlanis dilatata	b	**-**	**-**	**-**	**-**	**-**	**+**	**-**	**-**
9.Rotaria rotatoria	a-b	**-**	**+**	**-**	**-**	**+**	**+**	**-**	**-**
10.Vorticella sp.	b-a	**-**	**-**	**-**	**-**	**-**	**+**	**-**	**-**
11.Nematoda gen.sp.	a	**-**	**-**	**-**	**+**	C	+	+	+

Taxa	S	Phytoplankton				Periphyton			
12.Euglypta ciliata	b-a	-	+	+	-	-	-	-	+
13.Eug.alveolata (=acanthophora)	b	-	-	-	-	-	-	-	+
Deconsumers:									
Bacterium sp.	a	-	-	-	-	+	-	-	-
Pelonema subtilissima	a-b	-	-	-	-	+	-	-	-
Micota sp.	a-b	-	-	-	-	+	-	-	-
Symbols: S - saprobity of organisms; + - single occurrence; C - subdominants; D - dominants									

9.4.4 Aquatic Sensitive Receptors

The aquaticsensitive receptors are given in Table 181 and the details are explaned in Section 8.5.

Table 181: Aquatic Sensitive Receptors

Receptor	Sensitivity	Justification
Water Quality and Ecological Conditons	Medium	The water quality corresponds to class III (moderately polluted waters), which is associated with pollution and a slight increase in mineralization. The characteristics of the ecological invariant states of biocenose is AB - satisfactory ecological state, characterized by metabolic and ecological progress of biocenoses. Zooplankton types are the common heat-loving species – indicators of moderately polluted waters equal β-o saprobe area (an area of weak and moderate pollution). Zooplankton biomass level is which is characteristic of water with insufficient q-ty of biogenic substances and underdevelopment of zooplanktonic species.

Receptor	Sensitivity	Justification
Ichthyofauna	Medium	The species found in the sample are widespread, the dominant species are indicators of moderately polluted waters. Two fish species is listed as vulnerable in the UzbekistanRed book. The current fish fauna of the water reservoir has been formed by that of the Surkhandarya river. Consequently, irrespective of the damage as a result of construction, all fish type can be recovered. it can be concluded that if any species is damaged as a result of the construction, then over time the ichthyofauna of the reservoir will be able to recover, since all species of fish living in this reservoir have the potential to recover.
Ecosystem Services	Medium	There are ecosystem services used by the local communities such as, fishing, watering animals, usage as recreation and tourism area. The area is also used to water sources both wild and domestic animals.

9.5 Preliminary Critical Habitat Assessment

9.5.1 The Critical Habitat Assessment Process

The CHA process assesses the importance of a defined area to one or more biodiversity receptors that meet the requirements of IFC PS-6 in terms of Critical Habitat or Priority Biodiversity Features determination.

Determining the presence of Critical Habitat/Priority Biodiversity Features is a process that is explicitly separate from any consideration of a project's impacts, mitigation strategy, etc. The only influence of a project on the CHA process is for identification of the location and extent of the area to be assessed. This is determined by the Project's Area of Influence (AoI).

To assist with the determination of Critical Habitat or Priority Biodiversity Features, the guidance and threshold criteria described within IFC PS-6 has been followed.

PS-6 defines two sets of criteria for use in defining Critical Habitats or Priority Biodiversity Features.

These are as follows:

Critical Habitat

(i) highly threatened or unique ecosystems;

(ii) habitats of significant importance to endangered or critically endangered species;

(iii) habitats of significant importance to endemic or geographically restricted species;

(iv) habitats supporting globally significant migratory or congregatory species;

(v) areas associated with key evolutionary processes; or

(vi) ecological functions that are vital to maintaining the viability of the above biodiversity

features.

Priority Biodiversity Features

(i) threatened habitats;

(ii) vulnerable species;

(iii) significant biodiversity features identified by a broad set of stakeholders or governments

(such as Key Biodiversity Areas or Important Bird Areas); and ecological structure and functions needed to maintain the viability of priority biodiversity features described above.

The triggering of anyone (or more) of the above will result in Critical Habitat being classified (as such, features being considered against the above criteria are referred to as potential Critical Habitat or Priority Biodiversity Feature 'triggers'). Each category also has a corresponding Priority Biodiversity Feature threshold. These thresholds are referenced within the assessment where appropriate.

Step 1 – Define the Study Area

Under the requirements of PS-6, it is necessary for an appropriately defined area to be assessed for the presence of Critical Habitat. This is referred to in a number of ways; international guidance documents make reference to an 'ecological appropriate area of assessment' (EAAA), which is the wider distribution of a feature or receptor (often at a landscape level) within which there is connectivity between the ecological process that supports the feature or receptor. The EAAA is used throughout this report as the basis for the application of each of the criteria thresholds in order to determine Critical Habitat (or Priority Biodiversity Feature) EAAA.

Defining an appropriate EAAA is an important step in the CHA process as it ensures assessment of an ecologically relevant feature/area, rather than an area influenced only by the project footprint. It also has inherent appreciation of ecological function across an area, and therefore avoids the risk of considering the specific areas in which a Critical Habitat trigger may be present discontinuously or seasonally.

EAAAs should be identified separately for each individual biodiversity receptor being assessed during the CHA process.

Step 2 – Stakeholder Consultation and Initial Desktop Review Of Available Data

Step 2 is designed to identify features that may trigger Critical Habitat – the screening process. This is done through consultation with relevant stakeholders and a review of readily available data and published literature. At this stage, use of the Integrated Biodiversity Assessment Tool (IBAT)7 is recommended.

Step 3 – Verification of Available Information

This includes fieldwork and engagement with relevant stakeholders/specialists.

Step 4 – Confirmation of Biodiversity

This comprises review of confirmed biodiversity against the Critical Habitat (and Priority Biodiversity Features) criteria.

Step 5 – Determination of Critical Habitat Status

This comprises concluding remarks against each EAAA regarding Critical Habitat status, based upon Steps 1-4 above.

Critical Habitat Criteria

Assessment of each biodiversity receptor against the Critical Habitat (and associated Priority Biodiversity Feature) criteria makes use of both qualitative and quantitative thresholds. These are detailed within below.

Table 182: Criteria and Conditions for Identifying Priority Biodiversity Features and Critical Habitats

Criterion	Priority Biodiversity Feature	Critical Habitat
1. Priority Ecosystems		
1i Threatened ecosystems		
a) Resolution 4 of Bern Convention (signatory nations only) b) IUCN Red-List EN or CR ecosystems	EAAA is habitat type listed in Annex 1 of EU Habitats Directive or Resolution 4 of Bern Convention b) EAAA < 5% of the global extent of an ecosystem type with IUCN status of CR or EN	a) EAAA is habitat type listed in Annex 1 of EU Habitats Directive marked as "priority habitat type" b) EAAA ≥ 5% of global extent of an ecosystem type with IUCN status of CR or EN c) EAAA is ecosystem determined to be of high priority for conservation by national systematic conservation planning
2. Priority Ecosystems		
2i Threatened species		
a) Species and their habitats listed in EU Habitats Directive and Bern	a) EAAA for species and their habitats listed in Annex II of Habitats	a) EAAA for species and their habitats listed in

Criterion	Priority Biodiversity Feature	Critical Habitat
Convention (signatory nations only) b) IUCN Red List EN or CR species c) IUCN Red List VU species d) Nationally or regionally listed EN or CR species	Directive, Annex I of Birds Directive, or Resolution 6 of Bern Convention b) EAAA supports < 0.5% of global population OR < 5 reproductive units of a CR or EN species. c) EAAA supports VU species d) EAAA for regularly occurring nationally or regionally listed EN or CR species	Annex IV of the Habitats Directive b) EAAA supports ≥ 5% of the global population AND ≥ 5% reproductive units of a CR or EN species c) EAAA supports globally significant population of VU species necessary to prevent a change of IUCN Red List status to EN or CR, and satisfies threshold (b) d) EAAA for important concentrations of a nationally or regionally listed EN or CR species
2ii Range-restricted species		
	a) EAAA for regularly occurring range-restricted species	a) EAAA regularly holds ≥10% of global population and ≥ 10 reproductive units of the species
2iii Migratory and congregatory species		
	a) EAAA identified per Birds Directive or recognized national or international process as important for migratory birds (esp. wetlands)	a) EAAA sustains, on a cyclical or otherwise regular basis, ≥ 1 % of the global population at any point of the species' lifecycle b) EAAA predictably supports ≥ 10 % of global population during periods of environmental stress

Critical Habitat Determination

Determining the Candidate List of Biodiversity Receptors

This CHA focusses on biodiversity receptors identified during the baseline data collection process, which are considered to have the potential to trigger Critical Habitat or Priority Biodiversity Features.

These biodiversity receptors are listed in Table 183 together with reason for their inclusion/exclusion. Table 183 provides a candidate list based upon relevant published literature/information, together with the application of internationally recognized expertise, relevant to the region and prevailing habitats. An assessment of Critical Habitat against each of the 'screened in' candidate species is provided below.

Table 183: Observation of the Species

Biodiversity Value	Scientific Name	IUCN CR	IUCN EN	IUCN VU	Other Listing (UZ RDB)	Screening Comments	CH/PBF Criteria
Plant	*Allium rhodanthum*				1 (CR)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods.	-
Plant	*Dipcadi turkestanicum*				0 (EX)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods.	-
Plant	*Oligochaeta vvedenskyi*				3 (NT)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods.	-
Fish	*Capoetobrama kuschakewitschi*		X		2 (VU:D)	Screened in: species was caught at the confluence of the Zang canal into the Uchkizil reservoir	-
Fish	*Sabanejewia aurata aralensis*				3 (NT)	Screened in: species was caught at the confluence of the Zang canal into the Uchkizil reservoir	-
Central Asian tortoise	*Testudo horsfieldii*			X	2(VU)	Screened in: The observation was made in the Herp_1 area	-

Biodiversity Value	Scientific Name	IUCN CR	IUCN EN	IUCN VU	Other Listing (UZ RDB)	Screening Comments	CH/PBF Criteria
						within the plant site. Not a living individual, but 1 shell was observed. This species was not observed in the project area or in its vicinity during surveys in the spring and summer periods.	
Radde's toad-headed agama	*Phrynocephalus raddei boettgeri*				2(VU:D)	Screened in: species was observed in project area	_
Black-ocellated racerunner	*Eremias nigrocellata*				2(VU:D)	Screened in: species was observed in project area	-
Caspian Monitor	*Varanus griseus caspius*				2(VU:D)	Screened in: species was observed in project area	-
Tatary sand boa	*Eryx tataricus*				3 (NT)	Screened in: species was observed in project area	-
Indian gamma snake	*Boiga trigonata melanocephala*				2(VU:R)	Screened in: species was observed in project area	-
Northern wolfsnake	*Lycodon striatus bicolor*				2(VU:R)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, encounters along the Zang Canal are possible.	-
Central Asian cobra	*Naja oxiana*				3 (NT)	Screened out: This species was not observed in the project area or in its	-

Biodiversity Value	Scientific Name	IUCN CR	IUCN EN	IUCN VU	Other Listing (UZ RDB)	Screening Comments	CH/PBF Criteria
						vicinity during surveys in the spring, summer and autumn periods. However, encounters along the Zang Canal are possible.	
Mute Swan	*Cygnus olor*				3 (NT)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters are possible in winter.	-
Lesser White-fronted Goose	*Anser erythropus*			X	2(VU:R)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters are possible in winter.	-
Red-breasted Goose	*Branta ruficollis*			X	2(VU:R)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters are possible in winter.	-
Marbled Teal	*Marmaronetta angustirostris*			X	1 (EN)	Screened out: This species was not observed in the project area or in its vicinity during surveys	-

Biodiversity Value	Scientific Name	IUCN CR	IUCN EN	IUCN VU	Other Listing (UZ RDB)	Screening Comments	CH/PBF Criteria
						in the spring, summer and autumn periods.	
Common Pochard	*Aythya ferina*			X		Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters during seasonal migrations are possible.	-
Ferruginous Duck	*Aythya nyroca*				2(VU:D)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters during seasonal migrations are possible.	-
Great White Pelican	*Pelecanus onocrotalus*				2(VU:D)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters during seasonal migrations are possible.	-
Dalmatian Pelican	*Pelecanus crispus*				1 (EN)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods.	-

Biodiversity Value	Scientific Name	IUCN CR	IUCN EN	IUCN VU	Other Listing (UZ RDB)	Screening Comments	CH/PBF Criteria
						However, rare encounters during seasonal migrations are possible.	
Pygmy Cormorant	*Phalacrocorax pygmeus*				3 (NT)	Screened in: species was observed in project area	-
Squacco Heron	*Ardeola ralloides*				2(VU:R)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters during seasonal migrations are possible.	-
Little Egret	*Egretta garzetta*				2(VU:D)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters during seasonal migrations are possible.	-
Black Stork	*Ciconia nigra*				2(VU:R)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters during seasonal migrations are possible.	-

Biodiversity Value	Scientific Name	IUCN CR	IUCN EN	IUCN VU	Other Listing (UZ RDB)	Screening Comments	CH/PBF Criteria
White Stork	*Ciconia ciconia*				3 (NT)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters during seasonal migrations are possible.	-
Glossy Ibis	*Plegadis falcinellus*				2(VU:D)	Screened in: species was observed on project area	-
Lesser Kestrel	*Falco naumanni*				3 (NT)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters during seasonal migrations are possible.	-
Saker Falcon	*Falco cherrug*		X		1 (EN)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods.	-
Peregrine Falcon	*Falco peregrinus*				2(VU:R)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods.	-

Biodiversity Value	Scientific Name	IUCN CR	IUCN EN	IUCN VU	Other Listing (UZ RDB)	Screening Comments	CH/PBF Criteria
Barbary Falcon	*Falco pelegrinoides*				2(VU:R)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods.	-
Osprey	*Pandion haliaetus*				2(VU:R)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters during seasonal migrations are possible.	-
Pallas's Fish-eagle	*Haliaeetus leucoryphus*		X		1 (EN)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters are possible in winter.	-
White-tailed Sea-eagle	*Haliaeetus albicilla*				2(VU:R)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters are possible in winter.	-
Griffon Vulture	*Gyps fulvus*				2(VU:D)	Screened in: species was observed on project area	-

Biodiversity Value	Scientific Name	IUCN CR	IUCN EN	IUCN VU	Other Listing (UZ RDB)	Screening Comments	CH/PBF Criteria
Cinereous Vulture	*Aegypius monachus*				3 (NT)	Screened in: species was observed on project area	-
Bearded Vulture	*Gypaetus barbatus*				2(VU:R)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods.	-
Egyptian Vulture	*Neophron percnopterus*		X		2(VU:D)	Screened in: species was observed close to project area	_
Short-toed Snake-eagle	*Circaetus gallicus*				2(VU:D)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters during seasonal migrations are possible.	-
Pallid Harrier	*Circus macrourus*				3 (NT)	Screened in: species was observed in project area during surveys in the autumn period. This species was not observed in the project area or in its vicinity during surveys in the spring and summer periods.	-
Greater Spotted Eagle	*Aquila clanga*			X	2(VU:R)	Screened out: This species was not observed in the project area or in its vicinity during surveys	-

Biodiversity Value	Scientific Name	IUCN CR	IUCN EN	IUCN VU	Other Listing (UZ RDB)	Screening Comments	CH/PBF Criteria
						in the spring and summer periods. However, rare encounters during seasonal migrations are possible.	
Steppe Eagle	*Aquila nipalensis*		X		2(VU:D)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters during seasonal migrations are possible.	-
Eastern Imperial Eagle	*Aquila heliaca*			X	2(VU:D)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters during seasonal migrations are possible.	-
Golden Eagle	*Aquila chrysaetos*				2(VU:R)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods.	-
Little Bustard	*Tetrax tetrax*				2(VU:D)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods.	-

Biodiversity Value	Scientific Name	IUCN CR	IUCN EN	IUCN VU	Other Listing (UZ RDB)	Screening Comments	CH/PBF Criteria
						However, rare encounters are possible in winter.	
Black-tailed Godwit	*Limosa limosa*				2(VU:D)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters during seasonal migrations are possible.	-
Pallas's Gull	*Larus ichthyaetus*				2(VU:D)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods. However, rare encounters are possible in winter.	-
European Turtle-dove	*Streptopelia turtur*				2(VU:D)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods.	-
Hemprich's Long-eared Bat	*Otonycteris hemprichi*				2(VU:R)	Screened in: species was observed in project area during surveys in the autumn period. This species was not observed in the project area or in its vicinity during surveys in the spring and summer periods.	-

Biodiversity Value	Scientific Name	IUCN CR	IUCN EN	IUCN VU	Other Listing (UZ RDB)	Screening Comments	CH/PBF Criteria
Corsac Fox	*Vulpes corsac turkmenicus*				2(VU:D)	Screened in: species was observed in project area	-
Marbled Polecat	*Vormela peregusna*			X	2(VU:D)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods.	-
Central Asian Otter	*Lutra lutra seistanica*				1(EN)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods.	-
Striped Hyena	*Hyaena hyaena*				1(CR)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods.	-
Sand Cat	*Felis margarita*				3(NT)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods.	-
Caracal	*Caracal caracal michaelis*				1(CR)	Screened out: This species was not observed in the project area or in its vicinity during surveys in the spring, summer and autumn periods.	-

In accordance with the PS-6, Conditions for Working within Critical Habitat criteria, Critical Biodiversity Areas are also subject to Priority Biodiversity Feature and Critical Habitat if they are located within a 30 km radius of the project area.

Within a 30 km radius of the Project area: IBA Amudarya Floodplain near Termez, IBA Aktepe and Three Lakes, KBA Khaudagtau UZB035, as well as isolated Kattakum sands that do not have a protected status, but have a high level of biodiversity, including endemic subspecies of plants and animals (see Figure 151).

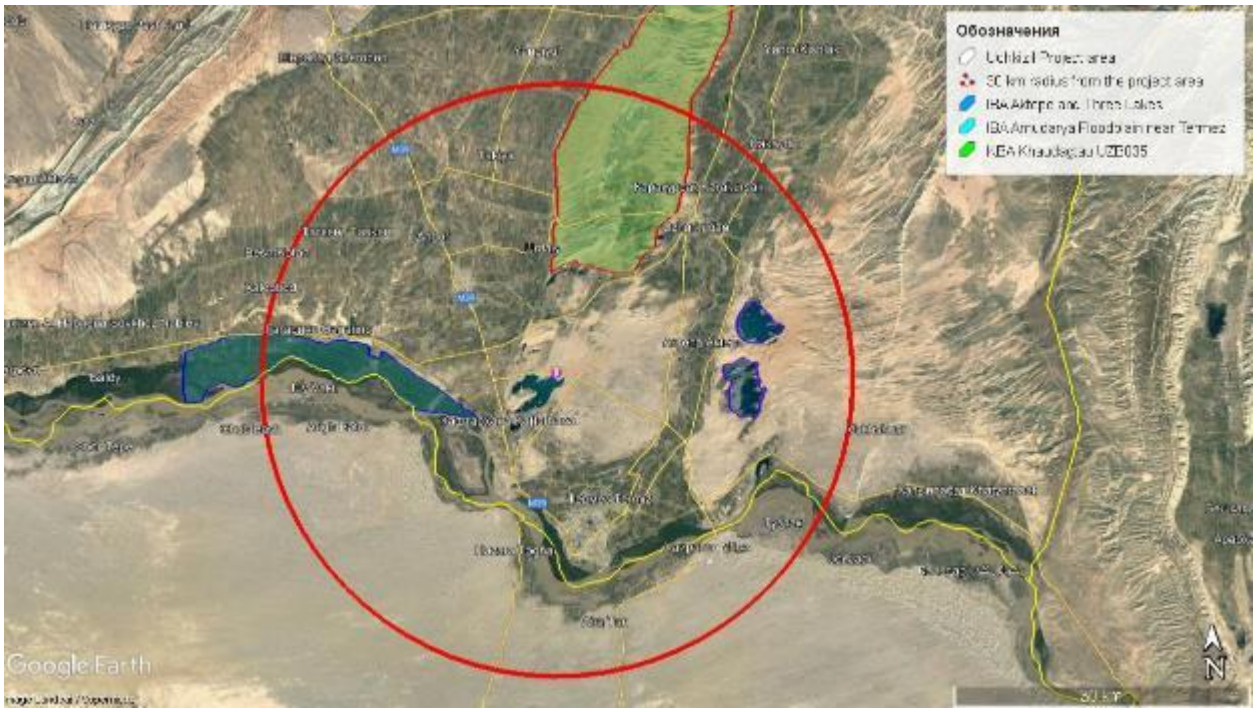


Figure 151: Critical Areas for Biodiversity Within A 30 Km Radius of The Project Area

Table 184: The Most Numerous Bird Species Visiting IBA Amudarya Floodplain Near Termez and Their Maximum Number

Species	Current IUCN Red List Category	Season	Year(s) of estimate	Population estimate	IBA Criteria Triggered
Greylag Goose *Anser anser*	LC	winter	2003-2005	5,942-31,010 adults	A4i
Lesser White-fronted Goose *Anser erythropus*	VU	winter	2003-2005	54-500 adults	A1, A4i
Marbled Teal *Marmaronetta angustirostris*	VU	passage	2001-2005	100 individuals	A1, A4i
Mallard *Anas platyrhynchos*	LC	winter	2003-2005	5,728-15,781 adults	A4i

Species	Current IUCN Red List Category	Season	Year(s) of estimate	Population estimate	IBA Criteria Triggered
Demoiselle Crane *Anthropoides virgo*	LC	passage	2005	140-1,500 adults	A4i
Common Crane *Grus grus*	LC	winter	2001-2005	6,010-22,169 adults	A4i
Little Bustard *Tetrax tetrax*	NT	winter	2003-2005	150-2,000 adults	A1
Great Cormorant *Phalacrocorax carbo*	LC	winter	2003-2005	9-2,211 individuals	A4i
Eastern Imperial Eagle *Aquila heliaca*	VU	winter	2005	6 individuals	A1
Saker Falcon *Falco cherrug*	EN	resident	2005	common	A1
A4iii *Species group - waterbirds*	n/a	winter	2003-2005	39,811-68,881 individuals	A4iii

Table 185: The Most Numerous Bird Species Visiting IBA Aktepe And Three Lakes and Their Maximum Number

Species	Current IUCN Red List Category	Season	Year(s) of estimate	Population estimate	IBA Criteria Triggered
Great Crested Grebe *Podiceps cristatus*	LC	winter	2003-2006	20-357 adults	A4i
Pygmy Cormorant *Microcarbo pygmaeus*	LC	winter	2003-2006	167-751 adults	A4i
Great Cormorant *Phalacrocorax carbo*	LC	winter	2003-2006	444-2,687 adults	A4i
European Roller *Coracias garrulus*	LC	breeding	2006	30 adults	A1
A4iii *Species group - waterbirds*	n/a	winter	2003-2004	21,267-26,354 individuals	A4iii

Table 186: IBA Amudarya Floodplain near Termez

Factor	Description
Species Conservation Status	International Bird Area
Receptor EAAA	Protected area site boundary. See Figure 151
Summary Description	The IBA is situated 23 km to the NW of Termez town, in the first floodplain terrace of the Amudarya river between Kaptarhona and Sholiker villages (on the border with Afghanistan). It is 1.5-6 km wide and about 30 km long. The Amudarya river is on the south and south-west boundary, less precipices which border the first and second floodplain terraces, waterlogged areas and reedbeds are the natural borders of the site. There are also rice and winter wheat fields, sandbanks, rivers, stream, marshes, canals and roads. bird list of this region is about 230 species. Winter IBA surveys in 2003-2005 recorded 59 species, including the globally threatened Pelecanus crispus, Anser erythropus, Aythya nyroca, Aquila clanga, Aquila heliaca and Tetrax tetrax. Phalacrocorax pygmaeus, Ciconia nigra, Ciconia ciconia, Haliaeetus albicilla, Aquila chrysaetos and Aquila nipalensis are included in the National Red Data Book. This site is internationally important for wintering and migratory waterbirds. 55,868 birds of 30 species wintering here in 2003-2004. The data presented below are relevant for 2001-2005.The dominant species were: Anser anser - 31,010 individuals (≥ 1 % of the global population – 1% = 10 000 – 11 000 in) Anser erythropus - 54-500 individuals (≥ 1 % of the global population – 1% = 240 – 400 in) Grus grus - 6,010-22,169 individuals (≥ 1 % of the global population – 1% = 4910 – 5030 in) Tetrax tetrax - 2000 individuals (≥ 1 % of the global population – 1% = 1000 – 4999 in) Species group – waterbirds - 21,267-26,354 individuals
Assessment	Given the data in the table for records of some bird species in the IBA Amudarya Floodplain near Termez, the number of migratory waterfowl would fit under category 2iii(a) Critical Habitat, but such concentrations of specific bird species are not regularly observed. Therefore, IBA Amudarya Floodplain near Termez is not considered of sufficient value for it to qualify as Critical Habitat under Criterion 2iii. But IBA Amudarya Floodplain near Termez is considered of sufficient value for it to qualify as a Priority Biodiversity Feature under Criterion 2iii (a).

Table 187: IBA Aktepe and Three Lakes

Factor	Description
Species Conservation Status	International Bird Area
Receptor EAAA	Protected area site boundary. See Figure 80
Summary Description	Aktepe Reservoir, and adjoining lakes, are situated in the south of Uzbekistan, 22-25 km NE of the town of Termez and 7 km SE of the town of

Factor	Description
	Jarkurgan, in the valley of the River Surkhandarya. It is situated in the sandy desert on the border of developed land. The area is hilly and the coastline is indented; in some places, it is precipitous. There are three islets with precipitous shores in the reservoir. Around the reservoir, there are shoreline thickets of reed, tugai forest and a sandy desert. A small canal flows into the SE part of the reservoir, feeding it with the water from the Amuzang canal. The average depth is 6.5 m. The water flow is regulated. There is a wastewater canal in the SE part of the reservoir. There is a chain of small lakes situated 7 km to the south of the reservoir, which include the so-called Three Lakes. The water level and salinity in these lakes have not been studied. In winter, these water bodies are not frozen. It is suggested that the IBA will include two sites. In recent years, 96 species (mainly waterbirds) have been recorded in the IBA area during winter and breeding. Aktepe together with adjoining lakes is of high importance for wintering birds. Winter counts (2003-2006) resulted in the record of 55 avian species. There are 34 species of waterbirds among them. Six species included in the IUCN Red List are included, namely, Pelecanus crispus, Marmaronetta angustirostris, Aythya nyroca, Haliaeetus leucoryphus, Aquila heliaca and Tetrax tetrax. During the 2006 summer survey (7 to 10 June 2006), 69 species were recorded, of which 3 species are included in the IUCN Red List: Marmaronetta angustirostris, Aythya nyroca and Coracias garrulous, as well as 4 species representing the biome 4b: Caprimulgus aegyptius, Hippolais rama, Parus bokharensis, and Emberiza bruniceps. Five globally endangered species were recorded there but in low numbers Marmaronetta angustirostris and Aythya nyroca are thought to be nesting in summer. Coracias garrulus is a common nesting species in this area. Falco cherrug and Falco pelegrinoides regularly visit the BOT area from adjoining territories for hunt. A flock of 30 Tetrax tetrax individuals was recorded in the neighboring fields in the spring 2005. See Table 185: The most numerous bird species visiting IBA Aktepe and Three Lakes and their maximum number
Assessment	The IBA does not support sufficient numbers of any single species to qualify as Critical Habitat under Criterion 4(a), with none of the IBA qualifying species' populations reaching 1% of the global population. The waterbirds assemblage at the IBA has been recorded as exceeding the waterbird assemblage threshold for Ramsar designation (20,000 or more waterbirds, under Ramsar selection criterion 5) within single years (such as 2003 and 2005); however, numbers within the last three years (potentially longer) have not exceeded this threshold. When considering the requirement for Ramsar designation under (Ramsar selection) Criterion 5 is for sites that '…regularly support 20,000 or more waterbirds.', and that 'regularly' in this context equates to two-thirds (or more) of seasons, then it is concluded that this site does not currently meet the threshold of Ramsar selection Criterion 5. The IBA Aktepe and Three Lakes is therefore not considered of sufficient value for it to qualify as Critical Habitat under Criterion 2iii. The IBA Aktepe and Three Lakes is therefore considered of sufficient value for it to qualify as a Priority Biodiversity Feature under Criterion 2iii(a).

Table 188: KBA Khaudagtau UZB035

Factor	Description
Area Conservation Status	Key Biodiversity Area
Receptor EAAA	Protected area site boundary..
Summary Description	Khaudag ridge is a low hill (553 m above sea level) with rare outcrops of the parent rock surrounded by Kattakum sands – small dune sands with slightly changed landscapes. This KBA was created to protect endemic plant species such as *Allium ophiophyllum, Allium rhodanthum, Climacoptera oxyphylla, Dipcadi turkestanicum, Euphorbia triodonta*. Also, the Haudag ridge is one of the most significant points in the region in terms of reptile biodiversity. Here live such endemic species as: *Phrynocephalus raddei boettgeri, Phrynocephalus sogdianus, Eremias scripta lasdini, Eremias nigrocellata*; as well as rare ones listed in the Red Book of the Republic of Uzbekistan (2019): *Varanus griseus caspius, Eryx tataricus and Boiga trigonata melanocephala*. Also, such rare bird species as *Gyps fulvus, Aegypius monachus, Gypaetus barbatus, Neophron percnopterus* are regularly observed on Haudag.
Assessment	This KBA is home to endemic plant species such as: Allium ophiophyllum, Allium rhodanthum, Climacoptera oxyphylla, Dipcadi turkestanicum, Euphorbia triodonta. However, these species are not included in the IUCN Red List and their global abundance has not been assessed, so it is not yet possible to assess this territory under the Critical Habitat and Priority Biodiversity Feature criteria. As for endemic reptile species, these subspecies have a low conservation status in the local Red Book and low status in the IUCN Red List. I would also like to note that the IUCN Red List does not consider the degree of threat to subspecies. The KBA Khaudagtau UZB035 is therefore not considered of sufficient value for it to qualify as Critical Habitat, and as a Priority Biodiversity Feature.

KBA Khaudagtau UZB035 does not meet any criteria, despite the fact that it is inhabited by many species of animals and plants, including endemic subspecies. However, these subspecies have a low conservation status in the local Red Book and low status in the IUCN Red List. it should be noted that the IUCN Red List does not consider the degree of threat to subspecies. Despite this, it should be noted that it is anticipated that the project will not have adverse impact on the KBAs, both during construction and during the operational phase.

Conclusions

- In accordance with the outcomes of the 3 site surveys (summer, spring and autumn), none of the species encountered meet the criteria for CHA.
- *Neophron percnopterus*, which temporarily visits the Project area in search of food, since there is a household waste dump near the project area, also does not meet the criteria for CHA, since its number is less than 0.5% of the global population.
- There are no nesting sites for the Egyptian Vulture in the project area.
- Central Asian Tortoise in project area comprise fixed sandy dunes, clay gullies with ephemeral vegetation throughout the project area and beyond. However, the abundance of the species in the area is relatively extremely low. And this territory is not typical for this species. The EAAAs comprise approximately 0,00008% of the Kizilkum population. The Central Asian tortoise, whose shell were found during the field trip in September 2022, most likely lives either in small

numbers on the periphery of the project area, or this shell was brought to the territory by predatory mammals (fox, jackal) or birds of prey (vulture, black vulture). In the spring period, no tortoise was found in the project area, which indicates either its absence or extremely low abundance.

- The project area is not located in protected natural areas, however, within a 30 km radius there are 2 IBAs that meet the 2iii (a) Priority Biodiversity Feature criteria and 1 KBA that does not meet the Critical Habitat and Priority Biodiversity Feature criteria.
- Phrynocephalus raddei boettgeri, Eremias nigrocellata, Varanus griseus caspius, Eryx tataricus Boiga trigonata melanocephala Varanus griseus caspius species were found in the project area included in the national red book of the Republic of Uzbekistan (2019) have local conservation statuses NT and VU. However, for the global population of these species, construction in this area will not bring negative consequences.
- In general, the species composition of mammals in the project area and the projected transmission line correspond to the species composition of mammals in the deserts of the temperate zone.
- Particularly rare and endemic species of mammals are not found here. Two species of mammals listed in the Red Book of Uzbekistan are widely distributed species with a low threat status category in the national Red Book[35] and no threat status in the IUCN Red List[31].
- In the reservoir there are two species (*Capoetobrama kuschakewitschi and Sabanejewia aurata aralensis*) listed in the Red Book of the Republic of Uzbekistan, however, this reservoir is not the main habitat for them, these species penetrate from the river through the channel and form the ichthyofauna of the reservoir. The Uchkizil reservoir is not a native or relic reservoir with unique ichthyofauna. The modern ichthyofauna of the reservoir is formed mainly by the ichthyofauna of the Surkhandarya River
- It can be concluded that if any species is damaged as a result of the construction of, then over time the ichthyofauna of the reservoir will be able to recover, since all species of fish living in this reservoir have the potential to recover.
- The rest of the plant and animal species that were found in the project area included in the national red book of the Republic of Uzbekistan (2019) have local conservation statuses NT and VU - which does not meet the CHA criteria.
- Animal species from literary sources that have high IUCN Red List statuses and meet CHA criteria is not encountered during site surveys.

9.6 Potential Impacts, Mitigation, Management & Residual Impact

This section asesses the potential impacts on terrestrial ecology that may occur as a result of the Project construction and operational activities and identifies recommended measures that can be implemented in order to mitigate and manage such impacts.

9.6.1 Construction Phase

Loss of Habitat/Habitat Fragmentation

The impact is generally direct as habitat will be lost through construction activities and this could include direct destruction of flora or damage to fauna habitat. The habitat defined as "shallow and semi-fixed" habitat and "wavy sands" is considered Plant communities are characterized with sparse canopy cover, low species diversity and low to high level of anthropogenic disturbance in the project area. The areas with low level of disturbance are situated deep in the sand massif, along the planned power line, while the habitats of the construction site are medium to strongly disturbed. There is no natural habitat in the project area as all habitats within the project area are exposed to medium or high levels of anthropogenic disturbance, especially grazing, mining and garbage.

Based on the site survey observation, there are limited flora diversity in the Project area and it should be notedproject area are exposed to medium or high levels of anthropogenic disturbance. In addition, there exist similar habitats around the Project area. Hence, it is not considered as a sensitive area. In general, the species composition of mammals in the project area and the proposed transmission line corresponds to the species composition of mammals in the deserts of the temperate zone. construction in this area will not bring negative consequences on global population of these reptile species. Therefore, clerance in the project area, which is currently under anthropogenic influence, will not cause significant habitat loss. The project area will not cause habitat fragmentation and hinder the movement of animals. In addition, the water protection zone will provide a corridor for movement of animals, if any.

Inadequate storage and handling of hazardous materials, and inappropriate design and storage of wastes could result with contamination of soils and groundwater which may also attract pest species and potential for disease. Pests may also be attracted to site by the accumulation of wastes (particularly domestic food wastes) if these are not stored and disposed of appropriately.

Loss of Flora

The desk study indicates that mainly common species of flora are present in the project effected area. These are generally considered to be of low conservation value and of low sensitivity. Impacts on these locally important species are considered to be minor adverse in magnitude and the likely effects are assessed as negligible.

Most of species recorded for the project area are typical for southern deserts of Central Asia and more or less common and widely spread. Within the area of project and along power transmission line, species listed as CR, EN or VU on the IUCN Red List, as well as plants included in the Red Data Book of Uzbekistan were not found. One species (*Salsola rosmarinus*) is assessed as endangered (EN) in the neighboring country, Tajikistan. Salsola rosmarinus is not endemic, it has a wide geographical range covering Middle East and southern part of Central Asia (Egypt, Arabian Peninsula, Iran, Afghanistan, Uzbekistan, Turkmenistan, and Tajikistan).

Micro survey will be conducted prior to site clearance. The EPC contractor should be educated about these rare plant species with photos and report to site Environmental Specialist and authority for transplanting of such plants, if observed.

Disturbance of Nature Conservation Areas

The risk of designated conservation areas being affected during operation is considered to be negligible given the distance to the Project area. Project impacts on protected areas during operation are therefore not expected to cause any significant effect.

Disturbance of Fauna

The poorest area where only arid species has been recorded is the reservoir, and species that typically live near water are not recorded here. The area with the least population and species diversity in terms of biodiversity is the Uchkizil reservoir and species that typically live near the water were not recorded during the autumn survey. it is possible to say that the impact on these species will be low due to the fact that similar habitats cover very large areas in the region and the ease of movement of large and medium mammal species. The generated noise due to construction activities, machinery and working personnel will have a negative impact on large and medium-sized mammals, the noise will scare them away. Light pollution will also deter these animals, which may affect their ability to access the reservoir and use some of it as a watering hole. Therefore, noise and light pollution will be minimized by applying noise reducing mitigation measures (see Section 7) and by adopting illumination measures and minimizing the contruction activities at night time.

In addition, while small fauna species (such as small mammals and reptiles) will be disturbed due to clearing and excavation of the area, the temporary noise and vibration and dust deposition during construction will affect the adjacent habitats. Movement of vehicles and heavy machinery within the Project area as well as the site clearance and excavation could potentially cause direct mortality of some fauna species such as reptile species.

In the project area, part of the reptiles, i.e. some species of Eremias, Phrynocephalus and colubrid snakes have a hibernation period between the end of October and February. Whereas other species such as *Varanus griseus caspius, Naja oxiana, Boiga trigonata melanocephala* have a hibernation period between August-September and end of April. The Central Asian tortoise is active only a few months a year. It leaves the state of hibernation in early March, and leaves for estivation, which usually goes into hibernation by the end of May. As a result, the best time to relocate reptiles from the project area is from mid-April to the end of May.

Prior to construction, micro-route survey is recommended to be conducted for reptile, fox (*Vulpes corsac)* and hedgehog (*Hemiechinus hypomelas)* species and experts will move them outside the project area before the site clearance. The micro-route survey will also assess the impacts along internal temporary and permanent access roads. A micro-road survey of fox dens and hedgehog nests will be conducted and if species are observed, these individuals will be moved out of the project area.

Increased risk of local pollution events due to use of construction vehicles affecting adjacent habitats and local changes in air quality resulting from construction activities and increased vehicle movements through the are may occurred.

The area contains many reptilian species and three of them (*Testudo horsfieldii*-Potential, *Phrynocephalus raddei boettgeri*-observed, *Eremias nigrocellata*-observed), are in the vulnerable category in the Uzbekistan Red List on which the construction activities may have significant impacts. In order to minimize the impacts on these species, closed zones shall be allocated for these species in the long term within the Project area. Closed zones to be allocated will be located within the BMP. As mentioned earlier, the project facilities will not occupy the entire Project area and there will be suitable habitats for these species. The Project Company will also monitor these species not only during construction but also in operation period.

Also, one of the effective methods of preserving the biodiversity of reptiles is to donate to existing centers for the rehabilitation and breeding of reptiles, and release them to their natural habitats after a stable population has formed in captivity.

Disturbance of Avifauna

The state of the habitats of the project area has already been significantly influenced by human activities, and at the moment it is unattractive for birds. On the other hand, Project area is located nearly 10 km from two international bird area. Therefore, Uchkizil can potentially also attract them due to the water surface, food and as a recreation area. Nesting biotope is absent on the open banks of the Uchkizil, therefore, it is not expected to be nesting of water birds in the project area but the region is of particular importance for the wintering. These impacts are considered direct and permanent. Bird counts conducted in the autumn show that the project site and the adjacent water body will not cause any load on the existing ecosystem. Waterfowl do not much prefer this reservoir, due to the fact that it is relatively deep and of disturbance from the local population.

Accidental Loss of Fauna

Movement of vehicles and heavy machinery within the Project site as well as the site clearance and excavation could potentially cause direct mortality of fauna species such as reptiles. Also, Access to the construction area and displacements from various field activities increase the risk of accidents for small species.

Introduction of Alien Species

Accidental introduction and dispersal of invasive species from construction activities may occur.

Damage to Aquatic Ecosystem/Loss of Habitat

The sensitivity of these species to pollution is not considered to be medium. But there is a high risk of cumulative effects. Especially in the event of a spillage, the effects may change from moderate to high.

Excavation works near the banks of the reservoir may result in a temporary disturbance to aquaitc fauna through noise and vibration originating from the excavation activities. Fish, are likely to be the most sensitive receptors to the noise and vibration. The main response of the fish and other species to noise levels is typically avoidance. Therefore, during noise creating activity it is probable that these fauna species would move away from the immediate source of the noise.

During commissioning, the hydro testing and steam cleaning will require 89,000 m^3 water. On the other hand, a small amount of treated blowdown water will be discharged back to Uchkizil Reservoir after being treated and meeting the effluent standards required bythe authority. According to the impact assessments on water resource and water quality, there will be no significant impact on the aquatic environment with mitigations during the construction.

It can be concluded that if any species is damaged as a result of the construction of, then over time the ichthyofauna of the reservoir will be able to recover, since all species of fish living in this reservoir have the potential to recover.

If the Project area is not properly graded and no erosion barriers are installed, then runoff composed of sediment and organic material may be washed into the reservoir and potentially compromise the water quality.

Barrier Effects on Fauna

The main natural biotopes are located to the east of the project area. Whereas to the west of the Project area, there are agricultural lands and settlements. Thus, the project area does not break any natural biotopes and migration corridors are not disturbed due to construction and operation activities of the project. Therefore, the project will not have barrier effect for reptiles and mammal. On the other

hand, limited construction activities regarding the water intake in Uchkizil reservoir may have temporary indirect barrier impact on bird species.

Loss of Ecosystem Services

There are ecosystem services used by the local communities such as grazing and browsing by domestic animals, fishing and usage the area as recreational. However, such impact will be limited to the Project site. The water quality and quantity of water withdrawn will be shared with the stakeholders identified in the SEP who will be affected directly/indirectly from the Project activities in this regard to monitor if there are any adverse impacts on the fishing and agricultural activities.

Apart from these, a Biodiversity Management Plan shall be prepared by the EPC contractor prior to the site clearance. The Project Company will include binding conditions in the EPC contract to prepare such plans.

Table 189: Impacts Significance of the Ecology during Construction Phase

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Loss of Habitat/Habitat Fragmantation (Terrestrial)	Flora	Medium	Medium	Moderate	All areas to be cleared should be precisely demarcated and work carried out only within those areas to decrease the disturbance. A Biodiversity Management Plan (BMP) shall be prepared by the EPC contractor prior to the site clearance. Log as part of the site clearance Works, actual permanent habitat removal. Prepare "Habitat Compensation Plan" based on actual disturbance footprint that provide for maintaining the overall coherence / integrity of the site Compensation planting will aim to i) provide the same ecological function as those lost and ii) be located as close as possible to the areas of impact. On-site (and perhaps offsite) vegetation restoration/rehabilitation to compensate for all permanent habitat loss generated by the following the "no net loss" mitigation standard per IFC PS6. This may include rehabilitation of degraded areas and replanting for habitat restoration (fixed sands) to improve biodiversity function of habitat around the site. Rehabilitation of temporary habitat loss as soon as possible after construction activity is finished to minimise risk of shifting sands. Monitoring effectiveness of vegetation restoration/rehabilitation to compensate for permanent habitat loss against No Net Loss (NNL) criteria. Create the Green Belt edge where possible**.** The Green Belt edge should be defined using local shrubspecies that create a visual barrier within the scope of the project. The landscape should also be used to help integrate a Green Belt boundary with the existing edge, which aims to maximize consistency over a longer distance. The green belt will be combined with the water protection zone. Develop a Pre-Construction monitoring and Relocation Procedure for reptiles and small mammals. Site clearance should avoid hibernation period. The best time to relocate reptiles from the project area is from mid-April to the end of May. Minimise permanent and temporary land take for civil works, clearance restricted to work sites. Prior to construction, micro-route survey for flora and fauna species is recommended to be conducted for reptile and otherspecies and experts will move them outside the project area before the site clearance. The micro-route survey will also assess the impacts along internal temporary and permanent access roads. Considering that the unique places for wintering and migration of birds are located in sufficient proximity, additional ornithological monitoring is needed in the project area and its environs, including in neighboring IBAs Temporary closed zones for the period of construction where construction vehicles, livestock, people should not enter to be used for the relocation of reptile species during construction. Hazardous materials used during the construction stage shall be adequately managed, in order to minimise the potential risk of spillage and therefore potential contamination of the ecosystem. Cleared areas no longer required for construction activities shall be rehabilitated by re-seeding with locally found grasses and shrubs increase soil stability. All vehicles and equipment to be restricted to within the project boundaries and only along the approved access road route. Access roads shall be defined before the beginning of the construction activities. Some of the public roads may need to be used for access. Driving out of the access roads by the construction vehicles taking part of the construction activities shall not be allowed.	Minor
	Fauna	High	Medium	Major		Modarate
	Avifauna	Medium	Medium	Moderate		Moderate

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
					First stage of mitigation should ensure that the Project site is prepared in such a way as to discourage animals from using the Project area.	
Disturbance of Nature Conservation Areas	Important Bird Areas	Low	Low	Minor	All vehicles and equipment to be restricted to within the project boundaries and only along the approved access road route. Where additional sites are needed (eg storage area), the distance of potential sites to IBAs will be determined. Care shall be taken not to work within 5 km of these areas.	Minor
Disturbance of Fauna	Small mammals and Reptiles	High	Medium	Major	There will be no encroachment to land outside of the Project footprint, or defined laydown areas, site access road. The project area boundaries shall be fenced to avoid fauna from entering the active construction site where they may be injured. If possible, gradual vegetation clearance will be conducted, to enable fauna to move to other areas The collection or hunting of any animals must be strictly prohibited. A 'no tolerance' policy must be adopted with respect to construction and operations workers. Additional surveys should be performed for wintering bird species and should be monitored during construction at intervals deemed appropriate by experts. Destructive searches for reptiles (including Central Asian tortoise) should be undertaken during site clearance under the supervision of a suitably experienced ecologist. Destructive searches for reptiles and amphibians involve the careful removal of turf and 100mm of topsoil in potentially suitable habitats. Also, one of the effective methods of preserving the biodiversity of reptiles is to donate to existing centers for the rehabilitation and breeding of reptiles, and release them to their natural habitats after a stable population has formed in captivity. Staff should be briefed on risks of exposure to scorpions, spiders and snakes as well as the preventative measures. Workers in the field should wear protective clothing; long trousers, closed shoes and leather gloves. Information regarding nearest location of treatment for any bites and stings should be made available. Route directions and speeds limit will be placed along the access road into the project site Shrub located on the Project site shall be inspected before they are cleared or translocated to ensure there are no nesting birds or roosting bats. Clearance of Shrub from the Project site shall not be conducted during the nesting season if it is established that there are birds on site. Any bird eggs observed in any nests on the Project site will not be disturbed and any damage to the eggs shall be recorded. Where burrows/dens of reptile (e.g. lizard) and mammals (e.g. fox, hedgehog) are encountered on the project site the contractor will make efforts to ensure that they vacate their burrows prior to site clearance and excavation works. Any sightings of fauna must be reported to the Environmental Manager and action taken following the BMP procedures and recorded.	Minor
	Big and medium mammals and bats	Medium	Medium	Moderate		

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
	Birds	Medium	Medium	Moderate	If necessary, work site and access roads should be irrigated to minimize dust impact.	Minor
	Barrier Effects on Fauna	Medium	Medium	Moderate	Appropriate training should be provided to relevant personnel concerning noise, vibration and lighting control and management Noise emission will be limited as much as possible: speed limit for vehicles, maintenance programs of machinery, avoidance of emission of noise during the night, etc. Wastes created during the construction activities will be managed under an Environmental and Social Management Plan (ESMP), to limit the disturbance to fauna as a result of presence of wastes and spills.	Minor
Accidental Loss of Fauna	Small mammals, Reptiles and Birds	Medium	Medium	Moderate	Project staff require environmental toolbox talks during construction to raise awareness, limit conflict and reduce additional disturbance to fauna and avifauna. Drivers operating in the area must be well briefed and must be aware of the dangers that vehicles pose to the local fauna. Route directions and speeds limit shall be placed along the access road into the project site Speed of vehicles shall be limited, in order to limit emission of dust in nonpaved accessed roads and in order to limit the risk of accidents with fauna. Any snakes encountered at the site must not be handled or harmed by Project workers. Animals must be relocated by appointed personnel. Staff shall be briefed on risks of exposure to scorpions, spiders and snakes as well as the preventative measures. Workers in the field should wear protective clothing; long trousers, closed shoes and leather gloves. Information regarding nearest location of treatment for any bites and stings should be made available.	Minor
Introduction of Alien Species	Change of Habitat	Medium	Medium	Moderate	Potential invasive flora species shall be identified, and action must be taken to clear these species if they occur in or around areas designated for bush clearance to prevent establishment after clearing. A monitoring plan shall be carried out to record alien species populations in the project area of influence and aimed at removing new populations and preventing them from spreading throughout the AoI. In addition, prompt revegetation (i.e. sowing of native herbaceous species and/or planting native shrubs/trees) on bare soil with natural or semi-natural vegetation will reduce the spread of alien species. No planting of alien species shall occur in the camps or any areas within the AoI, including landscaping of re-vegetated areas.	Minor
Damage to Aquatic Ecosystem/ Loss of Habitat	Water Quality	Medium	Medium	Moderate	Wastes and any other product containing hazardous chemical substances (i.e. fuel) will not be stored in the proximity of reservoir features. Their management will be done according to the Environmental and Social Management Plan (ESMP) that will consider among their objectives the avoidance of any spill affecting to the aquatic ecosystems. Excavated materials will not be dumped into aquatic features, nor will they be stored in their proximity, to avoid any increase of the turbidity levels. Maintain buffer shall be performed between construction and water boides if it is practical. As far as possible, care should be taken not to cause any effect in the aquatic environment during the spawning period of the fish. Vegetation clearance works will avoid affecting the riparian vegetation, whenever possible, since it provides areas for spawning and sheltering of many aquatic organisms.	Minor
	Fish	Medium	Medium	Moderate		Minor

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Loss of Ecosystem Services	Fishing, grazing, usage of recreation and tourism area, watering animals	Medium	Medium	Medium	There will be no encroachment to land outside of the Project footprint, or defined laydown areas, site access road. Minimise permanent and temporary land take for civil works, clearaminince restricted to work sites. Prior to project equipment and machinery transportation, a traffic survey/study shall be done and Warning signs along the motorway, to advice drivers about the risk of run over fauna. The survey includes necessary oversize haulage permits, local and international regulations along the path to the project area. The Emergency Response Plan shall be developed and the plan shall be include based on the results of the risk assessment (and in conformance with statutory requirements), design of spill prevention/containment structures around sensitive equipment, installation of appropriate spill clean-up equipment and development of response procedures. The water quality and quantity of water withdrawn will be shared with the stakeholders identified in the SEP who will be affected directly/indirectly from the Project activities in this regard to monitor if there are any adverse impacts on the fishing and agricultural activities.	Minor

9.6.2 Operational Phase

Loss of Habitat/Habitat Fragmentation and Damage of Habitats

There are no sensitive habitats on the Project sites and AoI (Area of Influence) that would be affected during operation. The habitats that may be affected by accidental pollution are of minor or moderate conservation value. Project effects can be stabilated with monitorings and migations measures.

The water quality and quantity of water withdrawn will be shared with the stakeholders identified in the SEP who will be affected directly/indirectly from the Project activities in this regard to monitor if there are any adverse impacts on the fishing and agricultural activities.

Inadequate storage and handling of hazardous materials, and inappropriate design and storage of wastes could result with contamination of soils and groundwater which may also attract pest species and potential for disease. Pests may also be attracted to site by the accumulation of wastes (particularly domestic food wastes) if these are not stored and disposed of appropriately.

Accidental Loss of Fauna

Depending on the intake design, water drawn in by the intake system may contain a variety of organisms from the reservoir. Some organisms are small enough to pass through the mesh screens into the intake. This process, called entrainment, may affect plankton and fish eggs and larvae (ichthyoplankton). Because of the abundance and short regeneration times of plankton, impacts of entrainment on these organisms have rarely been documented outside the immediate vicinity of the plant and are considered to be of little consequence. Therefore, entrainment impacts to phytoplankton and zooplankton are considered to have a relatively small significance. Aquatic organisms that are drawn into the intake and are too large to pass through the debris screens may be impinged against the screens. Mortality of fish that are impinged is high because they are eventually suffocated by being held against the screen mesh or are abraded, which can result in fatal infection. Depending on the design and location, impingement can affect large numbers of fish and is considered a medium negative impact. Impingement occurs when the intake through-screen velocity is too high for species, such as fish, to swim away and results in them being retained against the screens.

The Uchkyzyl reservoir is not a native or relic reservoir with unique ichthyofauna. The modern ichthyofauna of the reservoir is formed mainly by the ichthyofauna of the Surkhandarya River In the reservoir there are two species (*Capoetobrama kuschakewitschi* and *Sabanejewia aurata aralensis*) listed in the Red Book of the Republic of Uzbekistan, however, this reservoir is not the main habitat for them, these species penetrate from the river through the channel and form the ichthyofauna of the reservoir.

In order to minimize the impact on the aquatic life, following mitigations will be applied:

- Water intake velocity shall be limited with 0.15 m/s according to IFC EHS Guideline for Thermal Power Plants at the entrance of inlet structure.
- A bubble curtain shall be installed across the entrance of the intake channel to prevent fish and other fauna from going through the intake channel.
- Periodic monitoring of intakes will be undertaken during the operation phase to record the effectiveness and ensure that there is no injury to the vulnerable fish species.
- Brief visual observation of the intake channel will be undertaken daily to check that reptiles and large fish are not within the channel.
- Water temperature control system will be installed to the neutralization pond to ensure that the discharge temperature is within the Project discharge limits (see Table 91).

- The water quality and quantity of water withdrawn will be shared with the stakeholders identified in the SEP who will be affected directly/indirectly from the Project activities in this regard to monitor if there are any adverse impacts on the fishing and agricultural activities.

Disturbance of Fauna

Bird counts conducted in the autumn show that the project site and the adjacent water body will not cause any load on the existing ecosystem. Waterfowl do not much prefer this reservoir, due to the fact that it is relatively deep and of strong concern from the local population. Nesting biotope is absent on the open banks of the Uchkizil, therefore, it is not expected to be nesting of water birds in the project area but the region is of particular importance for the wintering. The proposed Project will have 65 m stack, which rarely pose a collision danger during daylight. However, lighted stacks may pose a collision danger since birds may be attracted by the lighted area. Therefore, lighting of stacks should be downward-directed and lights should be used that omit the red spectrum to avoid attracting birds and causing bird collisions.

The generated noise due to operation activities and working personnel will have a negative impact on large and medium-sized mammals, the noise will scare them away. Light pollution will also deter these animals, which may affect their ability to access the reservoir and use some of it as a watering hole. Therefore, noise and light pollution will be minimized by applying noise reducing mitigation measures (see Section 7). The illumination will be designed in such a way that, lights will be directional and will not point outward of the plant.

Table 190: Impacts Significance of the Ecology during Operation Phase

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Loss of Habitat/Habitat Fragmantation and Damage of Habitats	Flora	Low	Low	Minor	A Biodiversity Management Plan shall be prepared by the Project Company for Operation and Maintanance. During routine maintenance any invasive flora species shall be removed. Landscaping on site shall be incorporate indigenous plant species to minimise irrigation requirements and the need for fertilisers/pesticides. Intentional replanting of vegetation will enhance the biodiversity of the site as well as improve the visual aesthetics of the site. This will be coordinated with the no-net loss requirements defined during the construction phase permanent habitat removal focusing on rehabilitation and restoration of habitats (semi-fixed sands and wavy sands). Hazardous materials and chemicals shall be stored in designated areas in accordance with the national requirements and standards and good practices guidelines so as to prevent any spillage on the site. Use of persistent biocides shall be prohibited. In terms of surface run-off drainage, the Environmental Management Plan shall include: all surface run-off of the approaches, pollution prevention, water discharges etc. Periodic water and air quality, and noise level monitoring shall be performed. The water quality and quantity of water withdrawn will be shared with the stakeholders identified in the SEP who will be affected directly/indirectly from the Project activities in this regard to monitor if there are any adverse impacts on the fishing and agricultural activities.	Minor
	Fauna	Low	Low	Minor		Minor
	Avifauna	Low	Low	Minor		Minor
	Terrestrial Habitat	Low	Low	Minor		Minor
	Aquatic Habitat	Low	Low	Minor		Minor
Disturbance of Fauna	Birds	Low	Low	Minor	Monitoring studies shall be conducted to determine the use of the area by bird species that use the area as accommodation and feeding areas and to evaluate the effects. Appropriate training should be provided to relevant personnel concerning noise, vibration and lighting control and management. Water intake velocity shall be limited with 0.15 m/s according to IFC EHS Guideline for Thermal Power Plants at the entrance of inlet structure. A bubble curtain shall be installed across the entrance of the intake channel to prevent fish and other fauna from going through the intake channel. Periodic monitoring of intakes will be undertaken during the operation phase to record the effectiveness and ensure that there is no injury to the vulnerable fish species. Brief visual observation of the intake channel will be undertaken daily to check that reptiles and large fish are not within the channel Water temperature control system will be installed to the neutralization pond to ensure that the discharge temperature is within the Project discharge limits (see Table 91). Lighting of stacks should be downward-directed and lights should be used that omit the red spectrum to avoid attracting birds and causing bird collisions The illumination will be designed in such a way that, lights will be directional and will not point outward of the plant Noise emission will be limited as much as possible: speed limit for vehicles, maintenance programs of machinery, avoidance of emission of noise during the night, etc. Wastes created during the operation activities will be managed under an Environmental and Social Management Plan (ESMP), to limit the disturbance to fauna as a result of presence of wastes and spills.	Minor
	Reptiles and Mammals	Low	Low	Minor		Minor
Accidental Loss of Fauna	Plankton	Moderate	Moderate	Moderate	In cases where a large amount of water is required from the reservoir, the water will be withdrawn from the region with low fish populations. Especially during the spawning period, water intakes will not be made from the shore. The surface of the deeper middle parts of the reservoir can be evaluated. The water quality and quantity of water withdrawn will be shared with the stakeholders identified in the SEP who will be affected directly/indirectly from the Project activities in this regard to monitor if there are any adverse impacts on the fishing and agricultural activities.	Minor
	Fish	Moderate	Moderate	Moderate		Minor

9.7 Cumulative Impacts

The current main negative anthropogenic factors are grazing, cutting down psammophilic shrubs for firewood, spontaneous expansion of the earth roads network, fishing, oil production, using of the southern reservoir as public beach, recreational activities. Any anthropogenic intervention, especially major construction, alters the environment and subject ecosystems to change. It is possible to reduce the degradation and pressure on vertebrate populations caused by the construction of modern infrastructure with proper and long-term planning of activities.

The Project area is predominantly rural and agricultural and any other future developments in the Project's area of influence are unknown at this point. Summary of Cumulative Impacts of Ecological Environment is presented in Table 191.

Table 191: Cumulative Effects on Ecological Environment

Terrestrial Ecology		
Impact	**Construction Phase**	**Operation Phase**
Cumulative Impact on Flora and Fauna	There is no natural habitat in the project area as all habitats within the project area are exposed to medium or high levels of anthropogenic disturbance, especially grazing, mining and garbage. The Project site is limited in flora diversity and there is no protected species i. Therefore, the effect on the flora is negligible with the implementation of mitigation and management measures that mentioned Table 189 and Table 190. The detailed potential effects on fauna are explained in Section 9.6.1	During the operational phase, cumulative effects are considered negligible as there is no negative activity to the flora in the adjacent area. There is a possibility of the spread of invasive/foreign species in the area due to anthropogenic impacts not related to the project. The movement of project tools has the potential to have an impact that will facilitate this diffusion. The effect on the flora is negligible with the implementation of mitigation and management measures that mentioned Table 189 and Table 190. The detailed potential effects on fauna are explained in Section 9.6.2

Terrestrial Ecology		
Impact	**Construction Phase**	**Operation Phase**
Cumulative Impacts on Aquatic Ecosystem	Changes in noise, air quality and water quality are possible. with the implementation of mitigation measures defined in the project related management plans, the effects will be at a moderate level.	The cumulative effect of projected temperature and water changes could be important with climate change effects. Thermal pollution of water bodies. Even with a slight increase in temperature in the reservoir, all chemical reactions are accelerated, and oxygen deficiency increases. Over time, the reservoir can become waterlogged. This has a significant impact on the fauna - its composition changes, and species that need running water disappear. The effluent of the plant will include limited amount of blowdown water, which will meet the standard of temperature (less than 3 degrees of the temperature of the water body) before it is discharged into the reservoire (see Chapter 8). In such case, the cumulative on fauna would be insignificant. Monitoring of temperatures of the effluent and waterbody will be monitored to ensure the compliance with the standard.

9.8 Monitoring

The program for monitoring the flora and fauna of terrestrial and aquatic ecosystems should be carried out along the perimeter of the entire reservoir and within the AoI for Ecology determined in Section 2.4 (see Figure 19). It should cover all groups of terrestrial and aquatic organisms.

Table 192 shows the most suitable time of the year for the site surveys and Table 193 shows the monitoring plan for the Project.

Table 192: Preliminary Deadlines of Research for Each Of The Biodiversity Groups in The Project Area

	January (10-20)	March (15-25)	April (10-20)	May (10-20)	July (10-20)	September (5-15)	October (1-10)	Total:
Botany		+	+	+		+		15 field days
Herpetology			+	+	+	+		15 field days

	January (10-20)	March (15-25)	April (10-20)	May (10-20)	July (10-20)	September (5-15)	October (1-10)	Total:
Ornithology	+	+	+		+	+		25 field days
Theriology	+		+		+		+	20 field days
Ichthyology	+	+		+			+	20 field days
Hydrobiology		+	+	+	+			20 field days

Table 193: Monitoring Plan for Ecology Elements

	Suitable Time Period	Responsibility	Purpose
Pre-construction period			
Botany	Spring (from mid-April to end of May)	EPC Contractor	to determine existence of the rare species and relocation if necessary
Herpetology, Theriology	Spring (from mid-April to end of May)	EPC Contractor	to determine existence of the species, nest, burrow, etc. and relocation if necessary,
Ornithology	Spring (from mid-April to end of May), Winter (October-February)	EPC Contractor	to determine existence of the species, nest, burrow, etc. and relocation if necessary,
Ichthyology, Hydrobiology	Spring (from mid-April to end of May)	EPC Contractor	to determine existence of the rare species and define additional mitigation measures
Construction Period			
Botany	Spring - Autumn	EPC Contractor	To observe application of mitigation measures and implementation of the BMP, determine project related impacts and define additional mitigation measures, if needed
Herpetology, Theriology	Spring - Autumn	EPC Contractor	
Ornithology	Spring – Autumn - Winter	EPC Contractor	
Ichthyology, Hydrobiology	Spring	EPC Contractor	
Operation Period			
Botany	Spring - Autumn	Project Company	To observe application of mitigation measures and implementation of the BMP,
Herpetology, Theriology	Spring - Autumn	Project Company	

	Suitable Time Period	Responsibility	Purpose
Ornithology	Spring – Autumn - Winter	Project Company	determine project related impacts and define additional mitigation measures, if needed
Ichthyology, Hydrobiology	Spring	Project Company	

The deadlines for monitoring were chosen taking into account the specificity of the biology of organisms inherent in each of the research groups. The most optimal deadlines were chosen to catch the peaks of the activity of certain organisms in the project area.

Monitoring is carried out for species from the list of species approved by the State Committee for Ecology for Republican.

Also, for a more detailed analysis of the territory, it is required to conduct the following research in the future:

- It is recommended that pre-construction monitoring be linked to pre-construction species research and relocation.
- Collect survey data on the presence / absence of rare species from the local population and fishermen.

No Net Loss (NNL)

The Owner will undertake the following monitoring work in connection with the obligation to meet NNL for the permanently removed habitat. This will be elaborated in the project BMP.

- Perform regular (annual) monitoring to follow the success of compensation planting to achieve no-net loss" using quantitative metrics for a period of at least 5 years;
- Perform regular (annual) monitoring to ensure no invasive species encroach into planting area and correct mix of species diversity;
- Document the entire process (loss-gain calculation, stakeholder consultation, mitigation), Perform "no-net loss" assessment including:
  - Perform a loss-gain calculation to determine the amount of mitigation required to achieve "no net loss" of Natural Habitat and associated biodiversity values.
  - Facilitate stakeholder consultation to validate loss-gain calculation and identify suitable mitigation measures.
  - Document mitigation measures in "no-net-loss" action plan.
  - Implement mitigation measures.
  - Monitor the success of mitigation measures in achieving "no net loss" using quantitative metrics.
- Document the entire process (loss-gain calculation, stakeholder consultation, mitigation, monitoring, achievement of "no net loss") during annual reporting as required by the Project's Biodiversity Management Plan (BMP).
- Use results to inform annual changes to the Habitat Compensation Plan.

10. SOIL, GEOLOGY AND GROUNDWATER

10.1.1 National Standards

The relevant legislation related to soil and groundwater protection, quality of soil, groundwater and geology in Uzbekistan are given below:

- Land Code of the RUz, No.598-I dated April 30, 1998 (as amended on December 23, 2020).
- Law "On Subsoil" No.444-II dated December 13, 2002 (as amended on April 21, 2021).
- Law "On Water and Water Use", No.837-XII dated May 06, 1993 (as amended on April 21, 2021).
- Resolution of the Cabinet of Ministers "On Approval of the Regulations on the Order of Establishment of Water Protection Zones and Sanitary Protection Zones of Water Bodies in the Territory of the RUz" No.981 dated December 11, 2019.
- Decree of the Cabinet of Ministries of the RUz Regulation on Measures for Ground Water Management, Enhancement of Ground Water Protection against Pollution and Depletion, No.179 dated April 18, 1992.
- SanPiN No.0272-09 "Sanitary rules and norms for compiling hygienic justifications for soil protection schemes from pollution".
- SanPiN No.0191-05 "Maximum permissible concentrations (MPC) and Approximate allowable concentrations (AAC) of exogenous harmful substances in the soil".
- SanPiN No.0212-06 "Sanitary rules and norms for the hygienic assessment of soil contamination of different types of land use".
- SHNK 1.02.07-15 "Engineering surveys for construction Basic provisions".
- SHNK 1.02.09-15 "Engineering and geological surveys for construction. Set of rules".
- KMK 2.01.01-94 "Climatic and physical-geological data for design".
- KMK 2.01.03-96 "Construction in seismic areas. Change No.1.
- SHNK 4.02.01-04 "Collection of elementary estimate norms for construction work. Collection Earthwork. Additions and amendments to the technical part".
- KMK 2.03.11-96 "Protection of building structures from corrosion".
- GOST 5180-2015 "Soils. Laboratory methods for determination of physical characteristics".
- GOST 12071-2000 "Soils, selection, packaging, transportation, and storage of measurement".
- GOST 18164-72 "Drinking water. Method for determination of total solids content".
- GOST 4389-72 "Drinking water. Methods for determination of sulphate content".
- GOST 4245-72 "Drinking water. Methods for determination of chloride content".
- GOST 4151-72 "Drinking water. Method for determination of total hardness".
- GOST 31957-2012 "Water. Methods for determination of alkalinity and mass concentration of carbonates and hydro carbonates".

- GOST 9602-2005 "Unified system of protection against corrosion and aging. Underground structures. General requirements for corrosion protection".
- N.N. Goryainov, F.M. Lyakhovitsky. Seismic methods in engineering geology. Moscow, "Nedra": 1979.

Land Code No.598-I aims to regulate land relations in order to ensure that present and future generations have science-based, sustainable use and conservation of land, breeding and improvement of soil fertility, conservation and improvement of the environment and creating conditions for equitable development of all forms of management, the protection of individuals and legal entities' right for land, as well as strengthening the rule of law in this area.

Law "On Subsoil" aims to regulate relations arising from the possession, use, and disposal of subsoil (mountain relations).

SanPiN No.0272-09 provides the basic requirements for development of hygienic justification for the soil protection schemes against pollution, duties, and functions of state sanitary supervision bodies in this area.

SanPiN No.0191-05 defines MPC and AAC values of chemicals and pesticides polluting the soil. MPCs and AACs are designed to ensure that there is no negative direct or indirect impact on human health, its future generations, and public health through soil contact.

SanPiN No.0212-06 provides a unified methodology for hygienic assessment of soil pollution using a nomenclature of indicators of soil hygienic condition, which should be used both in the development of regulatory and technical documentation on the hygiene of soils, and in assessing the degree of its pollution.

10.1.2 Lender Requirements

IFC PS-3 (Resource Efficiency and Pollution Prevention) states that "the client will avoid the release of pollutants or, when avoidance is not feasible, minimize and/or control the intensity and mass flow of their release. This applies to the release of pollutants to air, water, and land due to routine, non-routine, and accidental circumstances with the potential for local, regional, and transboundary impacts. Where historical pollution such as land or ground water contamination exists, the client will seek to determine whether it is responsible for mitigation measures. If it is determined that the client is legally responsible, then these liabilities will be resolved in accordance with national law, or where this is silent, with GIIP."

There are no detailed numerical requirements to soil quality established by IFC guidance documents. Therefore, the Dutch Standards will be used to compare with national standards to identify maximum allowable concentrations for contaminants in soil, sediment, and groundwater (see Table 194).

Table 194: Soil Quality Parameters with National Standards

Parameter	Unit	National Standard (SanPİN No.0191-05)	Dutch Intervention Values 2013 (Soil Remediation Circular 2013)
Antimony	mg/kg	4.5	22
Arsenic	mg/kg	2.0	76
Barium			-
Cadmium	mg/kg		13
Chromium	mg/kg	6.0	
Chromium VI	mg/kg		78
Cobalt	mg/kg	5.0	190
Copper	mg/kg	3.0	190
Mercury (organic)	mg/kg	2.1	4
Lead	mg/kg	32.0	530
Molybdenum	mg/kg	10.0	190
Nickel	mg/kg	4.0	100
Selenium	mg/kg		100
Zinc	mg/kg	23.0	720
Cyanides	mg/kg		20 (free) 50 (complex)
Benzene	mg/kg	0.3	1.1
Ethylbenzene	mg/kg		110
Toluene	mg/kg	0.3	32
Xylenes (sum)	mg/kg		17
Styrene (vinylbenzene)	mg/kg	0.1	86
Phenol	mg/kg		14
Vanadium	mg/kg	150.0	250
Nitrates	mg/kg	130.0	-
Sulphates (H_2SO_4)	mg/kg	160.0	-
Total Petroleum Hydrocarbons (Mineral Oil)	mg/kg		5,000
PAHs (total)	mg/kg		40
Ammonia Nitrogen	mg/kg		1.5

10.1.3 Other Requirements

ASTM D 1586/ D1586M-18 "Standard Test Method for Standard Penetration Test and Split-Barrel Sampling of Soils".

10.2 Baseline Data

10.2.1 Survey Methodology

Territory of Uzbekistan forms part of the Turan Platform. Its multiply folded basement, which includes sedimentary, metamorphic and igneous rocks, belongs to the Uralo-Mongolian Late Paleozoic orogenic belt. Major ancient continental blocks are the Kazakh and Karakum-Tajik microcontinents separated by the Turkestanian paleo-oceanic structure. The latter originated by rifting during Late Proterozoic and closed progressively from the Ordovician through the Early Triassic. The last collision of both microcontinents followed the formation of a large nappe pile intruded by granite in S of Uzbekistan and the formation of a volcanic-plutonic belt in the N. Mesozoic and Cenozoic terrestrial and shallow-marine platform sediment unconformably overlie the orogenic belt. A Late-Neogene-Quaternary secondary orogeny formed the present appearance of the territory.

The platform consists of weakly deformed sedimentary rocks of Jurassic to Recent age. The SE part of the Turan Platform underwent secondary orogenic process the same as in the Alpine fold beIt (Pamir). As a result of this secondary tectonic activity, a new orogenic belt – The Tien Shan Mountains – appeared. This special geological position of the country has two advantages from the angle of regional geology; on one hand, through new tectonic activity the basement of the platform was exposed, which made it possible to investigate its composition and structure, and on the other hand, the existing geological relations within the basement were not affected by renewed movements, as frequently is the case in the high mountain parts of Tien Shon. These phases of deformations leaded to development of the current geological and tectonic settings which several active faults cross the region and control the seismicity as well as geological settings of the study area. These active faults are present at the north and southeast of the study area.

10.2.2 Geomorphological Structure and Hydrographic Network

The study area is located in the Termez district of the Surkhandarya region, south of the Republic of Uzbekistan. This area is at the north of the Amudarya River and at the northeastern coast of Uchkizil Reservoir. The main units covering the area are the Quaternary Upper Section (QIII), Quaternary Holocene (Qh), Upper Pliocene (N2-2) and Upper Miocene-Pliocene (N1-2) formation. However, the QIII unite dominantly covers the majority of the area and the study area is within this unit (see Figure 152). This unit is a sequence of various Alluvial, fluvial deposits, which the main lithological unit is sand.

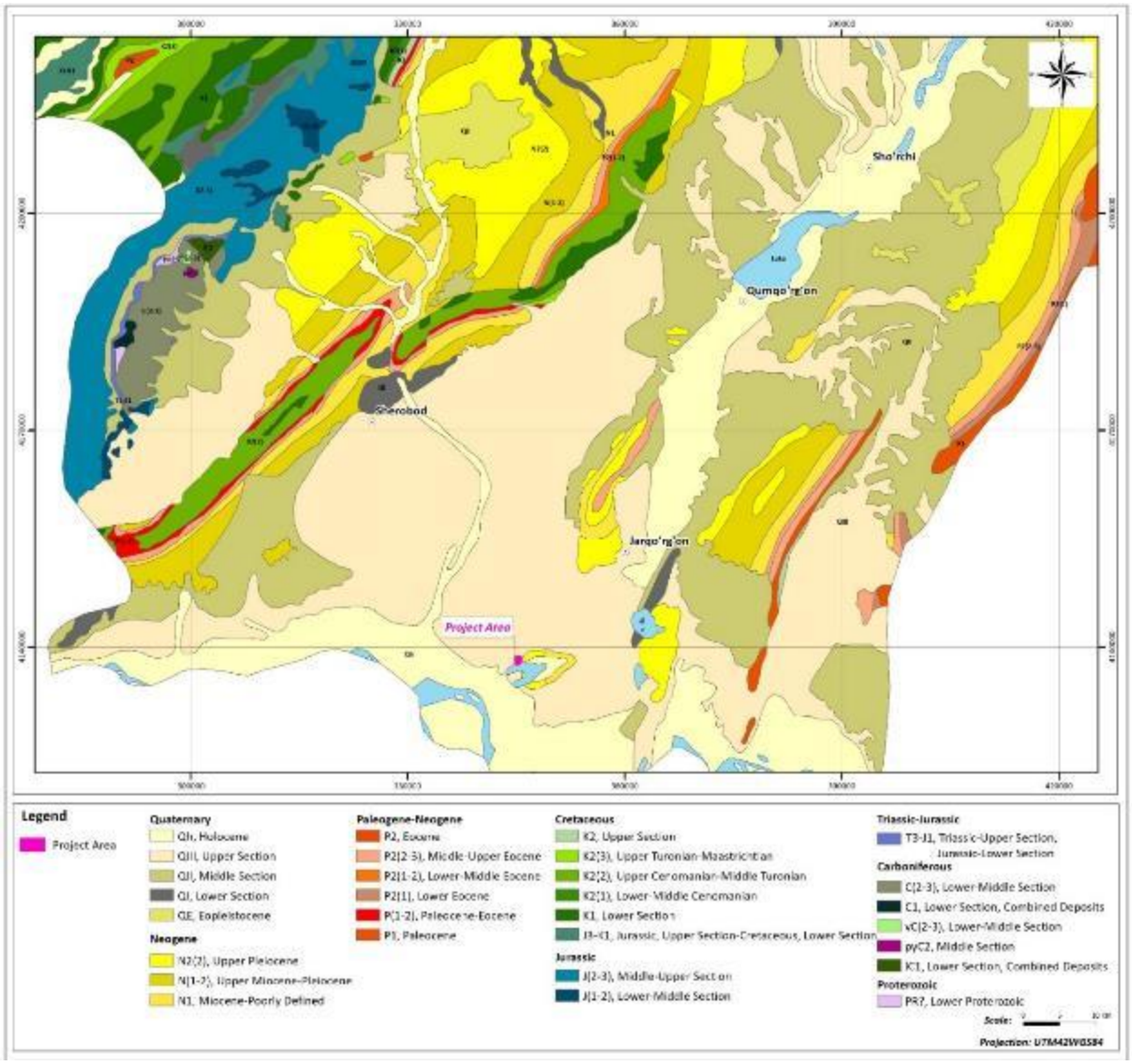


Figure 152: Geological map of the region

10.2.3 Local Geology

In the study area, the surface is covered with the Quaternary deposits and the top soil with vegetation is dominantly covering the most of the parts. However, from place to place, Aeolian sand dunes also can be observed (see Figure 152). Towards south, the study area is limited to the Uchkizil Reservoir. On the other hand, considering the morphology of the study area, no surficial feature is apparent and the area is almost flat with a very gentle undulation and very gentle slope towards south. This morphology changes at the coastal zone in which, the elevation drops more than 20 meters (see Figure 153).

In order to assess the subsurface geological structure of the study area and understanding the lateral and vertical variations of the lithological units, 4 boreholes within the study area were drilled. These boreholes are clustered at the center of the area as illustrated in Figure 154 and all have the maximum depth of 30 m. They were used to obtain the core measurement as well as disturbed soil Measurement from the subsurface which, in one hand are used in determination of the geological units and on the other hand, are used in various laboratory tests.

The lithological units of all boreholes are almost similar with slight variation. The top soil is a common unit that is present in all boreholes and contains vegetation and has the thickness between 20 cm to 40 cm. below this unit there is a sand layer, which in BH-7 is classified as Aeolian sand but this Aeolian sand is not present in other boreholes. This sand layer has 1 m - 1.5 m of thickness. Further down, a relatively thick layer of granular Gypsum with thickness varying between 7-9 m underlain by a relatively thinner layer of sand (2.5 - 4 m of thickness). Below these layers, there is a relatively thin layer of clay (between 90 cm and 1.7 m of thickness) and the lower unit which, is encountered in the drilling program is a thick sandstone layer with thickness of about 16 m - 17 m. In addition, dividing the lithological units into two major groups seems to be logical, the loose top layer of sand and sandy materials with thickness of about 14 m and hard sandstone layer with thickness of about 16 m.

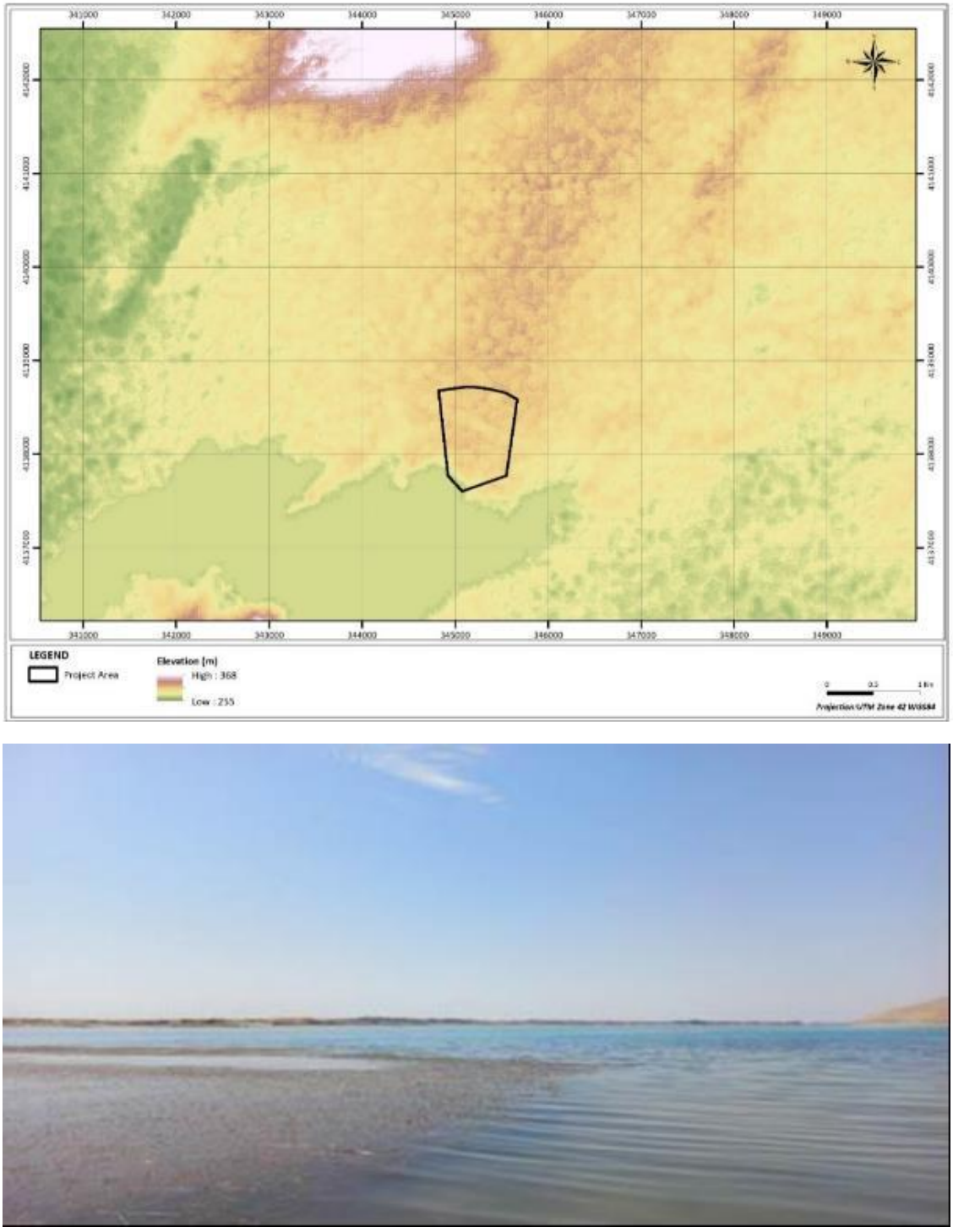


Figure 153: Topography of The Region (Top) and (Bottom) A View from The Uchkizil Reservoir

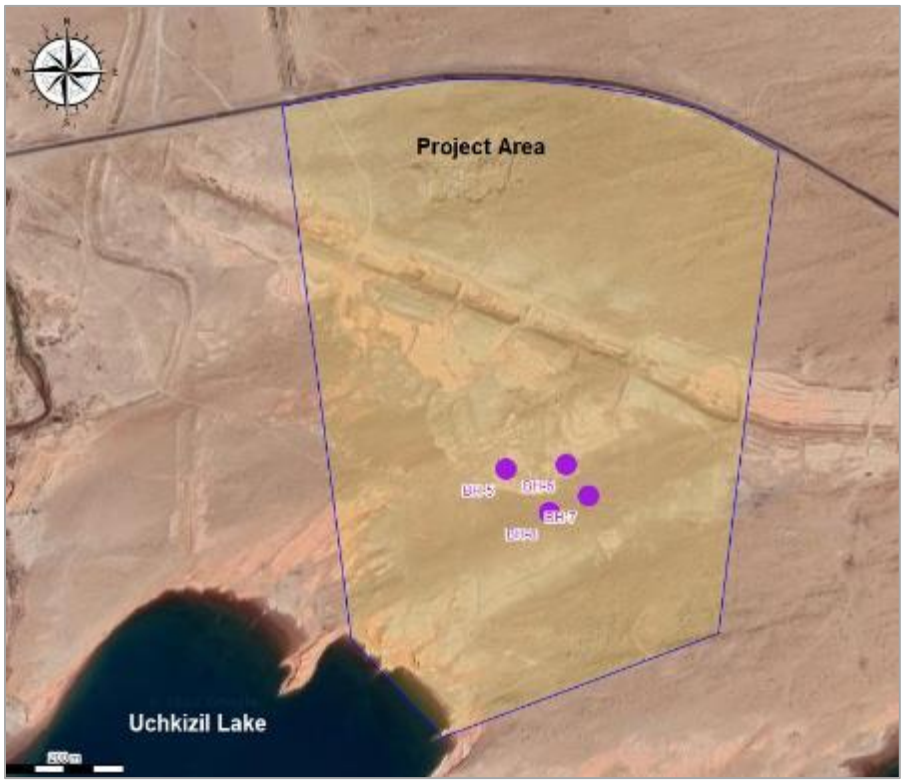


Figure 154: Location Map of The Boreholes

10.2.4 Geotechnical investigations

To assess the properties of the materials, which are present in the area, several geotechnical tests were conducted. These tests include downhole seismic survey (Goryainov and. Lyakhovitsky 1979) in two boreholes, which was yielded the one-dimensional velocity structure of the area, and performing in-situ and laboratory test. The in-situ tests include the Standard Penetration Test (SPT) and various laboratory tests to determine the physical properties as well as the grain size of the soils, which are present in the area.

It must be noted that the various engineering surveys, which were carried out are in accordance with the requirements of KMK 2.01.01, KMK 2.01.03, SHNK 1.02.07, SHNK 1.02.09 and SHNK 4.02.01 standards. However, in some tests and data processing, ASTM standards also were benefited.

The results of the downhole seismic logging confirm the general classification of the lithological units into two layers. These results show two distinct layers with very different velocity structures. The top layer has primary wave velocity (Vp) between 480 m/s and 620 m/s with the average of 535 m/s, and shear wave velocity (Vs) between 250 m/s and 280 m/s with the average of 265 m/s. the second layer, on the other hand, has significantly higher velocities with Vp ranging between 2240 m/s and 2760 m/s with the average value of 2510 m/s and Vs values ranging between 850 m/s and 1120 m/s with the average value of 980 m/s.

In addition, the obtained Vs values were used to calculate the harmonic average of shear wave velocity for top 30 m (Vs30), the calculated Vs30 values for BH-6 and BH-8 are 550 m/s and 574 m/s respectively. In this regard, the site will fall into class C (Dense soil and soft rock) according to NEHRP, National Earthquake Hazard Reduction Program

In total 41 SPT tests were carried out according to ASTM-D 1586 in 4 boreholes, at the depths varying from 1.5 m to 16.5 m. the result reveal that, at the depths of more than 11 m-12 m the SPT N values (more details can be seen in "the Project Surkhandarya, Interpretive Geotechnical Report") pass the value of 50 and it can be inferred that the materials which are present at this depth have high strength.

On the other hand, soil laboratory measurements were performed on the Measurement obtained from the different depths and units in each boreholes and the results show that the upper soil layers have the average particle density of 2.74 gr/cm^3, Average dry density of 1.59 gr/cm^3 and average bulk density of 1.97 gr/cm^3 whereas the lower sandstone layer has the particle density of 2.67 gr/cm^3, average dry and bulk densities of 2.33 gr/cm^3 and 2.38 gr/cm^3 respectively. All parameters were obtained in accordance to GOST 5180-2015.

The ground water level (GWL) also was measured in all boreholes and the results show that the GWL is below 12.7 m depth for all boreholes. Hence, it can be inferred that, the surficial soil layers, which have lower SPT values and low elastic wave velocities, located above the GWL and are unsaturated.

Additionally, the water Measurement were taken to perform the chemical analysis on the collected Measurement according to GOST 12071-2014. A standard chemical analysis was performed on groundwater Measurement in accordance with GOST 18164-72; GOST 4389-72; GOST 4245-72; GOST 4151-72; GOST 31957-2012.

The content of SO4 ions "varies from 1670.0 to 2890.0 mg / l, with an average content of 2250 mg / l, Cl 'ions - varies from 730.0 mg / l to 4158.0 mg / l, with an average content of 1680 mg / l. Hence, with respect to GOST 9602, the water can be considered as corrosive and corrosion resistance cements must be used during the construction.in order to protect the construction from the negative effects of corrosion in accordance to KMK 2.03.11-96.

10.2.5 Hazardous Phenomena

10.2.5.1 Earthquake Hazards

In Uzbekistan and surrounding regions, there have been several earthquakes with magnitude ML>7 in historical and modern times (see Figure 155). Therefore, maintenance of seismic safety is vital. The seismicity of the study area is controlled by several active faults as presented in Figure 155. Additionally, the seismic activity maps. The solution maps reveal that the dominant faulting in the region is Reverse in the mega seismic zone of the southern Uzbekistan. The study area is roughly 50 km away from the closest active fault and therefor is prone to effects of the seismic activity. According to research undertaken by the Institute of Seismology under the Academy of Science of the Republic of Uzbekistan, the seismic hazard zone map of Uzbekistan is presented in Figure 156. According to the generated map, the study area is located in seismic zone of 7.

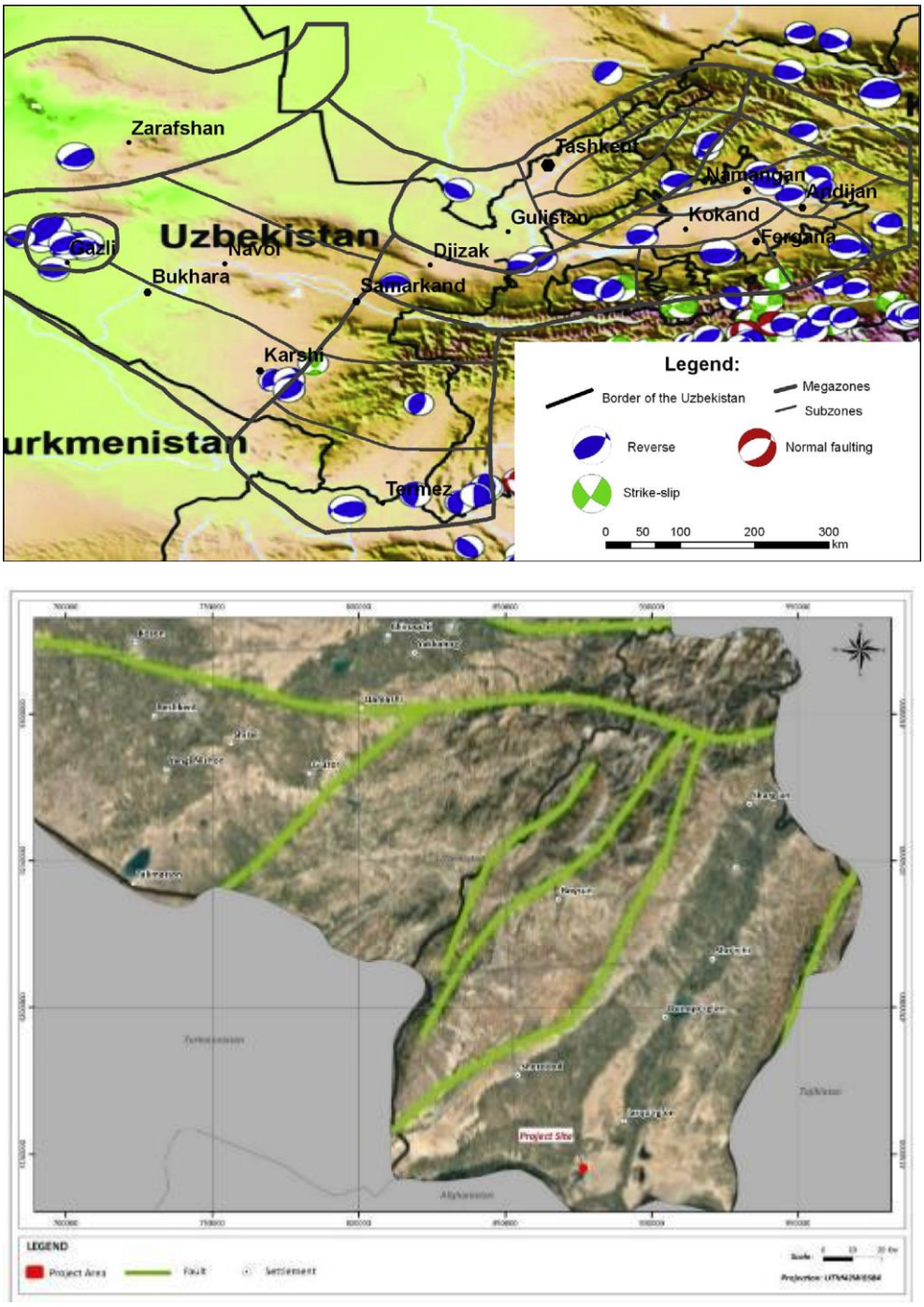


Figure 155: Focal Mechanism Solutions of Large Earthquakes Occurred From 1976 To 2013 (Top) and Map of Active Faults in The Region (Bottom)

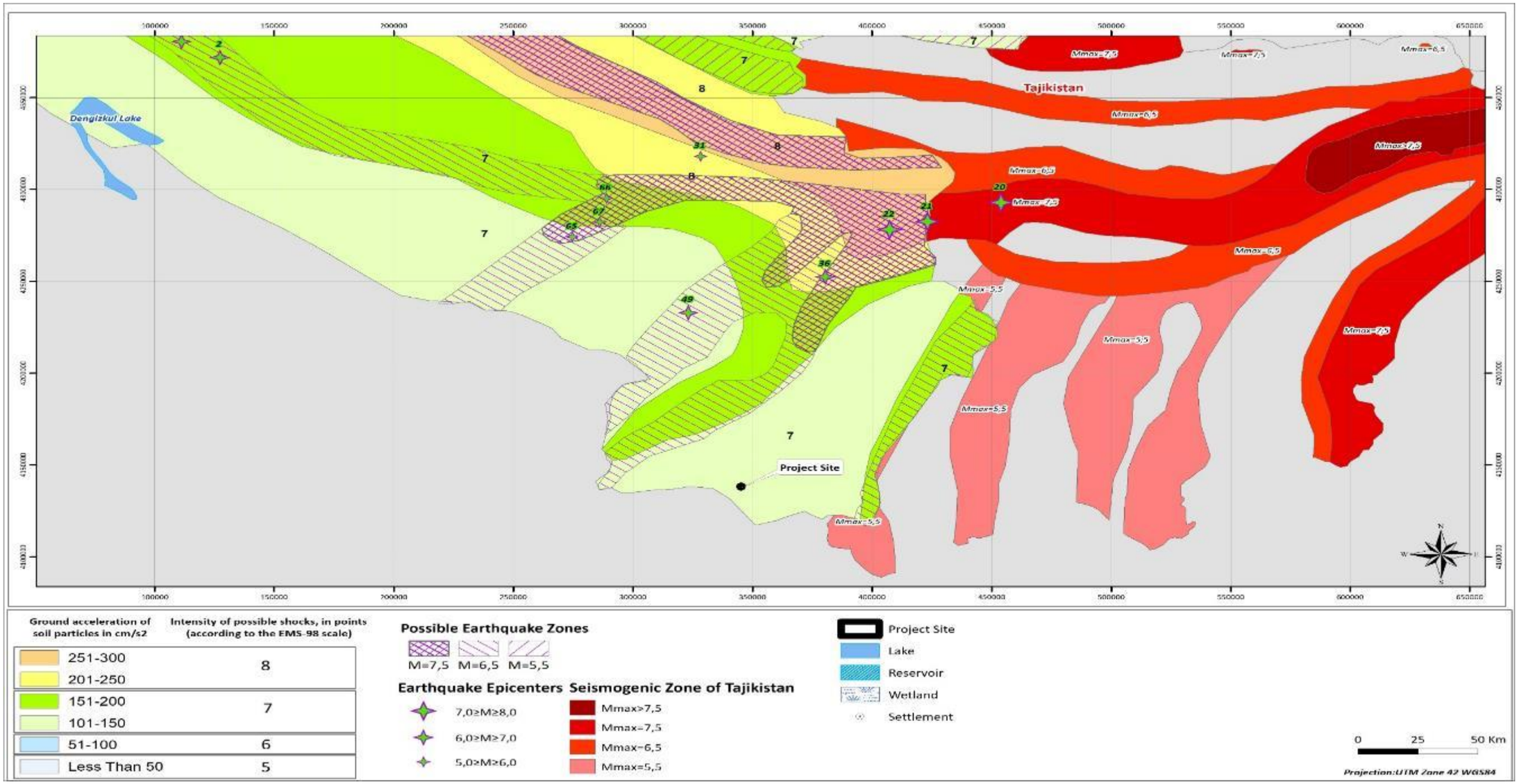


Figure 156: Seismicity Zone Map

On the other hand, while the dominant surficial material in the area is sand with the thickness of about 12 m, liquefaction can be another hazardous phenomena, however, while the surficial sand layer is above the water level, and lower sandstone has high strength the possibility of liquefaction is low. But, by changing in the current setting including the water level (which might change in different seasons) the possibility of the liquefaction must be assessed.

10.2.6 Sand Dune Migration and Aeolian sand transportation

While the Aeolian sand is present in the study area and there are sand dunes in various locations of the area, the sand dune migration as well as the sand transportation can induce hazard on the future structures. Also considering that the wind is one of the major transportation factor in the area as discussed in details in "The Project Surkhandarya, Interpretive Geotechnical Report" and there are various dominant directions of wind blow as shown in the wind rose diagram (see Figure 157), the effects of Aeolian sand should be considered and minimized by using engineering solutions.

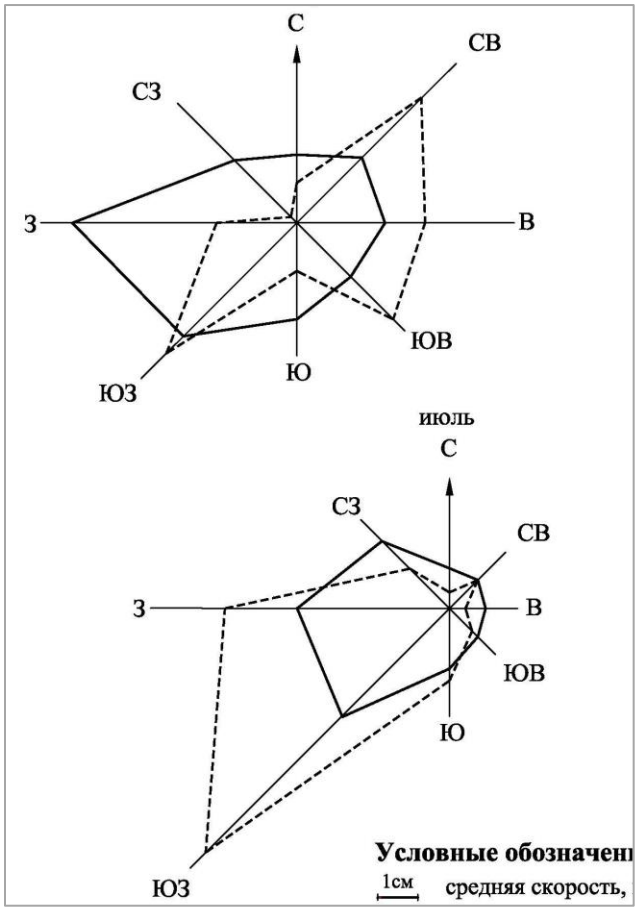


Figure 157: Wind Rose Diagram Maps. The dominant wind directions are shown with dashed lines for cold season (top) and warm season (bottom)

10.2.7 Groundwater

Groundwater and interstratal waters in the foothills are formed due to atmospheric precipitation and the inflow of groundwater from the mountains, occur at a depth of 3-10 m in river valleys, and at a depth of 50 m in the mountainous part. In the mountains, in some places they pinch out in the form of springs.

In hydrogeological terms, the following aquifers are distinguished in the study area:

- Aquifer complex of Oligocene deposits: sandstones, interbedded with clays and siltstones;
- Aquifer complex of chalk deposits: interbedded strata of sandstones, clays, less often limestones, sands, conglomerates, siltstones;
- Aquifer complex of Jurassic deposits: sandstones, gypsum, siltstones, clays, limestones, conglomerates [12]

10.2.7.1 Groundwater Quality Survey

Groundwater sampling activities were conducted in order to determine the baseline groundwater conditions in the Project area. The groundwater sample was taken from 1 point (UW-01) between July 9 and July 16, 2021 (see Table 195). Groundwater sampling stations are presented in Figure 158. Since there is no existing groundwater well in the Project area, one sample was taken from the closest well to the area. Prior to construction activities, the EPC contractor shall analyse the groundwater to document there is no any groundwater contamination from the wells to be drilled in the Project area.

Table 195: Groundwater Quality Sampling Station Coordinates

Monitoring Station	Station Location	Coordinates (deg/min/sec)
UW-01	SSG Kattakum Yangi Hayot Street, 24	N = 37°22’50,30" E = 67°13’34,62"

Figure 158: Locations of The Groundwater Quality Sampling Station (UW-01)

Sampling and analysis were conducted (see Figure 159) by an accredited laboratory of Yuksak Musaffo Tabiat LLC Company in accordance with the established state standards as specified by the corresponding regulatory, methodological and instructive documents.

Figure 159: Sampling of Groundwater at UW-01

Groundwater sampling was carried out in accordance with GOST 31861-2012 "Water. General requirements for sampling". The list of methods used to detect the substances in soil and bottom sediments is presented in Table 198. Assessment of the qualitative composition of

groundwater was carried out in accordance with O'z DSt 950: 2011 "Drinking water. Hygiene requirements and quality control".

The results of groundwater quality studies are presented in Table 196. Accordingly;

- The pH is within the normal range at 8.13.
- Mineralization in groundwater samples that were analysed as 1.69 g/dm^3.
- Sulphates, aluminum, iron, manganese, copper, nickel, lead and zinc concentrations are below the MPC
- Suspended solid concentrations are analysed as 194 mg/dm^3,
- Nitrite nitrogen concentrations are analysed as 0.009 mg/dm^3
- COD concentrations are found as 26.4 mg/dm^{3,}
- BOD concentrations are found as 2.37 mg/dm^3,
- The concentrations of the following parameters exceed the MPC:
    - Chloride (1.37 times of MPC),
    - Cadmium (5.8 times of MPC),
    - Mineralization (1.6 times of MPC).

The exceedance of chloride, cadmium, and mineralization can be caused by both natural and anthropogenic sources as follows:

- The presence of chloride in groundwater can result from the weathering of soils and common contamination sources are animal waste, fertilizer, and septic systems.
- Cadmium is a non-essential trace element that is widely distributed in the environment. Both geogenic and anthropogenic sources can elevate Cd concentrations in soils and groundwater.
- The groundwater mineralization is influenced by precipitation, base ion exchange process, anthropogenic activities, and water-rock interaction through weathering.

Since the groundwater sampling station is near agricultural areas, agricultural activities such as fertilizing, animal faces, etc. can cause an exceedance of MPC from these parameters.

Table 196: Groundwater Measurement Analysis Result

Parameters	Unit	Analysis Result	National Limit Value (O'z DSt 950:2011)
pH	-	8.13	6-9
Suspended substances	mg/dm^3	194	N/A
Ammonium nitrogen	mg/dm^3	<0.2	N/A
Nitrite nitrogen	mg/dm^3	0.009	N/A
Nitrate nitrogen	mg/dm^3	<0.09	45
Chlorides	mg/dm^3	343.86	250
Sulfates	mg/dm^3	338.8	400
Phosphates	mg/dm^3	0.08	3.5
Mineralization	mg/dm^3	1,694	1000
COD	mg/dm^3	26.4	N/A
BOD_5	mg/dm^3	2.37	N/A
Cyanides	mg/dm^3	<0.03	N/A
Hydrogen sulfide	mg/dm^3	<1.0	N/A
Aluminum	mg/dm^3	0.011	0.2
Barium	mg/dm^3	<1.0	0.1
Vanadium	mg/dm^3	<0.005	-
Cadmium	mg/dm^3	0.0058	0.001
Potassium	mg/dm^3	49.71	-
Sodium	mg/dm^3	73.90	-
Iron	mg/dm^3	0.101	0.3
Manganese	mg/dm^3	0.0237	0.1
Copper	mg/dm^3	0.00535	1
Nickel	mg/dm^3	0.0115	0.1
Mercury	mg/dm^3	<0.000005	0.0005
Lead	mg/dm^3	0.0186	0.03
Chromium (+3)	mg/dm^3	0.000036	N/A
Chromium (+6)	mg/dm^3	<0.0005	0.05
Zinc	mg/dm^3	0.00998	3

10.2.8 Soil

The soils of the Surkhandarya region are located in a continental climate, with intense solar radiation, aridity and at various absolute elevations from high mountains to foothills and sloping valleys. This creates conditions for the manifestation of a wide zoning. The following types of soils are identified in Surkhandarya region:

- Belt of light brown soils (highlands).
- Belt of brown soils (medium-altitude mountains with a highly dissected relief).
- Belt of dark gray soils (foothills and low mountains).
- A belt of typical gray soils (low mountains and sloping piedmont plains).
- Belt of light gray soils (foothills and piedmont wide-wavy plain).
- Semi-fixed and non-fixed sands.

Analysis of the areal distribution of soil types shows that 47% of the area falls on typical gray soils - 1579.82 km². In second place are light gray soils - 849.8 km2 (25% of the area). The third and fourth places are occupied by dark gray soils (495.3 km², 15% of the area) and brown soils (424.2 km², 12% of the area).

At the Site there are typical sierozem soils of medium and light loamy, medium washed out, saline, in places crushed, overlying the proluvium and eluvium of tertiary saline rocks. Poor pastures, selectively rainfed crops are developed on these soils. Typical serozems are characterized mainly by medium and light loams, with well-built skeletal cartilaginous filler of bedrocks.

The formation of the soil cover of the Project area under consideration is largely influenced by climatic conditions, the original underlying sediments of a variegated composition and heterogeneous structure with interbedded sands, loams, and clays, which are characterized by semi desert factors of soil formation, with the influence of saline groundwater.

The soil cover on the high terraces is represented by light gray soils in combination with old-irrigated gray soils. Old-irrigated soils were formed with periodic participation of groundwater. In terms of texture, loamy soil varieties prevail, formed on loamy-pebble and loamy-sandy deposits. Salinization is observed in some places. The content of carbonates increased to 6-9%. In the case of drainage, which ensures a constant outflow of groundwater, salinization is not threatening.

The landscape of the Project area is characterized by an exposed bedrock surface.

To the north of the construction site, to the east and west, the soil layer is represented by dark gray soils, eroded, loamy and rubble loamy. The soils are formed on skeletal-fine earthy diluvium and eluvium, subject to water erosion, moderately washed away, the humus content is low (1-1.5%).

Like other intermontane valleys of Central Asia, the Surkhan-Sherabad valley, where the gas-steam power plant is planned to be located, is a densely populated ancient agricultural oasis. Most of the valley is occupied by cultural landscapes (mainly agricultural and residential landscape).

In general, there are degraded areas of anthropogenic origin in the project area. There are quarries for the extraction of clay for the production of bricks and the extraction of sand. All this led to a strong degradation of the substrate on the territory.

10.2.8.1 Soil Quality Survey

Soil sampling activities were conducted in order to determine the baseline soil quality conditions in the project area. Soil Measurement were taken at three locations (i.e. S-01, S-02, S-03) and the background observation point (S-04) between July 9 and July 16, 2021 (see Table 197 and Figure 160.). Soil sampling stations are presented in Figure 160.

Soil samples are selected to represent the Project area and its surroundings. S-02 and S-03 stations are selected from agricultural areas; S-01 is selected within the Project area. S-04 is the natural soil.

Table 197: Soil Quality Sampling Station Coordinates

Number of Monitoring Station	Station Location	Coordinates (deg/min/s)
S-01	700 meters south of the Angor-Hairaton road	N = 37°22’39,3" E = 67°15’02,4"
S-02	500 meters north of the Angor-Hairaton road	N = 37°23’20,6" E = 67°14’21,8"
S-03	600 meters from the 4P23 motor road	N = 37°21’05,3" E = 67°14’59,7"
S-04 (background observation point)	800 meters from the sanatorium of Uzbek Railways	N = 37°21’13,2" E = 67°12’40,2"

Figure 160: Locations of the Soil Quality Sampling Stations

Sampling and analysis were conducted by an accredited laboratory which is Yuksak Musaffo Tabiat LLC Company in accordance with the established state standards as specified by the corresponding regulatory, methodological and instructive documents.

Soil sampling was carried out using a sampler or manually in accordance with GOST 17.2.3.01-83 "Nature protection. Soils. General requirements for sampling". The list of methods used to detect the substances in soil and bottom sediments is presented in Table 198.

Table 198: The list of Methods Used to Detect the Substances in Soil and Bottom Sediments

The component being defined	The name of the measurement procedure (MVI)
pH	GOST 26423-85 Soils Methods for determination of electrical conductivity, pH and dense residue of water extract
Chlorides in water extract	GOST 26425-85 Soil Methods for determination of chloride ion
Sulfates in water extract	GOST 26426-85 Soils Methods for determination of sulfate ion
Calcium in water extract	GOST 26428-85 Soils Methods for determination of calcium and magnesium in water extract
Magnesium in water extract	GOST 26428-85 Soils Methods for determination of calcium and magnesium in water extract
Nitrates	O ' z O ' U 0595: 2013 "Procedure for measuring the mass fraction of nitrates in soil by the photocolorimetric method"
Petroleum products	O ' z O ' U 0750: 2017 Methodology for measuring the mass fraction of petroleum products in soil and soil Measurement by the fluorimetric method on the fluid analyzer "Fluorat-02"

The component being defined	The name of the measurement procedure (MVI)
Lead	O ʻz O ʻU 0482: 2009 "Methodology for measuring the mass fraction of lead in water and soil by the atomic absorption method"
Cadmium	O ʻz O ʻU 0502: 2010 "Methodology for measuring the mass fraction of cadmium in water and soil by the atomic absorption method"
Ferrum	O ' z O ' U 0475: 2009 "Procedure for measuring the mass fraction of iron in soil by the atomic absorption method"
Copper	O ʻz O ʻU 0807: 2020 "Methodology for measuring the mass fraction of copper, lead, zinc and cadmium water-soluble, mobile and acid-soluble phori in soil Measurement by the atomic absorption method"
Zinc	O ʻz O ʻU 0807: 2020 "Methodology for measuring the mass fraction of copper, lead, zinc and cadmium water-soluble, mobile and acid-soluble phori in soil Measurement by the atomic absorption method"
Chrome $^{3+}$	O ʻz O ʻU 0510: 2010 "Methodology for measuring the mass fraction of chromium in soil by the atomic absorption method"
Chrome $^{6+}$	O ʻz O ʻU 07.0142: 2000 MVI of chromium mass fraction in soil Measurement by photocolorimetric method
Nickel	O ʻz O ʻU 290: 2006), "Procedure for measuring the mass fraction of copper, zinc, nickel, manganese in powder Measurement of rocks and soils by the atomic absorption method"
Manganese	O ʻz O ʻU 290: 2006), "Procedure for measuring the mass fraction of copper, zinc, nickel, manganese in powder Measurement of rocks and soils by the atomic absorption method"
Mercury	O ʻz O ʻU 0422: 2009 "Methodology for measuring the mass fraction of mercury in water and soil by the atomic absorption method"
Selenium	O ʻz O ʻU 0485: 2010 "Methodology for measuring the mass fraction of selenium in water and soil by the atomic absorption method"
Arsenic	O ʻz O ʻU 0521: 2011 "Methodology for measuring the mass fraction of arsenic in water and soil by the atomic absorption method"
Sodium	M-MVI-80-2008 "Methodology for measuring the mass fraction of elements in Measurement of soils, grounds and bottom sediments by atomic emission and atomic absorption spectrometry"
Potassium	M-MVI-80-2008 "Methodology for measuring the mass fraction of elements in Measurement of soils, grounds and bottom sediments by atomic emission and atomic absorption spectrometry"

Measurement of the local site (S-01, S-02, S-03) were taken by the "envelope" method 20x20 m from 4 corner points from a depth of 0-0.3 m (humus horizon) and 0.3-0.8 m (soil), and were quartered and mixed in the field. Soil Measurement were taken in special bags for sampling (see Figure 161).

Figure 161: Soil Sampling from The Territory of The Planned Construction of The Project at The Observation Station

The results of soil quality studies are presented in Table 199. The state of the soil was assessed by such indicators as chlorides, sulfates, nitrates, potassium, sodium, oil products, and heavy metal (lead, cadmium, copper, zinc, trivalent chromium and hexavalent chromium, nickel, cobalt, mercury, selenium and arsenic) concentrations.

Table 199: Soil Samples Analysis Result

	Parameters	Unit	Soil Sampling Result			
			S - 04 (Background)	S - 01	S - 02	S - 03
Chemical Analysis	**pH**	-	7.8	7.45	7.52	7.45
	Chlorides	%	0.0029	0.0042	0.006	0.006
	Sulfates	%	0.168	0.024	0.021	0.02
	Calcium	%	0.01	0.018	0.025	0.014
	Magnesium	%	0.008	0.015	0.017	0.012
	Sodium	mg/kg	46.5	53.1	69	55
	Nitrates	mg/kg	12	15.2	14	22.5
	Humus	mg/kg	0.72	0.57	0.62	0.68
	Petroleum products	mg/kg	0.082	0.09	0.06	0.138
	Arsenic	mg/kg	0.107	n/d	0.515	0.981

	Parameters	Unit	Soil Sampling Result			
			S - 04 (Background)	S - 01	S - 02	S - 03
Heavy Metals	**Lead**	mg/kg	9.748	41.724	5.64	6.050
	Cadmium	mg/kg	2.028	1.172	1.076	1.260
	Iron	mg/kg	10.332	11.811	10.185	12.092
	Copper	mg/kg	10.074	11.056	7.938	8.942
	Zinc	mg/kg	52.720	37.100	36.600	35.000
	Chrome (3+)	mg/kg	6.644	9.532	6.640	6.990
	Chrome (6+)	mg/kg	0.98	1.35	1.04	1.25
	Nickel	mg/kg	19.028	16.512	13.454	13.460
	Cobalt	mg/kg	6.040	4.644	3.804	4.204
	Aluminum	mg/kg	3.37	3.21	2.94	2.56
	Mercury	mg/kg	n/d	0.00137	n/d	n/d
	Selenium	mg/kg	0.129	0.155	0.271	0.179

The assessment of soil contamination was carried out by comparing the concentrations of pollutants from the analysis of the monitored area with the corresponding soil indicators of the background site. The initial (S- 04 background) state of soils was determined on undisturbed lands.

In accordance with the analysis result;

- Soil samples are slightly alkaline, pH from 7.45 to 7.80 and contains humus in the range 0.57-0.72%.
- The concentrations of the following parameters exceed the MPC:
  - Sulphates (1.3 – 1.5 times of MPC),
  - Lead at S-01 (1.3 times of MPC)
- S-04 is considered as representative for background concentration because S-04 sampling area is undisturbed natural area. In accordance with following parameters are observed at S-01, S-02 and S-03 stations higher than analysis result of S-04 station (background concentration);
  - Chlorides (1.5-2.5 times higher than background),
  - Calcium and magnesium (1.2-1.8 times higher than background),
  - Petroleum products at S-03 (1.7 times higher than background),
  - Chromium (3+) at S-02 (1.4 times higher than background),
  - Chromium (6+) at S-02 (1.4 times higher than background) and at S-03 (1.3 times higher than background),
  - Selenium (1.2-2.1 times higher than background)

- The content of heavy metals cadmium, copper, zinc, nickel, cobalt does not exceed background values.

- Mercury is present only in sample S-01 in the amount of 0.00137 mg/kg, which is below the MPC (2.1 mg/kg).

Arsenic is present in samples S-02, S-03 and S-04 (background) in amounts below the MPC and is absent in sample S-01.

10.2.8.2 Sediment Quality Survey

In addition to soil quality survey, sediment sampling activities were conducted in order to determine the baseline sediment quality conditions of the Uchkizil Reservoir and the river to the west of the project area. Sediment Measurement were taken at 2 local points (SD-01 and SD-02,) between July 9 and July 16, 2021 (see Table 200). Sediment sampling stations are presented in Figure 162.

Table 200: Sediment Quality Sampling Station Coordinates

Number of Monitoring Station	Station Location	Coordinates (deg/min/s)
BS-01	Uchkizil Reservoir	N = 37°22’26,7" E = 67°14’48,2"
BS-02	Zang Canal	N = 37°22’40,2" E = 67°14’32,0"

Figure 162: Locations of the Sediment Quality Sampling Stations

Sampling of bottom sediments was carried out in accordance with GOST 17.1.5.01-80 “Nature protection. Hydrosphere. General Requirements for Sampling of Bottom Sediments of Water

Bodies for Analysis for Contamination". The list of methods used to detect the substances in soil and bottom sediments is presented in Table 198.

Figure 163: Sampling of Bottom Sediments

Bottom sediments were collected for determination of baseline pollution from the surface layer

The state of bottom sediments of the Uchkizil Reservoir was assessed by such ingredients as pH, humus, chlorides, sulfates, nitrates, calcium, magnesium, potassium, sodium, heavy metals (lead, cadmium, iron, copper, zinc, manganese, trivalent chromium, nickel, mercury, arsenic). The results of bottom sediment studies are presented in Table 201.

Bottom sediments have a slightly alkaline reaction, pH from 7.95 to 8.58 and contain humus in an amount of 0.53-0.74%. The results of chemical analyze showed that the content of sulfates is 1.2-1.3 times higher than the MPC. The content of heavy metals of lead, manganese, mercury, and arsenic does not exceed the MPC standards

Table 201: Bottom Sediment Measurement Analysis Result

Parameters		Unit	Bottom Sediment Sampling Result	
			BS - 01	BS - 02
Chemical Analysis	**pH**	-	7.95	8.58
	Humus	%	0.53	0.74
	Chlorides	%	0.0042	0.0049
	Sulfates	%	0.019	0.021
	Calcium	%	0.01	0.011
	Magnesium	%	0.0072	0.0084
	Sodium	mg/kg	244.625	79.375
	Potassium	mg/kg	55.250	26.615
	Nitrates	mg/kg	7.5	10.8

Parameters		Unit	Bottom Sediment Sampling Result	
			BS - 01	BS - 02
Heavy Metals	**Lead**	mg/kg	17.708	7.278
	Cadmium	mg/kg	1.178	1.810
	Iron	mg/kg	14.674	14.315
	Copper	mg/kg	16.39	16.870
	Zinc	mg/kg	60,120	47,840
	Chrome (3+)	mg/kg	538.040	433.400
	Nickel	mg/kg	7.568	14.221
	Mercury	mg/kg	23.604	25.252
	Arsenic	mg/kg	0.0193	0.00337

10.3 Potential Impacts, Mitigation, Management & Residual Impacts

The most significant impact on soil, sediment, and groundwater will be caused during the construction phase of the Project; therefore, the construction works will be planned to minimize the adverse impacts to the possible extent. Moreover, the construction technique is also significant in reducing the time taken to construct the Project and consequently, the environmental disturbance.

Environmentally, the major activity that should be considered regarding the construction activities is the excavation. Following commencement of the construction activities, a detailed excavation plan must be developed that provides excavation and backfill for the entire site. The plan should include requirements for equipment methods, soil stabilization, dewatering, rock removal, if any, and backfill. It should also include the economic disposal of spoil materials.

The materials arising from excavation will be used for backfilling, road construction, land levelling and elevation adjustment to the extent possible.

For the purpose of final storage of surplus excavation materials stemming from excavation works, which cannot be used within the scope of the project, a surplus material storage area will be selected. For storage of the surplus excavation material, storage will be made in a stepwise manner to prevent landslide and pouring of materials. Bevel angles of steps will be arranged in an inclined manner to assure the stability of materials to the extent possible. Surplus material will be stored according to the structure of the material and mitigated against wind and rain erosion.

Due to rainfall in the region, the potential for soil erosion at the worksites will largely be confined to episodic intense rainfall events resulting in surface water run-off. In this respect, necessary precautionary actions will be taken such as rainwater collection channels and pools.

On-site refueling of the heavy-duty earthmovers will be conducted via a specially designed stationary refueling area with impermeable concrete standing, The bottom of the refueling area will be sloped to the rear side and possible leakages will flow to the side of the area where they could be collected and removed without reaching the soil.

Site contamination will be prevented with appropriately designed storage options and adoption of strict fueling and spill control procedures, as well as appropriate spill response measures. Floors of hazardous material storage areas will be leak-proof and equipped with a drainage system. Moreover, appropriate storm water management procedures will be applied to ensure that contaminants are not mobilized into the wider environment. Domestic and industrial wastewater during the site preparation & construction phases will be treated in accordance with the standards specified in the Uzbekistan legislation.

There is a risk of contamination groundwater where fuel or lubricant spillage occurs. Therefore, adsorbent materials with adequate amount and characteristics will be made available for oil leakage that may be caused by earthmovers and vehicles during excavation, filling, transportation operations carried out in the field so that any possible contamination of the soil.

The adoption of good on-site working and storage practices and the implementation of suitable control measures, on-site training, and the emergency preparedness will ensure that the potential contamination is avoided.

10.3.1 Construction Phase

In the process of organizing production, the impact on soils is due to the processes of removal, movement, compaction of soils during the construction of foundations and installation of equipment. In the process of soil compaction, their physical and mechanical properties will change. The nature of the impact is local, irreversible. The impact is weak.

Soil contamination during construction work is possible with the spill of oil products used as fuel for mobile vehicles and construction equipment. However, the pollution will be minor and localized. Due to poor solubility, oil products will have a low migration capacity and will not pose a hazard to groundwater. The likelihood of a fire occurring due to fuel spills is also low. In general, during the construction period, soils and groundwater contaminated with oil products will have a minor risk to the environment and personnel safety.

The presence and use of such dangerous and hazardous chemicals increase the probability of accidental spills or releases of minor quantities of these materials into the receiving hydrological environments. Further, site preparation activities and associated construction of infrastructure can result in increased sediment loads in reservoir.

To further minimize the impact on the environment of soils contaminated with oil products, it is recommended to collect contaminated soil layers in a specially provided container with subsequent disposal.

The potential impacts on the soil, bedrock and groundwater during the site preparation and construction phases and measures to be applied are presented in Table 202. As seen from the table, the impacts of the activities on soil, bedrock, and groundwater will vary between

minor and moderate assuming that good soil and hazardous waste management are applied on site.

Table 202: Impacts Significance of the Soil, Sediment and Groundwater and Mitigation Measures during Construction Phase

Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Temporary disturbance on soil, and ground water from excavation works	Soil Quality, Groundwater Quality in neighboring farms	Medium	Medium	Moderate	The impact of existing access routes across the site from and to the different communities and farms will be assessed and an alternative route provided before the commencement of construction activities. The alternative routes provided by the company will be marked in local languages and easy-to-read signs to prevent local communities from wandering into construction areas. Project activities will be only done in the project area, not beyond the border to avoid any increase in the footprint of the project.	Minor
Risks of contamination on soil, and ground water	Soil Quality, Groundwater Quality in neighboring farms	Medium	Medium	Moderate	Any leaks/damage to the soil and groundwater will be prevented through appropriately designed storage options. Strict fueling and spill control procedures will develop as well as emergency clean-up procedures. The quantities of hazardous substances will limit at site to reduce the risk of spillage. Areas where spillage of soil contaminants occurs will be excavated (to the depth of contamination) and suitably rehabilitated. If any other minor spillage occurs, the spillage will be cleaned immediately and the contaminated area will be rehabilitated. All contaminated material will be suitably disposed of.	Minor
Accidents	Soil Quality, Groundwater Quality in Neighboring farms	Medium	Medium	Moderate	The Contractor will develop a "Training Plan" for the personnel on fueling and spill control procedures as in line with the Environmental & Social Management System. The contaminated soil and treat as hazardous waste will remove, promptly.	Minor

10.3.2 Operational Phase

The key contamination regarding the soil, bedrock, and groundwater is associated with the potential leakage and spills during the plant operations and the storage of hazardous materials in the plant.

Site contamination will be prevented with appropriately designed storage options and the adoption of strict spill control procedures, as well as appropriate spill response measures. Floors of hazardous material storage areas will be leak-proof and equipped with a drainage system. Moreover, appropriate stormwater management procedures will be applied to ensure that contaminants are not mobilized into the wider environment. Domestic and industrial wastewater during the site preparation & construction phases will be treated in accordance with the standards specified in the Uzbekistan legislation.

The areas, where the maintenance-repairs of vehicles will be made and all the areas that have the risk to pollute groundwater and soil due to any spillage and scattering from tanks of chemicals, grease, etc. will be covered with an impermeable floor. Therefore, adsorbent materials with adequate amounts and characteristics will be made available for oil leakage.

The adoption of good on-site working and storage practices and the implementation of suitable control measures, on-site training, and emergency preparedness will ensure that the potential contamination is avoided.

The potential impacts on the soil, sediment, and groundwater during the operation phase and measures to be applied are presented in Table 203. As seen from the table, the impacts of the activities on soil, bedrock, and groundwater will be minor assuming that good hazardous waste and chemical management are applied at the plant.

Table 203: Impacts Significance of the Soil, Sediment and Groundwater and Mitigation Measures during Operation Phase

Potential Impacts	Receptor	Sensitivity of Receptor	Magnitude of Impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Risks of contamination on soil, and ground water	Soil Quality, Groundwater Quality in neighboring farms	Medium	Medium	Moderate	Any leaks/damage to the soil and groundwater will be prevented through appropriately designed storage options. Strict fueling and spill control procedures will develop as well as emergency clean-up procedures. The quantities of hazardous substances will limit at site to reduce the risk of spillage	Minor
Accidents	Soil Quality, Groundwater Quality in neighboring farms	Medium	Medium	Moderate	The Project Company will develop a "Training Plan" for the personnel on fueling and spill control procedures as in line with the Environmental & Social Management System. The Project Company will include handling of soil and ground water contamination in case of accidents to Emergency Preparedness and Response Plan The contaminated soil and treat as hazardous waste will remove, promptly.	Minor

10.4 Cumulative Impacts

All potential impacts on soil, sediment, and groundwater during the construction and operation phase are presented in Section 10.3. The summary of cumulative impacts on soil, sediment, and groundwater is presented in Table 204.

Table 204: Cumulative impacts on soil, sediment and groundwater

Environmental and Social Aspects	Construction Phase	Operation Phase
Cumulative Impacts	There are no known development projects in the vicinity of the Project Area. If any simultaneous activity is planned in the region, there will be very limited expected cumulative effects since impacts will be localized and limited within each Project areas. Also, in the event of a major leak/spill could the groundwater is highly likely to became contaminated.	There are currently no plans for any project activity in the vicinity of the site. However, should this change in the future, it could pose potential contamination risks to soil, groundwater and also the sediment of the Zang Canal and Uchkizil Reservoir due to effluents.

10.5 Monitoring

The monitoring requirements for soil, sediment, and groundwater for the construction, commissioning and operation phases of the Project are presented in brief in Table 212.

Table 205: Summary of Soil, Sediment, Groundwater Monitoring

Monitoring Activity	Parameters	Duration	Location	Responsiblity
Construction Phase				
Soil and Sediment Quality	Baseline section of this ESIA contains the analysis parameters (chemical and heavy metals) of the soil and sediment.	Annually	Monitoring should be conducted at predetermined sampling site.	EPC Contractor
Contaminated Land	Any soils around the sites that appear to be contaminated by leaked oil, hydrocarbons and other potentially hazardous or chemical pollution sources	Daily Visual Check	All the project area and access road to Project area.	EPC Contractor

Monitoring Activity	Parameters	Duration	Location	Responsiblity
Groundwater Quality	Baseline section of the this ESIA, contains the analysis parameters of the groundwater (chemical and heavy metals).	Quarterly	Monitoring should be conducted on location where baseline studies have been carried out. If necessary, new location will be selected.	EPC Contractor
Commissioning & Operation				
Soil and Sediment Quality	Any soils around the sites that appear to be contaminated by leaked oil, hydrocarbons and other potentially hazardous or chemical pollution sources.	Daily Visual Check	All the project area and access road to Project area.	Project Company (EPC Contractor during commissioning phase)
	Baseline section of this ESIA contains the analysis parameters (chemical and heavy metals) of the soil and sediment.	Annually	Monitoring should be conducted at predetermined sampling site.	
Groundwater Quality	Baseline section of the this ESIA, contains the analysis parameters of the groundwater.	Quarterly	Monitoring should be conducted on location where baseline studies have been carried out. If necessary, new location will be selected.	Project Company (EPC Contractor during commissioning phase)

11. SOLID WASTE & WASTEWATER MANAGEMENT

11.1 STANDARDS AND REGULATORY REQUIREMENTS

11.1.1 National Requirements

The project will comply with the Law on Waste No.362-II (dated, 5 April 2002 and modified 4 January 2011) that regulates solid waste treatment procedures and defines the authority of various institutions involved in solid waste management. The law also provides rules for the transport of solid waste. Regulation Document on Order of endorsement and approval of projects of wastes disposal and limits for its disposal (RH 84.3.22:2006) shall also apply.

The project will comply with the provisions approved by the SCEEP; the Ministry of Health No. 2438 dated March 20, 2013, for hazardous waste specifically for placement of hazardous chemicals and hazardous waste in special landfills, their protection, transport, and disposal.

Hazardous wastes that are transported must undergo environmental certification and be transported by special vehicles for disposal. The SCEEP and the Ministry of Health also provide approvals i.e., 'proper performance of work" for hazardous waste generated. The transportation and disposal of hazardous waste is under the purview of the State organization "Qishloqxujalikkimyo" (Agricultural Chemicals).

11.1.2 Lenders' Requirements

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.

Solid Waste

IFC EHS Guidelines on Waste Management covers hazardous and non-hazardous waste management. According to this guide, hazardous wastes should always be segregated from non-hazardous wastes. If generation of hazardous waste can not be prevented through the implementation of the above general waste management practices, its management should focus on the prevention of harm to health, safety, and the environment, according to the following additional principles:

- Understanding potential impacts and risks associated with the management of any generated hazardous waste during its complete life cycle,
- Ensuring that contractors handling, treating, and disposing of hazardous waste are reputable and legitimate enterprises, licensed by the relevant regulatory agencies and following good international industry practice for the waste being handled,
- Ensuring compliance with applicable local and international regulations.

For waste storage, transportation, treatment, disposal and monitoring processes, the requirements in IFC EHS Guidelines on Waste Management shall be followed, as minimum.

Wastewater

The World Bank General EHS Guidelines (2007) establish general requirements for direct or indirect discharge of process wastewater, wastewater from utility operations or storm water to the environment.

"Projects with the potential to generate process wastewater, sanitary (domestic) sewage, or storm water should incorporate the necessary precautions to avoid, minimize, and control adverse impacts to human health, safety, or the environment".

However, wastewater effluent pollutant limits are only established for sanitary wastewater for discharge to the sanitary sewer systems. Water effluent guidelines in industrial wastewater for discharge to surface waters are established for the power sector in World Bank EHS Guidelines for Thermal Power Plants (2008) and have been presented in the Standards and Regulatory Requirements.

11.2 Local Conditions and Observations

Solid and liquid wastes may have certain characteristics depending on their chemical, physical, and biological properties. Different types of waste require different management and disposal techniques depending on the potential risk the material poses to human health or the environment. In order to categorize the different risks to these receptors, it is often useful to divide the streams into different categories that effectively correspond to the level of management and disposal required for each. Industrial or domestic wastewater streams can contribute to a number of environmental problems if they are not properly handled, stored, and/or managed. These include direct contamination of water bodies, which can lead to serious environmental and public health problems.

Although there is limited information about the infrastructural conditions on waste and wastewater management in Angor and Termiz regions, according to the resolution of the Khokim of the Surkhandarya region dated February 21, 2018 No. Q-154, the removal and management of solid domestic waste from the territory of the Angor region is carried out by the Bio Texno Eko LLC, which is located with a distance of 250 m to the project area.

During the social site survey, an interview was performed with this facility representatives and it has been stated that the waste generated during the construction and operation of the proposed CCPP can be accepted by the facility. It has also been informed that the facility has an allocated area for landfill. The capacity of the enterprise is about 180,000 tons/year, and they provide services to 285,000 residents of the city of Termez, Termez and Angor districts [5][6][7]. The collected domestic waste is processed and secondary semi-products (i.e. polyethylene pipes, are produced.

In Tashkent, recent surveys show daily municipal solid waste generation at 0.55 kilograms/person/day, a rate that dramatically decreases progressively in smaller cities, towns, and rural areas. Uzbekistan is estimated to generate over 12,000 tons of municipal solid waste daily, or over 4 million tons annually. This is expected to accelerate to over 7 million tons per year by 2030, cumulatively generating from 2013 to 2030 about 100 million tons of municipal solid waste [8].

Waste transport and disposal as well as the operation of garbage containers or collection points in the capital city of Tashkent are handled by the state-owned enterprise "Makhsustrans". The state-owned enterprise "Tozakhudud" is responsible for the disposal and treatment of waste in the autonomous republic of Karakalpakstan and other regions of Uzbekistan. Since 1 August 2018, private companies have also been allowed to provide waste disposal services in Tashkent and the regions.

Outside of Tashkent, solid waste management services are basic, generally with an underfunded solid waste management services company striving to provide adequate waste collection while operating rudimentary dumpsites and dumping grounds. In rural areas, solid waste management is informal, with communities often self-funding waste collection on an ad hoc basis [8].

Regarding wastewater management system in Termez, wastewaters from the urban population, institutional and municipal establishments and industrial wastewater are discharged into the municipal sewerage system. The wastewater is collected by the gravity sewer system in the South – Western part of the city and flows under gravity through the collector sewers to the main pumping station, situated at the wastewater treatment plant.

The theoretical capacity of the existing sewerage system is 35,000 m^3 /day. The current influent to the sewerage system is estimated at 15,900 m^3 /day.

Urban population: 6,010 m^3/day,

Institutional organizations: 6,800 m^3/day, and

Industrial enterprises: 3,090 m^3/day [9][8]

The existing WWTP is located 500m from the southern part of Termez city and was first put into operation in 1984. In 2020, the quantity of wastewater treated is 25,000 m^3 /day and it is planned to reach the capacity of 45,000 m^3 /day in 2035 [10].

11.2.1 Waste Management at the Project Area

The Contractor should subcontract a licensed and reputable waste management company for the collection, transport, and disposal of waste produced at site. Wastes at the sites and the project facilities shall be segregated and collected at the temporary waste storage areas. There should be waste collection and segregation area in the project area depending on the number of project personnel and the anticipated volume of waste.

The waste storage area shall have separate storage segments for prime recyclables (scrap metals, tires, plastic, wooden material), and separate segment for other hazardous waste including waste oils, oil filters etc. Special care should be taken to ensure that liquid wastes are kept in a segment with secondary containment. Proper waste segregation will be maintained at all times. Environmental labelling including visual communication elements shall be applied to the area/on the containers where appropriate.

Solid waste generated during the project is expected to come from various activities such as accommodation, canteens, vehicle maintenance, clinics, and construction works. The possible wastes generated can be found in the list of Table 206.

Table 206: List of Waste Types

Waste Type	Phase	Amount	Source, Characterization, and Management
Medical Wastes	Construction + Operation	0.03 t/year	The construction camp is expected to has a clinic expected to generate medical waste All medical wastes will be treated as hazardous waste, collected, transported, and removed separately from domestic wastes. Medical wastes will be collected in specially coded containers in the clinic and also they will be stored in the designated area in a safe place.
Domestic Wastes (Solid wastes)	Construction + Operation	1296 tones /year	The construction camp will provide accommodation and other basic needs for workers during construction phase. Administration Buildings will provide daily working conditions for the employers during operation phase. Domestic solid waste will be collected in closed containers. The domestic solid waste generated will have to be taken to the waste area daily by the site responsible. These solid wastes should be taken to the nearest landfill approved by the municipality
Waste Oils	Construction + Operation	28.5 tones /year	The maintenance process of the vehicles to be used during project phases will be carried within the facilities located in the project area. Waste oil shall be collected in a closed temporary waste storage area with a leak-proof floor and covered with a shelter constructed nearest location to the maintenance facility and/or also in a waste storage area. The oil collected would be given to a licensed waste oil recovery company. Additionally, waste vegetative oil will occur in the cafeterias of the campsites within the scope of the project. These wastes will be collected and stored separately from other wastes and stored in segregated segments in the waste storage area until disposal by a waste contractor. These segments differ from others with a structure (secondary containment) to avoid spilling and leakage, soil pollution accordingly.
Oil filters	Construction + Operation	0.2 tones /year	The maintenance process of the vehicles to be used during Project phases will be carried out within the facilities located in the Project area. Waste oil filters shall be collected in waste bins with secondary containment and transferred to the waste storage area for

Waste Type	Phase	Amount	Source, Characterization, and Management
			final disposal by a third-party sub-contractor. Air filters also will be collected in waste air filter bins and then transferred to the waste storage area for final disposal by a third-party sub-contractor.
Waste Tyres	Construction + Operation	1.22 tones /year	The maintenance process of the vehicles to be used during Project phases will be carried within the facilities located in the project area. If there is a need to change the tires of these vehicles and machines, the end-of-life tires that come out would be sent to tires distribution companies or to authorized third-party companies. Until disposal, waste will be stored in the waste storage area in the designated segment.
Batteries, Accumulators, Tonners, Cartridges	Construction + Operation	0.675 tones /year	Waste batteries will be stored in collection points located in office areas and will be delivered to third-party subcontractors. Waste accumulators (vehicle batteries) will be stored in the temporary storage areas until final disposal. Tonners and cartridges will be stored in separated bins in storage areas.
Recyclable Wastes (Paper, Plastics, Cardboard, Metal Scraps)	Construction + Operation	87.5 tones /year	Paper and card waste from offices and domestic type sources at the main construction camp will be segregated, if practicable and sent for recycling by third party contractor. Separately collected recyclable wastes will be taken to the waste storage areas and be ready for transfer to recyclers. Recyclable wastes mainly resulting from construction activities (metal scraps, plastics, pipes etc.) will be collected in designated areas in construction sites and transferred to the waste storage area located in project area. Recyclable wastes will be stored in waste storage area until taken by third party subcontractors.
Spoiled soil	Construction	NA	The spoil soil shall be dumped in dumping areas located along the Project site.
Domestic Sewage	Construction Operation	32 m^3 /day 8 m^3 /day	This includes wastes from the bathrooms, toilets etc. This waste shall be collected and treated in the wastewater treatment plant at the time.
Concrete Batch plants	Construction		Concrete wash out pits will be used to allow sediments to settle and water will be re-used for dust control activities. If water is not able

Waste Type	Phase	Amount	Source, Characterization, and Management
			to re-use, acidic chemicals will be added to balance pH into the range for discharge standards and will be discharged to the environment. Daily pH Control shall be undertaken to ensure compliance to discharge standards.
Residual sludge from waste water treatment	Construction+ Operation	20 tones /year	Different chemicals will be added to water for corrosion prevention, so probably this kind of waste can be classified as a hazardous waste. Also existence of heavy metals in wastewater with significant concentrations can strengthen this hypothesis.
Wastewater from the operational processes	Operation	NA	Wastewater from water treatment plant, sewage treatment plant, cooling water system, RO plant; and storm water system will be generated and treated in wastewater treatment plant of the project and discharged to Uchkizil Reservoir.
Wastewater from test and commissioning processes	Construction	NA	Wastewater from hydrotesting, acid cleaning and boiler steam blowing will be generated and treated in waste water treatment plant of the project and discharged to Uchkizil Reservoir.

Waste can exhibit certain characteristics according to the process stream from which it is generated and any pre-treatment processes that are undertaken. Different types of waste require different management and disposal techniques according to the potential risk that the material poses to human health or the environment. For this Project, waste has been classified into three main categories as presented in Table 207.

Table 207: Waste Characterization

Waste Classification	Description
Domestic Waste	Household, commercial, agricultural, governmental, industrial and institutional wastes, which have chemical and physical characteristics similar to those of household such as garbage, paper, cardboard, plastic, cans, etc. Disposal of such waste can generally be routed to municipal recycling or disposal facilities
Industrial waste	Non-hazardous wastes that have physical and chemical characteristics that are different from domestic wastes such as construction waste, glass, scrap metal, wood, used containers, tires etc. This waste generally poses little risk to the environment and can be disposed to normal municipal facilities after waste minimisation options are exhausted and before obtaining approval

Waste Classification	Description
Hazardous waste	Simply defined, a hazardous waste is a waste with properties that make it dangerous or capable of having a harmful effect on human health or the environment. Hazardous waste is generated from many sources, ranging from industrial manufacturing process wastes to batteries and may come in many forms, including liquids, solids gases, and sludge. Hazardous wastes have flammable, corrosive, reactive, toxic, or radioactive properties according to USEPA.

11.2.2 Waste Management Hierarchy

Waste hierarchy is a tool used in the evaluation of processes that protect the environment alongside resource and energy consumption to most favorable to least favorable actions. The hierarchy establishes preferred program priorities based on sustainability. To be sustainable, waste management cannot be solved only with technical end-of-pipe solutions and an integrated approach is necessary.

The waste management hierarchy indicates an order of preference for action to reduce and manage waste, and is usually presented diagrammatically in the form of a pyramid. The hierarchy captures the progression of a material or product through successive stages of waste management, and represents the latter part of the life-cycle for each product.

The aim of the waste hierarchy is to extract the maximum practical benefits from products and to generate the minimum amount of waste. The proper application of the waste hierarchy can have several benefits. It can help prevent emissions of greenhouse gases, reduces pollutants, save energy, conserves resources, create jobs and stimulate the development of green technologies. Waste hierarchy, which reflects mitigation orders can be seen in Figure 164.

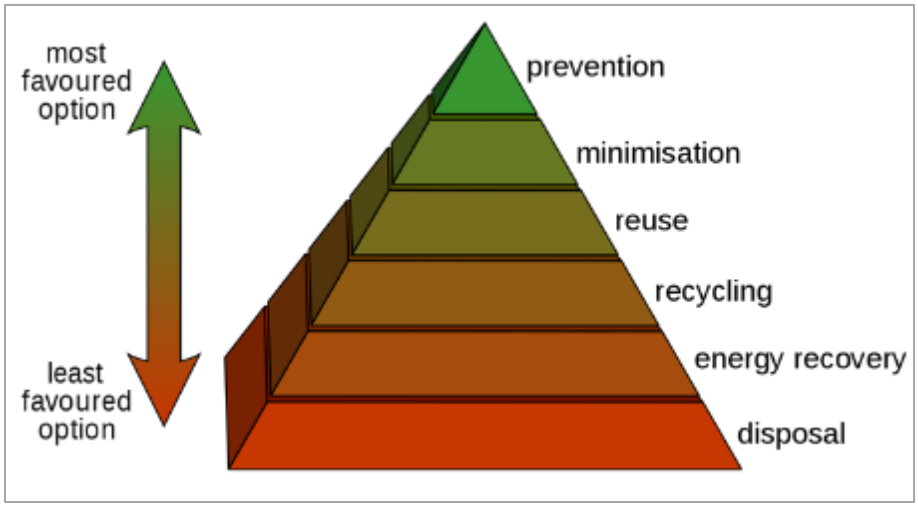


Figure 164: Waste Hierarchy

11.2.2.1 Minimisation

A waste minimization philosophy will be implemented for the construction work. Whenever feasible, project personnel shall review the potential to reduce the volumes of wastes generated during construction. This may be accomplished by applying source reduction techniques to minimize waste (e.g., do not over - excavate contaminated soil). The following source reduction strategies and practices shall be followed:

- Review major waste streams for potential for source reduction. A plan should be developed for at least one waste stream to reduce the total annual volume of that waste.
- Waste shall only be treated by using acceptable technologies.
- Materials shall be purchased in quantities that can be used within a short period of time and inventories shall be rotated to minimize out - of - date inventory.
- Whenever possible, materials used in large quantities should be purchased in reusable or returnable containers to minimize packaging waste
- Alternative materials or products should be used that are non - hazardous or less hazardous
- Waste will be properly stored to avoid accidental releases to the soil, water or air
- Collection and segregation of waste according to its type, whether it is re-usable, recyclable, non-hazardous or hazardous waste.

11.2.2.2 Waste Re-use

Reuse of waste means any operation by which products or components that are not waste are used again for the same purpose for which they were conceived. Reuse of materials that are in good condition should be consider (e.g. used clothes, wood pallets).

11.2.2.3 Waste Recycling

Recycling is the process of converting waste materials into new materials and objects. Recycling can prevent the waste of potentially useful materials and reduce the consumption of fresh raw materials, thereby reducing energy usage, air pollution (from incineration), and water pollution (from landfilling).

11.2.2.4 Segregation and Sorting

All waste produced at site should be sorted out, if possible, at the place where they were produced. Waste must be proper transported to the Management Areas to be segregated and sorted. During the transport, all mitigation measures will be taken to prevent and minimize likely environmental impacts.

11.2.2.5 Disposal

Before the amount of waste stored in the waste storage area reaches the maximum temporary storage capacity, the disposal/reuse process must start. Send the disposal to an authorized operator.

The Project Management will subcontract the waste management companies in charge of collecting, transporting, and disposing of the waste produced at site.

11.2.3 Hazardous Waste

Simply defined, hazardous waste is a waste with properties that make it dangerous or capable of having a harmful effect on human health or the environment. Hazardous waste is generated from many sources, ranging from industrial manufacturing process wastes to batteries, and may come in many forms, including liquids, solids gases, and sludge. Any waste with flammable, corrosive, reactive, toxic, or radioactive properties expected as hazardous waste

Cradle to Grave principle for hazardous wastes can be seen in Figure 165.

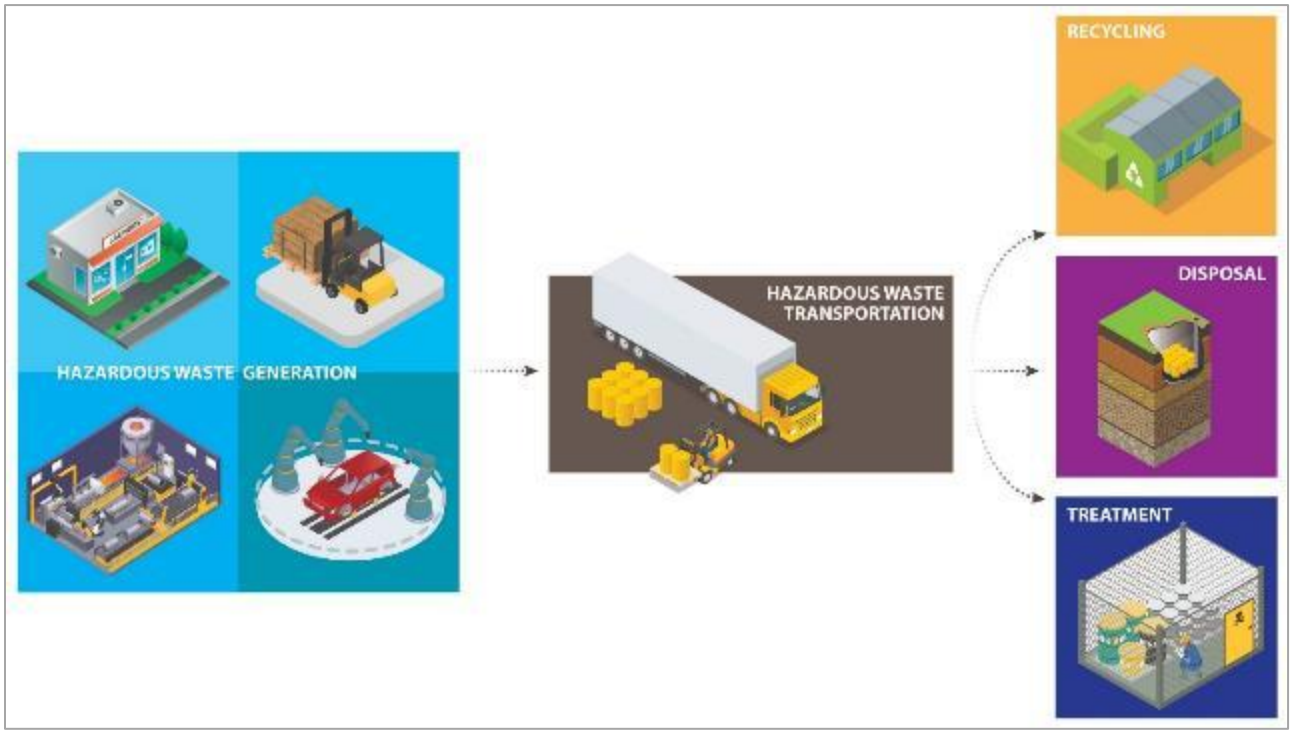


Figure 165: Cradle to Grave Principle for Hazardous Wastes

11.2.3.1 Hazardous Waste Generation

All hazardous waste sources must be determined if the waste is hazardous and the project must oversee the ultimate fate of the waste. Furthermore, the project must ensure and fully document that the hazardous waste that they produce is properly identified, managed, and treated prior to recycling or disposal.

The types of hazardous wastes that will be generated during the development of the project, their quantity and sources are presented in Table 208.

Table 208: List of Hazardous Wastes

Waste Type	Phase	Amount	Source, Characterization, and Management
Cinders of electrodes	Construction	1.3 t / year	Sent to "Vtorchermet" facility located in Surkhandarya region
Worn out overalls	Construction + Operation	0.780 t / year	The workwear consists of shirt, mitten, jacket, and trousers will be generated as hazardous waste. They are leased to specialized enterprises for the processing of such types of waste.
Sludge from cleaning waste heat boilers	Operation	20.0 t / year	It is originated from cleaning waste heat boilers and leased to specialized enterprises for the processing of such types of waste.
Waste fuels and lubricants	Operation	28.5630 t / year	It is originated from turbine oil, compressor oil, engine oil and transformer oil and leased to specialized enterprises for the processing of such types of waste.
Dry matter of water preparation	Operation	480.0 t / year	It is originated from water preparation processes and leased to specialized enterprises for the processing of such types of waste.
Waste filter material	Operation	0.0024 t / year	It is originated from operational activities and leased to specialized enterprises for the processing of such types of waste.
Waste cartridge filters VPU	Operation	0.168 t / year	It is originated from operational activities and leased to specialized enterprises for the processing of such types of waste.
Spent cation exchanger	Operation	25.0 t / year	It is originated from operational activities and leased to specialized enterprises for the processing of such types of waste.
Waste insulation and lining	Operation	484.0 t / year	It is originated from waste management activities and leased to specialized enterprises for the processing of such types of waste.
Captured oil products	Operation	0.097596 t / year	It is originated from wastewater treatment plant and leased to specialized enterprises for the processing of such types of waste.
Wastewater treatment sludge	Operation	3.90384 t / year	It is originated from wastewater treatment processes and leased to specialized enterprises for the processing of such types of waste.
Waste ferrous metals	Operation	87,224 t / year	It is originated from operational processes and leased to specialized enterprises for the processing of such types of waste.
Waste non-ferrous metals	Operation	0.32706 t / year	It is originated from operational processes and leased to specialized enterprises for the processing of such types of waste.
Used batteries	Construction+ Operation	0.675 t / year	It is originated from constructional and operational activities and leased to specialized enterprises for the processing of such types of waste.

Waste Type	Phase	Amount	Source, Characterization, and Management
Waste tires	Construction + Operation	1.22 t / year	It is originated from vehicles and leased to specialized enterprises for the processing of such types of waste.
Rags	Operation	0.091 t / year	It is originated from operational processes and leased to specialized enterprises for the processing of such types of waste.
Abrasive metal dust	Operation	0.0011725 t / year	It is originated from operational processes and leased to specialized enterprises for the processing of such types of waste.
PE bags for reagents	Operation	2.7 t / year	It is originated from operational processes and leased to specialized enterprises for the processing of such types of waste.
Waste energy saving LED bulbs	Operation	0.04964 t / year	It is originated from lighting activities and leased to specialized enterprises for the processing of such types of waste.
Waste from the first-aid post	Construction + Operation	0.03 t / year	It is originated from medical activities and leased to specialized enterprises for the processing of such types of waste.

11.2.3.2 Hazardous Waste Transportation

After the project produces hazardous waste, authorized transporters may transport the waste to a facility that can recycle, treat, store or dispose of the waste. Since such transporters are moving regulated wastes on public roads, highways, rails, and waterways according to Uzbekistan regulations.

Also, following recommendations shall be followed from World Bank EHS Guidelines for hazardous material transportations:

- Ensure that all waste containers designated for off-site shipment are secure, and labelled with the contents and associated hazards.
- Ensure that the waste is properly loaded on the transport vehicles before leaving the site and that these are accompanied by a shipping paper that describes the load and its associated hazards,
- Mention that the contractor should ensure that the company that is transporting hazardous waste has all the permits necessary for this action and that these permits will be reviewed on a regular basis.

11.2.3.3 Hazardous Waste Recycling, Treatment, Storage, and Disposal

Many hazardous wastes can be recycled safely and effectively, while other wastes will be treated and disposed of in landfills or incinerators.

Recycling hazardous waste has a variety of benefits including reducing the consumption of raw materials and the volume of waste materials that must be treated and disposed of.

However, improper storage of those materials might cause spills, leaks, fires, and contamination of soil and drinking water.

Treatment Storage and Disposal Facilities might provide temporary storage and final treatment or disposal for hazardous wastes. Since they manage large volumes of waste and conduct activities that may present a higher degree of risk, Treatment Storage and Disposal Facilities are stringently regulated by government organizations. The Treatment Storage and Disposal Facilities requirements establish generic facility management standards, specific provisions governing hazardous waste management units, and additional precautions designed to protect soil, groundwater, and air resources.

11.3 Potential Impacts, Mitigation, Management & Residual Impacts

11.3.1 Construction Phase

11.3.1.1 Non-Hazardous Waste

During construction, waste will be generated during earthworks, construction of the fences, paths and buildings.

Typical construction wastes include concrete, asphalt, scrap steel, glass, plastic, wood, packaging materials and domestic waste from construction workers (i.e. relating to food consumption). Concrete may be found in two forms on the construction site; structural elements containing reinforced concrete, while foundations (such as surface level concrete slabs) have mass non-reinforced concrete.

Non-Hazardous waste generated from construction activities at the Project site will include the following:

- The project shall develop and implement a Project-specific Waste Management Plan in line with committed mitigation measures in this ESIA report and the provisions of the ESMP.
- Domestic solid wastes to be segregated and identified from the other waste streams into separate waste containers/skips clearly to facilitate recycling.
- Waste containers/skips should be clearly labelled and placed in designated waste storage locations. Labels will be waterproof, securely attached, and written in English and other languages as required such as Uzbek and Russian.
- For litter (food waste, domestic waste), an adequate number of covered bins should be strategically placed throughout the site at locations where construction workers and staff consume food. These will be regularly collected and taken to the main waste storage area.
- Food waste must be stored within a sealed metal or plastic skip or bin to prevent pests from gaining access.
- On-going training should be provided to all staff on the importance of the need to avoid littering.

- Heavy waste may be contained within an open skip, provided that segregation occurs effectively enough to remove all lightweight material that could be blown away.
- Waste generated during construction will only be transported off-site for disposal by an appropriately licensed waste contractor.
- Only licensed waste transporters and waste management facilities will be engaged.
- Develop and maintain a waste inventory to document and track domestic solid wastes generated, segregated, reused and consignments
- Completed waste manifests are required to show the chain of custody of the waste generated on-site, its transportation and treatment/disposal. All records will be maintained on-site.
- Mandatory training program for employees to increase their awareness of waste management protocols including proper handling and storage of waste, and emergency response and contingency plans.
- Contractor will identify the closest recycling companies in Uchkizil, Navshahar, Kaftarhana or Talashkan in order to promote the recycling of waste especially packaging materials, wood and metal waste etc.
- Disposal of any type of waste to the canal or lake is strictly prohibited

11.3.1.2 Hazardous Wastes

Hazardous waste generated from construction activities at the Project site will include the following;

- Develop and maintain a hazardous waste inventory to document and track hazardous wastes generated, segregated, reused and consignments.
- Segregate and identify hazardous waste from the other waste streams into separate signed and labelled waste containers/skips.
- Store hazardous waste in allocated impervious hard standing areas in sealed containers stored with impermeable bases, sufficient containment and separation capacity, sun/rain shelter, separate drainage system, good ventilation and equipped with spill kits & spill response procedures. This area must be placed away from any sources of ignition.
- The hazardous waste storage area should be constructed away from the drainage system. A rain shelter will also be provided to avoid any potential instance of runoff or leakage of runoff.
- Waste containers should be marked with appropriate warning labels to accurately describe their contents and detailed safety precautions. Labels will be waterproof, securely attached, and written in English and other languages as required such as Russian and Uzbek. Wherever possible, chemicals will be kept in their original container.
- Keep hazardous waste storage areas away from any ignition sources or fire hazards.
- Disposal of hazardous waste to the canal or Lake is strictly prohibited.
- Used face masks shall be stored in designated bins and disposed off as medical waste.

- Any generated medical waste (i.e. form on-site clinics) shall be stored in appropriate medical waste containers.
- All medical waste shall only be handled by trained personnel.
- Removal of any medical or hazardous waste from the site for appropriate treatment, disposal/incineration shall only be conducted by a licensed contractor.
- Training programmes for employers shall be conducted that will be involved in the on-site management of hazardous materials in the management activities related to hazardous materials impact, including proper handling of hazardous waste, personal protective elements, and compatibility among different types of hazardous waste.

11.3.1.3 Excavation Soil and Contaminated Soils

- In-situ testing of soil to ensure it is not contaminated and can be reused or disposed of into land.
- Training –Contractor staff to be able to identify signs of potential contamination (smell of hydrocarbon, staining).

Contaminated Soil Management Plan should be prepared regarding what to do in case of soil contamination. When contamination is found, precautions should be taken according to the contaminated soil management plan and necessary actions should be taken for disposal.

11.3.1.4 Sanitary Wastewater

Wastewater generated from construction activities at the project site will include the following:

- Contractor to develop and implement a project specific Wastewater Management Plan and Wastewater Treatment Plant Operation Procedure following committed mitigations measures in this ESIA report and provisions of the ESMP.
- Sanitary wastewater tanks to be properly maintained and inspected to ensure tanks do not overflow.
- Site inspections will be carried out regularly by the EPC contractor to ensure that all wastewater generated is properly managed, and no leakages or spill occurs. In the event of a spill or overflow, immediate action will be taken per spill containment procedures and clean up procedures.
- Engage a municipality approved waste contractor for the periodic removal of the tanks.
- Sanitary wastewater tanks should be placed in allocated impervious hard standing areas with bonding capacity to hold 110% volume of the maximum volume stored.
- In common with the IFC EHS Guidelines, an effort will be made in training construction personnel to minimise water consumption for ablutions and to ensure an understanding of water resource and wastewater issues.

11.3.1.5 Process Wastewater During Test and Commissioning Phase

Contractor will develop the following procedures before the start of the commissioning stage:

- Hydrotesting Procedure;

- Acid Cleaning Procedure; and
- Boiler Steam Blowing Procedure

Household wastewater generated during construction is planned to be directed to a temporarily installed storage tank (a waterproof cesspool) with subsequent removal to the nearest treatment facilities in the city of Termez. The EPC Contractor will also seek other options such as establishment of package (small-scale) wastewater treatment plant in accordance with the requirements set in the national legislation.

Table 209: Impacts Significance of the Waste Management During - Construction Phase

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Potential Impact Significance (without impact mitigation measures)	Mitigation and Management Measures	Significance of Residual Impacts
Non-Hazardous Wastes	Uchkizil Reservoir, aquatic life, flora, and fauna	High	Low	Moderate	The project must prepare and implement a waste management plan in line with commitments given in ESIA, ESMP, and local EIA. All the mitigation measures defined in the above-mentioned plans shall be covered in the procedure. Domestic solid wastes must be segregated and segregated from the other waste streams into separate waste containers/bins clearly to facilitate recycling. Waste containers/bins should be labeled in the local language and English and placed in designated waste storage locations. Labels must be waterproof, securely attached, and written in English and other languages as required such as Uzbek and Russian. An adequate number of dustbins, the waste containers should be placed along the construction site for litter (food waste, domestic waste) to avoid project personnel to litter. The wastes from the containers will be regularly collected and taken to the waste storage area. Food waste must be stored in sealed metal or plastic containers to avoid pests and avian species accumulated in the waste area. On-going training shall be conducted on the project personnel. Including staff to avoid littering and impacts of wastes on the environment. Plastic pollution awareness training should be developed too. All wastes generated during the construction phase has to be transported off the site only for disposal by licensed waste contractors If possible, wood waste produced from construction activities and packaging of cargoes shall be donated to the nearby schools or public/community houses for firewood if not contaminated and safe to do. Only licensed waste transporters and waste management facilities will be engaged. The Contractor will maintain copies of the waste management licenses on site. Develop and maintain a waste inventory to document and track domestic solid wastes generated, segregated, reused, and consignments Completed waste transportations and disposals are required to show the chain of custody of the waste generated on-site, its transportation, and treatment/disposal. All records will be stored on HSE teams. Mandatory training program for employees to increase their awareness of waste management protocols including proper handling, segregation, and storage of waste, and emergency response and contingency plans. The contractor will identify the closest recycling companies in Uchkizil, Navshahar, Kaftarhana, or Talashkan in order to promote the recycling of waste especially packaging materials, wood, and metal waste, etc. Disposal of any kind of waste to the canal or lake is strictly prohibited	Minor

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Potential Impact Significance (without impact mitigation measures)	Mitigation and Management Measures	Significance of Residual Impacts
Hazardous Wastes	Uchkizil Reservoir, Aquatic life, flora, and fauna	High	Medium	Major	A hazardous waste inventory shall be developed which includes hazardous waste generation sources, segregation, reuse, and consignments Hazardous wastes must be collected in separate containers than nonhazardous waste. Hazardous waste bins should be signed and labeled. Hazardous wastes must be stored on an impermeable surface that has bunds nearby to avoid and spillage to contaminate the soil. In the temporary waste storage area sufficient containment, separation, sun/rain shelter must be provided. The hazardous waste storage must have spill kits and fire extinguishers ready at all times. The hazardous waste storage area should be constructed away from the drainage system. A rain shelter will also be provided to avoid any potential instances of runoff or leakage of runoff. Hazardous waste bins should be labeled to describe their content. The label should be in Uzbek, English, and Russian and should be securely attached and be waterproof. Wherever possible, chemicals will be kept in their original container. Hazardous waste storage areas must be away from fire sources to avoid fire risk. Disposal of hazardous waste to the canal or lake is strictly prohibited. Used face masks shall be stored in designated bins and disposed of off-as medical waste. Any kind of medical waste (i.e. from on-site clinics) must be stored in appropriate medical waste containers. All medical waste shall only be handled by trained personnel. Removal of any medical or hazardous waste from the site for appropriate treatment, disposal/incineration shall only be conducted by a licensed contractor Training programmes for employers shall be conducted that will be involved in the on-site management of hazardous materials in the management activities related to hazardous materials impact, including proper handling of hazardous waste, personal protective elements, and compatibility among different types of hazardous waste.	Moderate
Excavation Soil and Contaminated Soils	Uchkizil Reservoir, Aquatic life, flora, and fauna	Medium	Medium	Moderate	In-situ testing of soil to ensure it is not contaminated and can be reused or disposed of into land. Appropriate training should be conducted on the chemical handling personnel and staff. After training, the personnel should be able to identify signs of a potential contamination incident. A contaminated soil management plan should be developed in order to appropriate handling treatment and disposal of contaminated soil.	Minor

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Potential Impact Significance (without impact mitigation measures)	Mitigation and Management Measures	Significance of Residual Impacts
Sanitary Wastewater	Uchkizil Reservoir, Aquatic life, flora, and fauna	High	Medium	Major	The contractor should develop and implement a Project Specific Wastewater Management Plan. The wastewater management plan should cover every mitigation measure defined in this ESIA and other associated documents such as ESMP, ESAP, etc. Wastewater tanks should be free of leakage and overflow at all times. Regular checks should be done to ensure there is no overflow or leakage. Site inspections should be carried out regularly by the contractor to ensure that all wastewater generated is properly managed, and no leakages or spills occur. In the event of a spill or overflow, immediate action will be taken per spill containment procedures and clean-up procedures. For the removal of wastewaters, the municipality-approved waste contractor should be hired. Sanitary wastewater tanks should be placed on impermeable surfaces. The area should has secondary containment (bunds) and secondary containment should be %110 of the tank volume. In common with the IFC EHS Guidelines, an effort will be made in training construction personnel to minimise water consumption for ablutions and to ensure an understanding of water resource and wastewater issues.	Moderate
Process Wastewater During Test and Commissioning Phase	Uchkizil Reservoir, Aquatic life, flora, and fauna	Moderate	Moderate	Moderate	The contractor must develop procedures for the following processes prior to the start of the test and commissioning phase; Hydrotesting Procedure Acid Cleaning Procedure; and Boiler Steam Blowing Procedure The procedures should include the disposal of wastewaters.	Minor

11.3.2 Operation Phase

11.3.2.1 Non-hazardous Wastes

The operation of the proposed Project will generate small amounts of non-hazardous domestic waste from the operation of the administration facilities and from activities of the employees.

This waste can be classified as both recyclable and non-recyclable. Recyclable waste includes paper, tin cans, plastics, cartons, rubber, and glass, while non-recyclables will consist mainly of food residues and other organic waste. Other solid non-hazardous waste generated during operation will be landscaping waste and uncontaminated replacement parts and packaging.

Non-Hazardous waste generated from construction activities at the Project site will include the following:

- Waste and Management Plan in line with committed mitigation measures in this ESIA report and the provisions of the ESMP.
- Domestic solid wastes to be segregated and identified from the other waste streams into separate waste containers/skips clearly to facilitate recycling.
- Waste containers/skips should be clearly labelled and placed in designated waste storage locations. Labels will be waterproof, securely attached, and written in English and other languages as required such as Russian and Uzbek.
- For litter (food waste, domestic waste), an adequate number of covered bins should be strategically placed throughout the site at locations where construction workers and staff consume food. These will be regularly collected and taken to the main waste storage area.
- Food waste must be stored within a sealed metal or plastic skip or bin, to prevent pests from gaining access.
- Heavy waste may be contained within an open skip, provided that segregation occurs effectively enough to remove all lightweight material that could be blown away.
- Paper cardboard, metal cans, plastic, glass to be collected for recycling by a Uchkizil, Navshahar, Kaftarhana or Talashkan approved waste contractor.
- Waste generated during construction will only be transported off-site for disposal by an appropriately licensed waste contractor.
- Only licensed waste transporters and waste management facilities will be engaged.
- Develop and maintain a waste inventory to document and track domestic solid wastes generated, segregated, reused and consignments
- Completed waste manifests are required to show the chain of custody of the waste generated on-site, its transportation and treatment/disposal. All records will be maintained on-site.

11.3.2.2 Hazardous Wastes

This fraction of waste can potentially cause significant adverse impacts on human health and the environment if improperly managed. Examples of likely hazardous waste streams that may arise during the operation of the Project include the following:

- Develop and maintain a hazardous waste inventory to document and track hazardous wastes generated, segregated, reused and consignments.
- Segregate and identify hazardous waste from the other waste streams into separate waste containers/skips signed and labelled.
- Store hazardous waste in allocated impervious hard standing areas in sealed containers stored with impermeable bases, sufficient containment and separation capacity, sun/rain shelter, separate drainage system, good ventilation and equipped with spill kits & spill response procedures. This area must be placed away from any sources of ignition.
- Waste containers will be marked with appropriate warning labels to accurately describe their contents and detailed safety precautions. Labels will be waterproof, securely attached, and written in English and other languages as required such as Uzbek and Russian. Wherever possible, chemicals will be kept in their original container.
- Used face masks shall be stored in designated bins and disposed of as medical waste.
- Training programmes for employers shall be conducted that will be involved in the on-site management of hazardous materials in the management activities related to hazardous materials impact, including proper handling of hazardous waste, personal protective elements, and compatibility among different types of hazardous waste.

11.3.2.3 Sanitary Wastewater

Wastewater generated from operation activities at the project site will include the following:

- Sanitary wastewater will be treated at the onsite and must meet the discharge standards before being discharged into the reservoir or for landscaping.
- Periodic testing of the treated waste water shall be conducted and the results logged.

11.3.2.4 Process Wastewater

- Conduct regular checking and monitoring of water quality and discharges from:
- Water treatment plant
- Sewage Treatment Plant;
- Cooling water system;
- RO plant; and
- Storm water system
- Sludge from treatment systems will be disposed in accordance with IFC/WB and Uzbek regulations.
- Maintain storm-water handling systems and routinely monitor effluents.

Provisions for the containment of the first flush of storm water will be considered to ensure that the initial runoff from rainfall events does not lead to contamination of the receiving canal waters. Impacts relating to storm water contamination can also be reduced via good housekeeping practices on site during operation. Such good practices include road sweeping, effective cleanup of liquid spills, appropriate covering of stockpiles & equipment and good waste management practices.

Table 210: Impacts Significance of the Waste Management During Operation Phase

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Potential Impact Significance (without impact mitigation measures)	Mitigation and Management Measures	Significance of Residual Impacts
Non- hazardous wastes	Uchkizil Reservoir, Aquatic life, flora, and fauna	Moderate	Moderate	Moderate	The project must prepare and implement a waste management plan in line with commitments given in ESIA, ESMP, and local EIA. All the mitigation measures defined in the above-mentioned plans shall be covered in the procedure. Domestic solid wastes must be segregated and segregated from the other waste streams into separate waste containers/bins clearly to facilitate recycling. Waste containers/bins should be labelled in local language and in English and placed in designated waste storage locations. Labels must be waterproof, securely attached, and written in English and other languages as required such as Uzbek and Russian. Food waste must be stored in sealed metal or plastic containers to avoid pests and avian species accumulated in the waste area. A training shall be conducted on the project personnel, including staff to avoid littering and impacts of wastes to the environment. Plastic pollution awareness training should be developed too. All wastes generated during the operation phase has to be transported off the site only for disposal by licensed waste contractors Only licensed waste transporters and waste management facilities will be engaged. The Project Company will maintain copies of the waste management licenses in the HSE office Develop and maintain a waste inventory to document and track domestic solid wastes generated, segregated, reused, and consignments Completed waste transportations and disposals are required to show the chain of custody of the waste generated on-site, its transportation, and treatment/disposal. All records will be stored on HSE teams. Mandatory training program for employees to increase their awareness of waste management protocols including proper handling, segregation, and storage of waste, and emergency response and contingency plans. The Project Company will identify the closest recycling companies in Uchkizil, Navshahar, Kaftarhana, or Talashkan in order to promote the recycling of waste especially packaging materials, wood, and metal waste, etc. Disposal of any type of waste to the canal or lake is strictly prohibited.	Minor

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Potential Impact Significance (without impact mitigation measures)	Mitigation and Management Measures	Significance of Residual Impacts
Hazardous Waste	Uchkizil Reservoir, Aquatic life, flora, and fauna	High	High	Major	A hazardous waste inventory shall be developed which includes hazardous waste generation sources, segregation, reuse, and consignments Hazardous wastes must be collected in separate containers than non-hazardous waste. Hazardous waste bins should be signed and labeled. To avoid any further spillage and soil contamination, prior to disposal, hazardous wastes must be stored on an impermeable surface. In the temporary waste storage area sufficient containment, separation, sun/rain shelter must be provided. The hazardous waste storage must have spill kits and fire extinguishers ready at all times. The hazardous waste storage area should be constructed away from the drainage system. A rain shelter will also be provided to avoid any potential instances of runoff or leakage of runoff. Hazardous waste bins should be labeled to describe their content. The label should be in Uzbek, English, and Russian and should be securely attached and be waterproof. Wherever possible, chemicals will be kept in their original container. Hazardous waste storage areas must be away from fire sources to avoid fire risk. Disposal of hazardous waste to the canal or lake is strictly prohibited. Waste facemasks shall be stored in designated bins and disposed of off-as medical waste. Any kind of medical waste (i.e. form on-site clinics) must be stored in appropriate medical waste containers. All medical waste shall only be handled by trained personnel. Subsequent to removal of medical wastes from the site, disposal or incineration process shall only be conducted by licensed contractors. Training programmes for employers shall be conducted that will be involved in the on-site management of hazardous materials in the management activities related to hazardous materials impact, including proper handling of hazardous waste, personal protective elements, and compatibility among different types of hazardous waste.	Moderate
Sanitary Wastewater	Uchkizil Reservoir, Aquatic life, flora and fauna	Medium	Medium	Moderate	The effluent of the sanitary wastewater treatment plant must meet the criteria defined in the permit obtained from Uzbekistan authorities. Regular wastewater analysis should be done at least quarterly to ensure that the treatment plant working properly.	Minor
Process Wastewater	Uchkizil Reservoir, Aquatic life, flora and fauna	Medium	Medium	Moderate	The project should conduct regular checks and should monitor water quality and discharges from the following structures: Water treatment plant Sewage Treatment Plant; Cooling water system; RO plant; and Storm water system Sludge from treatment systems will be disposed of according to requirements defined in IFC/WB and Uzbek regulations. Storm water handling systems should be regularly checked. Measures should be taken containment of initial storm water runoff to ensure that initial storm event runoff does not result in pollution of the receiving water body. Storm water pollution impacts can also be reduced through good on-site housekeeping practices during operations. These good practices include sweeping roads, effectively cleaning up spills, adequately covering stockpiles and equipment, and good waste management.	Minor

11.4 Cumulative Impacts

The purpose of a cumulative impact assessment is to determine how the potential impacts of a proposed development might combine cumulatively, with the potential impacts of other projects or human activities as well as natural stressors such as droughts or extreme climatic events. Summary of Cumulative Impacts of Solid waste and waste water is presented in Table 211.

Table 211: Summary of Cumulative Impacts of Solid Waste and Wastewater

Environmental and Social Aspects	Construction	Operation
Solid Waste and Wastewater		
Cumulative Impacts	Methane generation from biodegradable organic waste will occur from landfill disposal, which is a greenhouse gas and cause a cumulative impact together with the other Projects.	Methane generation from biodegradable organic waste will occur from landfill disposal, which is a greenhouse gas and cause a cumulative impact together with the other Projects.

11.5 Monitoring

Considering the best international practices, a monitoring plan is developed for solid waste and wastewater management. During the preparation of monitoring plan the following actions presented by the World Bank EHS Guidelines are considered:

- Regular visual inspection of all waste storage collection and storage areas for evidence of accidental releases, and to verify that wastes are properly labelled and stored.
- When significant quantities of hazardous wastes are generated and stored on site include:
    - Inspection of vessels for leaks, drips or other indication of loss.
    - Identification of cracks, corrosion, or damage to tanks, protective equipment, or floors, verification of locks, emergency valves and other safety devices for easy operation.
    - Checking the operability of emergency systems.
    - Documenting results of testing of integrity, emissions, or monitoring stations (air, soil vapor, or groundwater if Agreed)
    - Documenting any changes to the storage facility, and any significant changes in the quantity of materials in storage.
- Regular audits of waste segregation and collection practices
- Tracking of waste generation trends by type and amount of waste generated, preferably by facility departments.

- Keeping manifests or other records that document the amount of waste generated and its destination
- Periodic auditing of third-party treatment and disposal services including re-use and recycling facilities when significant quantities of hazardous wastes are managed by third parties.

The monitoring plan on solid waste and wastewater management is presented in Table 212.

Table 212: Summary of Solid Waste and Wastewater Management Monitoring

Monitoring Activity	Parameters	Duration	Location	Responsiblity
Construction, Commissioning & Operation Phases				
Visual Inspection	Any accidental releases, labelling and proper storage Inspection of vessels for leaks, drips or other indication of loss. Identification of cracks, corrosion, or damage to tanks, protective equipment, or floors, verification of locks, emergency valves and other safety devices for easy operation. Checking the operability of emergency systems.	Daily	Waste Storage Collection and Storage Areas	EPC Contractor for construction and commissioning phases Project Company for Operation phase
Documentation	The results of testing of integrity, emissions, or monitoring stations (air, soil vapor, or groundwater if Agreed) The any changes to the storage facility, and any significant changes in the quantity of materials in storage. Waste generation trends by type and amount of waste generated, preferably by facility departments Manifests or other records that document the amount of waste generated and its destination	In case of neccessity	Waste Storage Collection and Storage Areas	EPC Contractor for construction and commissioning phases Project Company for Operation phase

Monitoring Activity	Parameters	Duration	Location	Responsiblity
Auditing	Waste segregation and collection practices Third-party treatment, and disposal services including re-use and recycling facilities when significant quantities of hazardous wastes are managed by third parties	Weekly Annually	Waste Storage Collection and Storage Areas	EPC Contractor for construction and commissioning phases Project Company for Operation phase

12. TRAFFIC AND TRANSPORTATION

12.1 Standards and Regulatory Requirements

12.1.1 National Requirements

The relevant law related with traffic and transportation in Uzbekistan is given below:

- Law "On Traffic Safety", No: 818-I, dated August 19, 1999 (as amended on December 29, 2015).

Law "On Traffic Safety" came into force defining a priority of protection of citizens' lives and health, their rights, and interests, as well as the environment and the basic principles of the traffic safety provision.

12.1.2 Lenders Requirements

The traffic and transport issues will be assessed in line with IFC PS-1 (Assessment and Management of Environmental and Social Risks and Impacts) and PS-4 (Community Health, Safety and Security).

12.2 Observation and Baseline Condition

12.2.1 General view

Uzbekistan has the highest road density in Central Asia, with 41 km of roads per 100 km² area. The total size of the road network is 185,000 km, of which 42,700 km are common-use public roads. Common use roads are functionally divided into international roads - 3,981 km, national roads - 14,100 km, and regional roads - 24,614 km. For the most part, Uzbekistan has achieved basic road connectivity and only a few remote regions lack all-weather road access. About 95% of the network is paved and less than 5% is gravel and earth surfaced. At the end of 2017, nearly two-thirds of the common-use roads were assessed as being in good or excellent condition. This assessment is based on biannual visual inspections, which are highly subjective and may not be based on a consistently applied metric. Much road deterioration is due to aging infrastructure, which needs both structural and safety upgrades. Lastly, Uzbekistan has 83 cars per 1,000 people in 2018.

At the province level, the transport infrastructure of Surkhandarya is fairly developed. The length of railways crossing the territory of the region is 372.5 km. There are more than 10 railway stations in the region. Railway route (or line) Taguzar - Boysun – Kumkurgan connects the south of Uzbekistan with the center of the country and Kazakhstan. There is the main passageway running between Termez and Tashkent. There is 2,844 km of automobile roads in the region, including international and national. There is also Termez Cargo Center is a large logistical terminal, located in the Termez district of the region in close proximity to the border with Afghanistan. This terminal provides transport and logistical services, including customs checks, loading and offloading, goods storage at warehouses of the terminal, as well

as the processing of transit cargo for intermodal transportation (rail - truck) to and from Afghanistan highways.

Transportation part of two districts is going to describe the sector by analyzing public-private vehicle share, public transport provision, number of private vehicles per 1,000 populations, and the conditions of roads.

According to the Khokimiyat of Angor district, there are 2,149 vehicles in 2020 to serve the local population, including private vehicles and vehicles of legal entities and/or enterprises. Of these, 75% of transport is private, 25% belongs to enterprises. There are 7,657 vehicles in the Termez district to serve the local population. Of these, 90% of transport is private, and 10% belongs to enterprises (see Figure 216).

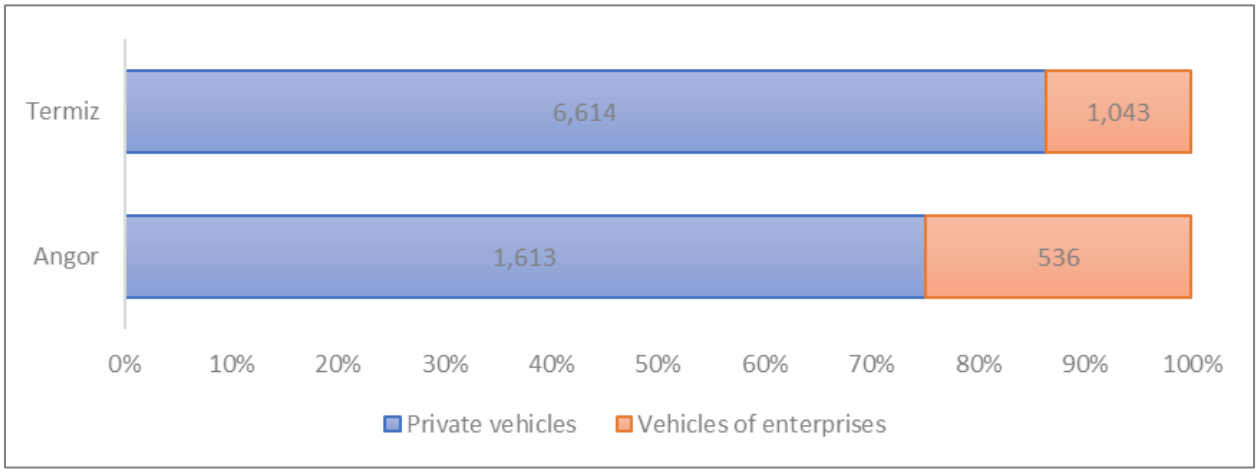


Figure 166: Private Vehicles and Vehicles of Enterprises Distribution in Termez and Angor districts

Another indicator is the number of people per vehicle, which is used as public transport (taxi, bus, minibus). The public transport system in both Termez and Angor districts is operated by private organizations. According to the data of the Khokimiyat of Angor region, there are 11 working enterprises with a total of 356 vehicles to serve the local population. Most of them are light vehicles (taxi services with a maximum capacity of 7 passengers) in the amount of 348 units. In addition, there are 6 buses and 2 minibuses. Overall, there are 379 people per unit of transport, with the calculation of the total population of the district being 134,700 people.

In the Termez district, there are only 2 engaged enterprises with a total of 48 transport vehicles to serve the local population. Most of them are automobiles (taxi services) in the amount of 40 units. The number of buses is 8 units of minibuses. This complicates the maintenance of transport by most of the population, since there are 1,650 people per unit of transport, with the calculation of the total population of the district being 79,200 thousand people.

However, the number of people per private car could explain the significant difference between the ratios of public transport. In Angor per 1,000 people own 11 private cars, while

in Termez, it is 83. Therefore, people in Termez depend less on public transport in their daily needs, while the Angor population mostly depends on public vehicles.

Another important public asset to know about the social condition is road infrastructure. Society relies on a good road system as the basis to access jobs, health care, education, and social connections. The total length of internal roads in Angor district is 604.3 km of which only 28 km of the road was repaired in 2020 and 379.6 km of the road requires further repair. In the Termez district, the total length of internal roads is 716.2 km, of which only 9.5 km of the road were repaired in 2020 and 274 km of the road require further repair. It can be concluded that in Angor 30% while in Termez 60% of internal roads require repair. As conclusion, the roads, which need repair prevails the roads with good conditions. Public transport is more used by the Angor population than Termez. Understandably, population in Angor owns fewer private cars comparing to Termez even though its population is more than Termez at 60%. It should be noted that these roads are within the city centers and hence not be used during the project construction activities for abnormal load transportation.

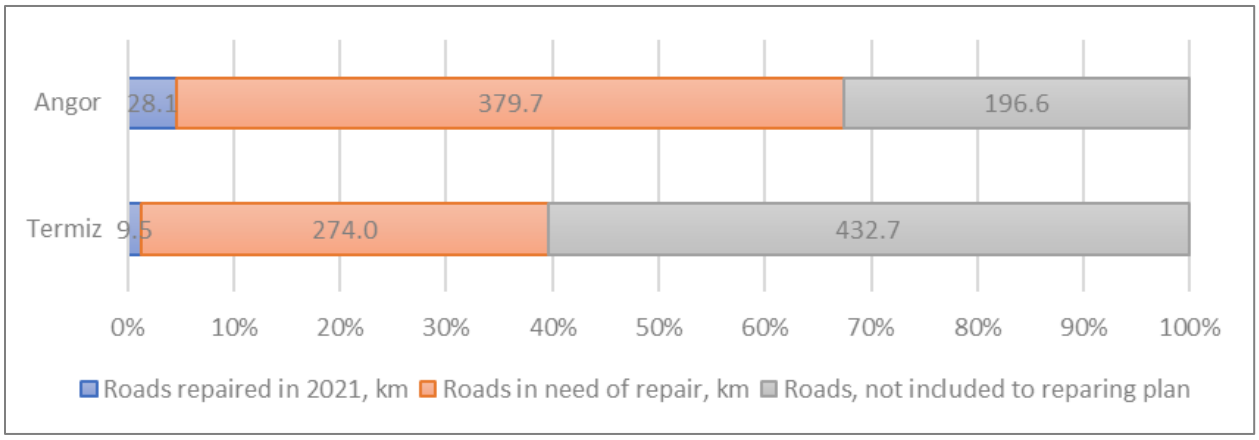


Figure 167: Total Condition of Roads in Termez and Angor districts in 2020

12.2.2 Project Site Observations

The main highways connecting the city of Termez with other settlements of Uzbekistan and Tajikistan are M41 "Termez - Jarkurgan - Denau - Dushanbe" and M39 "the Big Uzbek Highway".

The M39 Highway connecting Tashkent and Termez, is a 4-laned road in some 300 km of its length, although poorly maintained and without carriageway separation in most of its length. M39 Highway has state significance in the I technical category, has an asphalt concrete surface with a roadbed width of 18 m and a carriageway width of 12 m. The project location is access to M39 at a distance of 500 meters and to M41 at a distance of 14.5 km.

In addition to the above roads, there are regional roads, of which the 4P100 road, which has the IV technical category, with a roadbed width of 9-10 m and a carriageway width of 6-7 m.

The closest road nearby to the project area is Babamurk Sarmez – Kaftarkhana Road. These two villages are not very populous. The traffic load between the two cities is not expected to be high.

Figure 168: Babamurk Sarmez – Kaftarkhana

As can be seen from the photo given below, the main road passing north of the project area is a two-lane road and is already partially damaged. It is recommended that the EPC Contractor will develop a Logistics and Traffic Management Plan and outline the baseline of the existing road conditions. In addition, the Logistics and Traffic Management Plan should include proposed repair requirements for roads.

Furthermore, there is the main railway line Kagan-Termez-Dushanbe at a distance of 7 km from the south of the Project Area. Railway passenger and cargo transportation is carried out by the Termez I station at a distance of 14 km from the south of the Project Area.

Moreover, Termez International Airport is the nearest airport at a distance of 10.7 km from the southeast of the Project area, which accesses by M39 highway from the project area. The main transportation network around the Project is presented in Figure 169.

In addition, the Amudarya is used for river transport (at a distance of 10 km), which is based in a large port near the southern borders of Termez city.

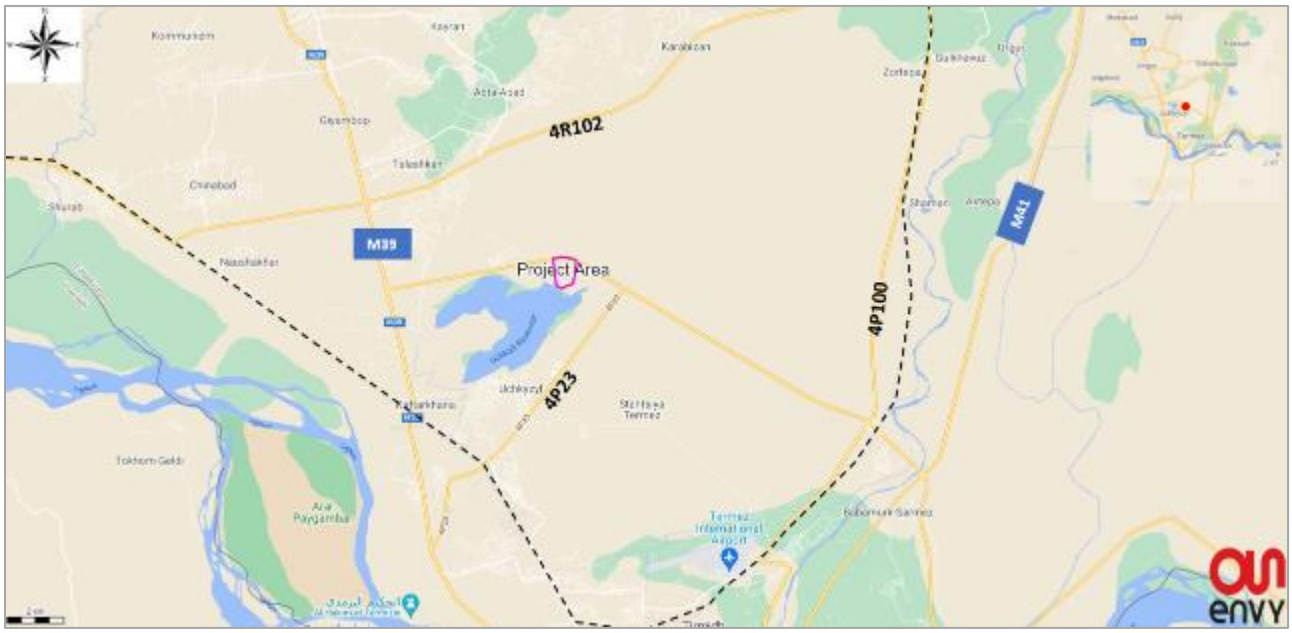


Figure 169: Transportation Network Around the Project area

12.3 Sensitive Receptors

The potential sensitive receptors are local livestock farmers, residents of Uchkizil, Kaftarkhana, Kattakum, and other village' road users, and drivers in local roads and highways.

12.4 Potential Impacts, Mitigation, Management & Residual Impact

12.4.1 Construction Phase

The majority of the components needed for the construction of the facility are the ones that cannot be assembled in the project area. So that sophisticated pieces of equipment of the project shall be transported to the construction site in their built form. These sophisticated pieces of equipment are very likely to be transported to the site by special vehicles and oversize or haul containers. It is expected that a significant portion of the materials will arrive by road, but that an amount of equipment may also require shipping, prior to final delivery by road and/or railway.

Where materials and equipment are shipped, they will go via different international airports/highways/railways and will then require road hauling to the site via the national/international highway and/or railway network. The exact route the construction vehicles will take to reach the site is not known, however, all vehicles will eventually need to use the local road to the north of the Project site in order to enter via the site access point. The Contractor will be required to get necessary permits from relevant national and

international authorities and obey the restrictions identified in the permits to transport equipment and machinery across borders.

The existing road north of the site is used by local communities to access between Babamurk-Sarmez and Kaftarkhana villages. The construction activities will increase traffic load temporarily. It is anticipated that there will be no accommodation facility in the project area during the construction activities. The workforce will be expected to be accommodated in nearby cities and will be transferred by shuttle buses to the construction area. The maximum workforce will be around 2,050 during the peak construction activities. Assuming that shuttle buses have a capacity of 40 people, it is anticipated that additional 50 shuttle buses will be in the traffic during the shift hour changes. The Project will not create any additional load on the existing public transportation.

Construction activities are expected to increase Heavy-Goods Vehicle (HGVs) movement within the project region. The volume of the HGV will be dependent on phases of construction and the demand for natural resources. The main factors that will affect the number of vehicles on the roads will be related to material usage manpower needs and waste generation. Where alternative routes are available, roads through settlements will be avoided. Local people and, if necessary, local authorities will be informed about transportation routes and timetables.

During the construction activities, deliveries to the site should be scheduled during non-peak hours and the following measures shall be applied;

- All construction vehicles should adhere to national speed limits and onsite speed limits;
- In the event of an emergency, the emergency services should be contacted immediately;
- The Project should raise awareness amongst the local population to explain the benefits of the Project;
- A complaint procedure should be developed which will outline a communication process between the local population with the Company to raise issues /complaints as well as a procedure for closing out complaints and undertaking corrective action;
- Toolbox Talks should be provided on safe driving practices on public roads and onsite;
- In the case of vehicle accidents, a vehicle accident report should be provided with causes and corrective actions to prevent further accidents from occurring.
- Where appropriate (e.g. during daylight hours early in the day), traffic will be scheduled to avoid rush hours on the local road network. Program information and planned traffic jams will be notified in advance to all interested parties, including authorities, local communities and nearby businesses.
- Police escort will be provided at all critical locations (eg pinch points), such as areas where traffic needs to be stopped or areas where traffic flow needs to be reversed.
- Trucks and trailers used for off-site transportation will have a gross weight within the allowable load to protect roads from damage.
- Deliveries by vehicles carrying hazardous materials and waste will be carefully planned to avoid risks to the environment, local communities and Project personnel.
- Construction contractors need to arrange buses/services for Project personnel transportation to reduce external traffic

It is recommended that the EPC Contractor will prepare a detailed Traffic Management Plan, and a dedicated training programme will be delivered covering the following aspects but not limited to;

- Raising the importance of the safety aspects for all drivers (belt use, speed limits, mirror use, etc.,),
- Enhancing driving skills and having a mandatory requirement of driving license,
- Setting limits for trip duration and ensuring rotation of drivers to avoid risks caused by overtiredness.
- Assessment of the dangerous routes in advance to avoid accident risks.
- Use of speed control devices on trucks, and remote monitoring of driver actions.
- Traffic diversion and traffic control management including setting up of traffic signages near the construction site.

The project's northern border, which is neighbor to the road, will be the most vulnerable part in terms of accident risk. As a result of the Project's development has the potential to result in road traffic accidents affecting humans and livestock.

The potential impacts caused by traffic and transportation during the construction phase and mitigation measures are presented in Table 213. Mitigation measures will further reduce the impacts and therefore residual impacts will be minor or moderate on the environment.

Table 213: Impacts Significance of the Traffic and Transportation during - Construction Phase

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Potential Impact Significance (without impact mitigation measures)	Mitigation and Management Measures	Significance of Residual Impacts
Loss of trials/tracks within the project site	Local livestock farmers	Medium	Medium	Moderate	The impact of existing access routes across the site from and to the different communities and farms will be assessed and an alternative route provided before the commencement of construction activities. The alternative routes provided by the company will be marked in local languages and easy-to-read signs to prevent local communities from wandering into construction areas. Project activities will be only done in the project area, not beyond the border to avoid any increase in the footprint of the project.	Minor
Safety of Residents of nearby villages and farmers	Residents of Uchkizil, Kaftarkhana, and other villages which uses the Uchkizil Reservoir for watering their animals	High	High	Major	All activities related to traffic and transportation within the scope of the Project will be carried out in accordance with the provisions of the Law "On Traffic Safety". Prior to project equipment and machinery transportation, a traffic survey/study shall be done which includes necessary oversize haulage permits, local and international regulations along the path from origin to the project area. A Traffic Management Plan shall be developed. The plan must confirm the designated access routes, site entrance points, speed limits, waiting, parking areas and map out accident and traffic hotspots for project access vehicles etc. Construction traffic management to limit impacts on local communities, personnel and other road users should be outlined in the plan. Necessary information and baseline data should be obtained from the local police force prior to the development of traffic management plan. Proper signage on the service road and project access road shall be ensured all the time Buses will be used to transport laborers and carpooling among staff is encouraged (social distancing due to COVID-19 should be considered). Route directions and speeds limit will be placed along the access road to the project site. Delivery of construction materials will be coordinated to reduce congestion on local roads and to reduce the waiting time for drivers. Where applicable the Contractor will obtain the relevant permits to transport heavy loads and oversize cargos into the project site and adhere to the requirements outlined in the permit (i.e. delivery routes and timings). Where applicable, the Contractor will notify the local communities on the delivery of wide/heavy loads and how it could potentially impact their road use. Heavy-duty vehicle drivers will be competent and legally authorized to operate such vehicles in Uzbekistan and across borders where applicable. No construction vehicles will be allowed to use the access roads leading to communities near the Project site and will remain within the designated routes. The contractor will train its personnel on traffic safety. If possible, Uchkizil traffic police will prepare and conduct the training. Every traffic accident and incident will be recorded and investigated. Corrective actions will be followed and implemented. The local police department will be involved in the process. A grievance mechanism will be established to allow local communities to make complaints relating to Project drivers. In case, any livestock is injured or dies by project vehicles, compensation will be done. Prices of livestock will be identified by the local market and community leaders. Transportation of any unauthorized personnel or goods by project drivers will be banned and will be announced on the project notice board.	Moderate
Increase in vehicle flow on the local roads and M39 Highway	Road users, drivers in local roads and highways	Medium	Medium	Moderate		Minor

12.4.2 Operational Phase

During the operation phase, impacts on transportation infrastructure will not be as high as the construction phase. The operation of the Project will not require continuous delivery of materials or other equipment.

During the operation phase of the project, the main traffic source will be due to the daily commute of the personnel. It is anticipated that the personnel will live in nearby towns and will use shuttle buses. The operations will be in shift and the impact on the traffic will be limited to shuttle buses. There will be car-parking area at the project site and car journeys can be expected for the personnel who may not prefer shuttle buses and guests visiting the project area.

In regards to road safety within the Power Plant area, there will be a limited number of vehicle movements during the operational phase. Clear walkways will be constructed and personnel will be trained on health and safety aspects regarding internal road safety. All personnel will be equipped with high-visibility jackets.

During the operation stage, it is not expected a large number of HGVs will be used. Chemical delivery, waste transportation, and occasional maintenance will be the other sources of traffic during the operation. None of these is expected to create significant negative impacts on the local roads. Hence, additional road movement during the operation stage will not have adverse impacts on local people. There are potential safety risks associated with the transport of chemicals during the operation phase, other hazardous materials, and the removal of hazardous wastes. Risks derived from hazmat transport are spillages (to land, drains, waterways) chemical fumes, fire, or direct exposure to local communities (or other road users). The resulting magnitude of impacts will depend on the type of exposure and sensitivity of receptors but can potentially be of high significance. Although such risks will primarily be under the responsibility of suppliers and service providers, it will be necessary for the project to engage with the selected suppliers to ensure that processes are in place for effective responses to be made in the event of emergencies and to attempt to reduce the likelihood of such events from occurring. The Project Company will contractually require traffic safety analysis from the suppliers.

The operational activities of the project are not expected to increase the existing number of movements on the local road network. Besides, it is not anticipated that abnormal loads on the roads will be required during the operation stage.

All potential impacts caused by traffic and transportation during the operation phase and mitigation measures are presented in Table 213. Mitigation measures will further reduce the impacts and therefore residual impacts will be minor or moderate on the environment.

12.5 Cumulative Impacts

The purpose of a cumulative impact assessment of traffic and transportation is to determine how the potential impacts of the proposed project might combine cumulatively, with the potential impacts of other projects. All potential impacts caused by traffic and transportation during the construction and operation phase are presented in Section 12.4. The summary of cumulative impacts of traffic and transportation is presented in Table 214.

Table 214: Summary of Cumulative Impacts of Traffic and Transportation

Environmental and Social Aspects	Construction Phase	Operation Phase
Cumulative Impacts	There are no known development projects in the vicinity of the Project Area. In the case of another project and/or development in the same region at the same period, it is expected that the traffic increase on the local roads and the related safety problems will increase during the arrival of the construction materials and workers to the site.	If there exists a new development that will contribute to the traffic in the near region. Therefore, the Traffic Management Plan will be revised accordingly. Additionally, the transportation of hazardous materials and the commuter hours of the employees will be revised within this scope.

12.6 Monitoring

Standard daily monitoring of on-road incidents or any complaint from the local communities will be conducted in accordance with national requirements.

13. ARCHAEOLOGY AND CULTURAL HERITAGE

13.1 Standards and Regulatory Requirements

13.1.1 National Requirements

The main legislation related to protection of archaeology and cultural heritage in Uzbekistan are given below:

- Law "On the Protection and Use of Objects of Archaeological Heritage", No. 229 dated October 13, 2009, (as amended on April 18, 2018),
- Law "On the Protection and Use of Cultural Heritage" No. 269 dated August 30, 2001 (as amended on April 18, 2018),
- Decree of the Cabinet of Ministries of the RUz "On measures on further development protection and usage the cultural heritages" No.269. dated 29 July,2002

The purpose of *Law "On the Protection and Use of Objects of Archaeological Heritage*", shall be to regulate relations in the sphere of protection and use of the objects of archaeological heritage. Objects of archaeological heritage shall be considered those inserted in State register of objects of cultural heritage. The state shall have exclusive right of ownership of the objects of archaeological heritage. State protection, conservation and management of the objects of archaeological heritage shall be carried out in accordance with the legislation on protection and conservation of the objects of cultural heritage. Objects of archaeological heritage shall be subject to compulsory state registration.

Law "On the Protection and Use of Cultural Heritage" regulate the protection and use of cultural and archaeological objects; but these relate more explicitly to State measures for preservation, excavation, and use of objects of cultural heritage. The Law on the Protection and Use of Cultural Heritage is directed primarily at preservation and management of important elements of the built environment, but also addresses protection of historical, archaeological, aesthetic, ethnological, or anthropological territories, as well as natural landscapes connected with historical event. Official permission from the Ministry of Culture of the RUz should be received prior to starting rehabilitation works.

According to *Resolution of the Cabinet of Ministries of the RUz "On measures on further development protection and usage, the historical heritages"* for artifacts/findings nonregistered yet which could be evaluated as cultural heritage, a full procedure on registration needs to be implemented.

13.1.2 Lender Requirements

IFC, PS8, Cultural Heritage state that "the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to ensure that clients protect cultural heritage in the course of their project activities. In addition, the requirements of this Performance Standard on a project's use of cultural heritage are based in part on standards set by the Convention on Biological Diversity."

According to Performance Standard 8, cultural heritage means "tangible cultural heritage types such as movable or immovable object, property, area, building or group of structures of archaeological (prehistoric), paleontological, historical, cultural, artistic and religious value, sacred settlement, Intangible cultural types that bear sacred values such as rocks, lakes and waterfalls, which are recommended to be used for commercial purposes such as cultural knowledge, innovation and practices that reveal unique natural features or tangible objects and traditional lifestyles of communities ".

For tangible cultural heritage items, applicable laws that fulfill the legislative obligations of the country where the project is located must be followed. With this law, cultural heritages must be determined and protected by the practices accepted in the world for the protection, finding, research and certification of cultural heritages by authorized institutions.

It seeks to protect the adverse impacts of project activities and support their preservation and promote equitable sharing of benefits from the use of cultural heritage. Therefore, the project will be assessed in line with (Assessment and Management of Environmental and Social Risks and Impacts) and PS8 (Cultural Heritage).

13.2 Observations and Baseline Conditions

As depending on the desktop studies and field survey, no archaeological, cultural heritage and historical monuments were identified or encountered within the borders and within 5 km radius of the Project area.

On 13th July 2021, UzAssystem sent a request letter to the Ministry of Culture of the RUz requesting information regarding any archaeological or cultural sites near or within the proposed Project Site. In official response of Ministry dated 28 June 2021 (see Attachment D), the archaeological and cultural sites in the region were listed and it was observed that there were no officially known archaeological or cultural artifacts/findings in the project area or within 5 km of areas.

The archaeological sites in the vicinity of the project area are shown in Figure 170.

In addition, during the site survey conducted in July 2022, face-to-face interviews were performed with Department of Cultural Heritage of Surkhandarya Region and Termiz Archaeological Museum. Conclusion of the meetings are summarized below:

- List of immovable cultural heritage assets and archaeological areas have been gathered by their location, coordinates, historical backgrounds, types, etc.
- There are no archaeological and cultural assets within the Project area.
- There are also no cultural heritage assets under UNESCO world cultural heritage. However, they given requesting to UNECO to add cultural heritage object list (Fayyaztapa and Karatapa) it is the object of Buddhism.

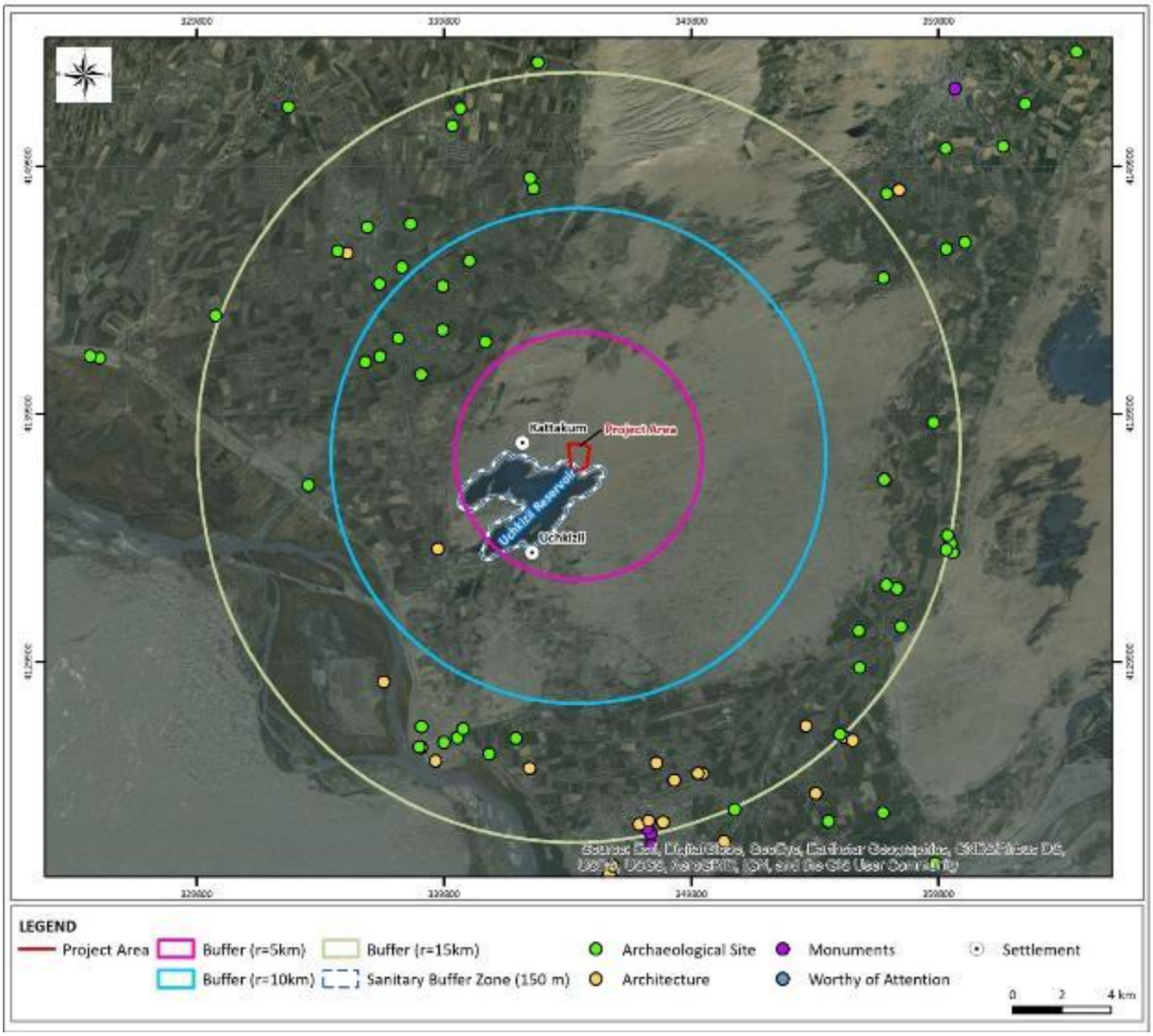


Figure 170 Archaeological Sites within 5 km radius of the Project area

Besides, during the stakeholder consultation meetings, no information/concerns are issued from the local people regarding the archaeological sites.

The Chance Finds Procedure is developed and will be provided to all contractor and subcontractor personnel, as part of the induction training (to be given at the time of employment) and refreshments will be done through toolbox talks throughout the construction phase. The Chance Finds Procedure is presented in Attachment G.

13.2.1 Sensitive Receptor

There are not officially known archaeological or cultural artifacts/findings in the project site or its immediate surroundings. Therefore, the only potential receptors are unknown buried artifacts/findings.

13.3 Potential Impacts, Mitigation, Management & Residual Impact

13.3.1 Construction Phase

Although there are no observed archaeological remains or cultural heritage that will affect or be affected by the future Project activities, there is still some probability that archaeological or cultural artifacts/findings can be unearthed at any time during the construction period. For that reason, a "Chance Find Procedure" will be prepared for the area to be reserved for construction activities. This procedure should be prepared and applied during the site preparation and construction periods of the Project by construction contractors.

The main intention of the procedure is to point out that it is beholden of all parties on the construction site to cease all works immediately and inform the relevant authorities, and the proposed steps will be taken under the supervision of the authorities.

The training of the project workers will include the "project requirements, protection of cultural and archaeological heritage, laws and legislations related with the archaeological and historical monuments and chance find procedure". Such kind of training should be included within the "Induction Trainings" of the construction contractors.

The impacts of the Project activities on the buried archaeological and cultural artifacts/findings and measures to be applied during site preparation and construction phases are presented in Table 215.

As seen from the table, the impact of the future Project activities on the cultural environment will be minor, upon implementation of the "Chance Find Procedure" during site preparation and construction activities, because, there are no archaeological and historical remains at the site.

13.3.2 Operational Phase

Although there are no archaeological remains or cultural heritage that will affect or be affected by the future Project operation activities. If buried archaeological or cultural artifacts/findings were found in the Project Area, they would have been disturbed and removed during the construction phase. If all necessary mitigation measures are implemented, no permanent impact is expected on the environment. Therefore, it is foreseen that the impact of the operation on cultural heritage will be insignificant.

13.4 Monitoring

Standard daily and regular monitoring will be conducted for buried archaeological or cultural artifacts/findings in compliance with the “Chance Find Procedure” during the site preparation and construction periods.

Table 215: Significance Impacts on Archaeological and Cultural Artifacts/Findings during the Construction Phase of the Project; and Mitigation and Management Measures

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Potential Impact Significance (without impact mitigation measures)	Mitigation and Management Measures	Significance of Residual Impacts
Damage on buried archaeological and cultural artifacts/findings	Archaeological and cultural artifacts/findings	Low	High	Moderate	The Contractor will develop a "Chance Find Procedure" as in line with the Environmental & Social Management System. The Contractor will develop "Cultural Environment Management Plan (including regular monitoring)" to be applied during site preparation and construction works in line with the Environmental & Social Management System. The Contractor will develop a "Training Program" for the workers regarding the archaeological and historical monuments as in line with the Environmental & Social Management System. Contractors and/or subcontractors and other personnel at the construction site will be informed/trained about the archaeological site and historical artifacts/findings before the construction, excavation, and land arrangement works are started. This briefing will ensure the personnel to be informed when findings are found. The work (Excavation and others) shall be suspended immediately, a local administration (Khokimiyat) shall be informed, and the works shall be continued under the supervision of an organization that will be appointed by the authorities.	Minor

14. LANDSCAPE AND VISUAL AMENITY

14.1 Standards and Regulatory Requirements

There are no well-recognized legislations on visual impact assessment (VIA) studies across the world and RUz, either. However, there are some guidelines established and widely used. One of which is and the most commonly used one is the "Scottish Natural Heritage Environmental Impact Assessment Handbook". The VIA work within the scope of this project was performed in parallel to "Guidelines for Landscape and Visual Impact Assessment 3rd Edition" [14].

14.2 Observations and Baseline Conditions

In the European Landscape Convention definition, 'Landscape' means an area, as perceived by people, whose visual features and character are the result of the action and interaction of natural and/or human factors. All landscapes combine natural components (such as geology, soils and watercourses) and human influences (such as settlement and land use) with cultural perceptions (such as history, social associations and aesthetic values).

Visual impact can be defined as any alteration in landforms, water bodies, or vegetation, or any introduction of structures or other man-made visual elements, that negatively or positively affect the visual characteristics or quality of a landscape and the visual experience of people viewing the landscape through the introduction of visual contrasts (opposition of different forms, lines, colors, textures in a landscape) in the basic elements of form, line, color, and texture. They cover the impacts on specific views and on the general visual amenity experienced by people and the potential visual impact is primarily originated from changes in visual characteristics in the view field.

Baseline conditions represent the existing scenic conditions of the Project area independent from the Project. The first step in any landscape or visual impact assessment is to identify the existing landscape and visual source in the vicinity of the Project that is the baseline visual conditions.

The Project area is located in the very south of the RUz close to the border between Uzbekistan and Afghanistan (the distance to the State border is 14 km) in the Surkhandarya intermountain area (Surkhan-Sherabad valley), inclined from north to south, to the floodplain of the Amudarya river. Like other intermountain valleys of Central Asia, the Surkhan-Sherabad Valley is a densely populated ancient agricultural oasis. Most of the valley is occupied by cultural landscapes (mainly agricultural landscape and residential landscape). Based on the field studies and satellite views, the areas of natural landscapes preserved in the central part of the valley on the Kattakum sandy massif and on the Khaudaktau Upland are intensively used by the local population for grazing, including the project area.

There are no green spaces (woody and herbaceous vegetation) on the construction site of the Project. Arboreal plantations (from decorative – thuja, pine, mulberry, from fruit-flavored, and stone fruits - apple, apricot, walnut, almond), as well as grapes are found on the territory of the nearest village "Uchkizil". In 1.2 km to the north-west of the planned Project territory there is a waste recycling enterprise - "Biotechnoeco Ltd".

14.2.1 Sensitive Receptors

The nearest town is Uchkizil with a population of 3,500 which is located 2 km in the south of the area. The potential sensitive receptor is the community is identified as Kattakum Village, which is located 1 km in the west of the site.

14.3 Potential Impacts, Mitigation, Management & Residual Impact

14.3.1 Construction Phase

The sensitivity of landscape or in other words, the sensitivity of high valued landscapes depends on its inherent quality, condition, and its ability to adjust changes. The sensitivity of the ones who are exposed to visual impact is based on their location and viewing opportunity. The potential sizes of the impacts on visual amenity and on the elements composing landscape depend on the nature and intensity of changes derived from development.

The assessment of landscape sensitivity was conducted by examination of the locations for permanent facilities. Therefore, visual impacts and landscape impacts are closely connected with predicted changes in terrain, soil, and vegetative cover.

In that regard, the project sites are assessed in terms of their landscape and visual aspects to determine the areas with high landscape value that can be impacted by the project activities at the project site and its close vicinity.

However, there is no element at the project site, which is planned to be constructed at the unused (see Figure 171) flat land. Moreover, there is no natural vegetation that can be considered as visual landscape element at the Project site. There are only bushes suitable for desert vegetation in the area.

The landscape and visual impacts will be potentially resulted from the elements listed below:

- Possible changes in elements and the physical structure of landscape, and the impacts on the general landscape characteristic due to construction and operation activities at the project site;
- The impacts of landscape and visual changes on people due to construction and operation activities.

Construction activity is highly visible activity. The elements of construction may cause a significant change in the landscape in which they are conducted. On the other hand, all of these are temporary activities. The activities will become significant for a couple of months at any location.

The potential impacts on landscape and visual amenity during the construction phase and mitigation measures are presented in Table 216. Mitigation measures will further reduce the impacts and therefore residual impacts will be moderate on the environment.

Figure 171: General View of the Project Area

For the terrain that will be affected by the construction activities, the interfered topography shall be reinstated as it was to the extent possible. The first activity to be performed during the landscaping studies is leveling. Subsequent to leveling, the topsoil will be spread over the terrain by establishing underground and above-ground drainage systems at required locations. Basically, the land topography will be reinstated as compliance to the natural structure of the terrain, climate of the region and the soil characteristics at the areas where construction activities are conducted and the permanent facilities are built. The most significant stage after the spreading of the topsoil is the planting process. The planting process will be carried out by the species that are specific to the area (natural plant species if possible). The detection of the species that is specific for the area, using the right planting methods, execution of good design and monitoring and maintenance programs will enhance the success of the landscaping studies.

Table 216: Significance Impacts on Landscape and Visual Amenity during the Construction Phase of the Project; and Mitigation and Management Measures

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Potential Impact Significance (without impact mitigation measures)	Mitigation and Management Measures	Significance of Residual Impacts
Disturbance on visual view on receptors	Residential and commercial Areas in, Kattakum Village, Kaftarkhana & Uchkizil Towns	Medium	Medium	Moderate	Minimize the extent to which Project activities will be visible from various view locations; Minimize the visual contrast between the main infrastructure elements associated with the Project and the surrounding landscape in which they will be seen. The number of lights during nighttime works will be kept to a minimum, insofar as is consistent with maintaining operations and health and safety requirements. Light spill will be contained to the greatest extent possible e.g. by using directional lighting wherever possible. If required based on feedback of affected people an additional shielding might need to be installed. Regular monitoring of the affected people's feedback with regards to visual impacts will be provided.	Minor

14.3.2 Operational Phase

The objective of the landscape studies during the operation phase is to provide the visual screening of the landscape damaged during the project activities and to create an environment that has scenic value and is consistent with the natural structure.

The map showing the visibility of the study area of the Project is given in Figure 172 which is determined as a 10 km circular area drawn from the center of the Project area. The detected 10 km study area is based upon the Project description, site visits, and good practice guidance. This map is created based on the height of the stack, which is the highest component of the planned Project. As can be seen from the figure, the planned facility stack can be seen from many regions (including from Turkmenistan and Afghanistan) due to the fact that there are not many obstacles around the project area and due to its topography. Other structures, such as power blocks, cooling towers and associated electrical transmission lines, will also be visible, although not as much as the stack's visibility (see Figure 173- Figure 176).

Although relatively long distances may exist between potential view locations and infrastructure within the Project area, the color contrast and reflectivity of materials and finishes will be taken into account when selecting construction materials with the aim of minimizing any potential visual impacts.

In that regard, the topsoil stripped during the excavation works will be used for landscaping activities during the operation phase, with the intention to constitute a vegetative cover, primarily at the location where it was stripped and in the vicinity.

The maintenance process is a significant phase, during when the application area should be controlled periodically; the plants that are damaged and cannot grow should be replaced. When required, maintenance works such as irrigation, fertilization, pruning, disinfection, protection against external impacts, should be carried out.

The visual screening of the newly constructed facilities will be accomplished through landscape applications. The project area will provide ongoing screening for a number of surrounding view locations resulting in a reduction or complete mitigation of visual impact.

The re-establishment of vegetation cover across disturbed areas were not conflicting with longer-term operational infrastructure will help to increase the visual absorption capability of the landscape within the Project area and reduce the overall visibility of the Project infrastructure.

The potential nighttime lighting may issue of direct light spill from floodlights or other lighting elements toward surrounding rural residential dwellings and roads. It will be minimized through compliance with UK CIBSE Lighting Guidance (or international equivalent) to avoid unnecessary light spill into dark areas.

During colder and drier periods, there may also be a visual impact linked to steam plumes from the cooling towers, which will tend to rise vertically from the cooling blocks.

There will also be a visual impact linked to steam plumes from the cooling towers during colder and drier periods.

All potential impacts on landscape and visual amenity during the operation phase and mitigation measures are presented in Table 217. Mitigation measures will further reduce the impacts and therefore residual impacts will be moderate on the environment.

During the social surveys, residents of nearby villages especially Kattakum and Uchkizil, were informed about the heights of the project units including stack (with a height of 65 m) and no negative responses were collected.

Figure 172: Project Area visibility within the 10 km Radius Area (Project Area can be seen from the green shaded areas)

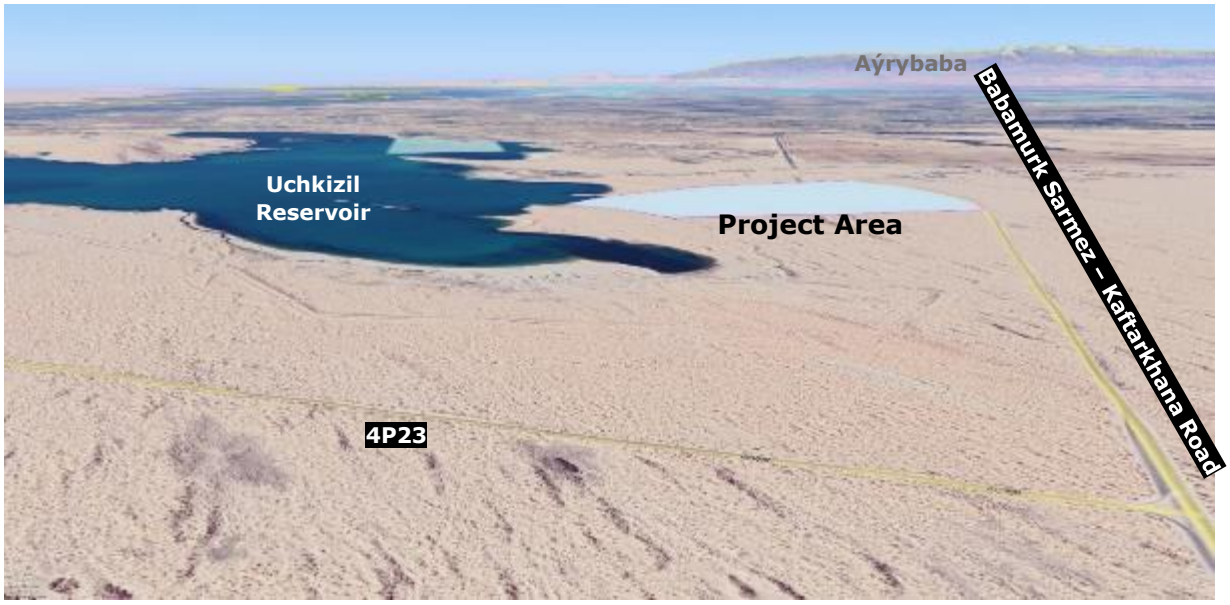


Figure 173: View of the Project Area from the East Direction

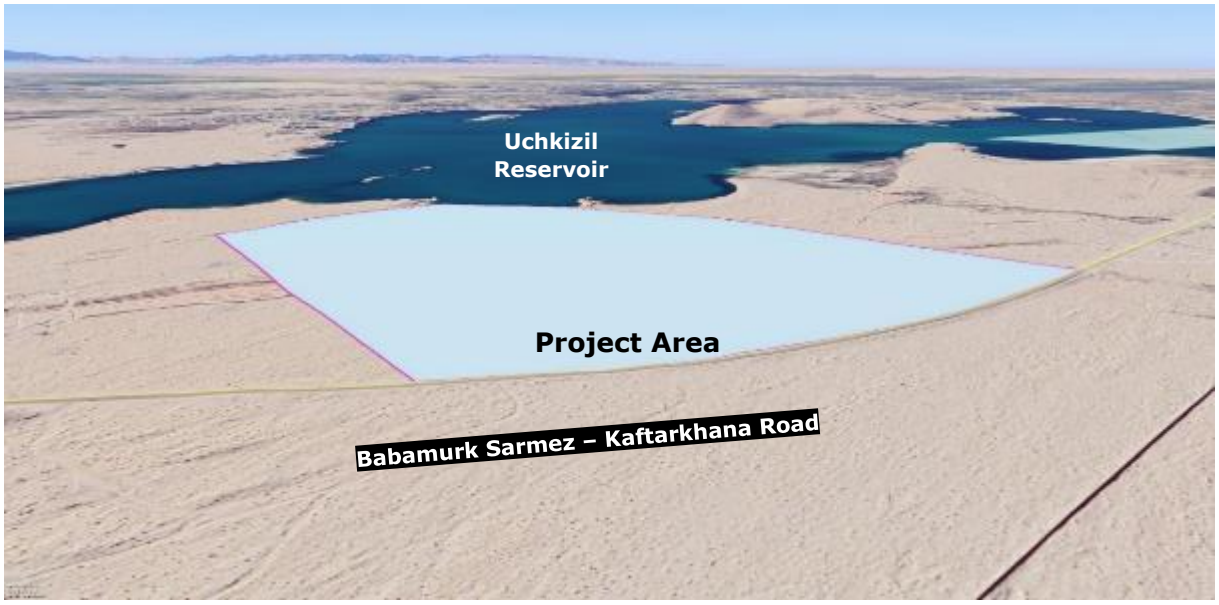


Figure 174: View of the Project Area from the North Direction

Figure 175: View of the Project Area from the West Direction

Figure 176: View of the Project Area from the South Direction

Table 217: Significance Impacts on Landscape and Visual Amenity during the Operation Phase of the Project; and Mitigation and Management Measures

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Potential Impact Significance (without impact mitigation measures)	Mitigation and Management Measures	Significance of Residual Impacts
Disturbance on visual view on receptors	Residential and commercial areas in, Kattakum Village, Kaftarkhana & Uchkizil Towns	Medium	Medium	Moderate	Minimize the extent to which Project activities will be visible from various view locations. Shiny building materials will be avoided Minimize the visual contrast between the main infrastructure elements associated with the Project and the surrounding landscape in which they will be seen. The number of lights during nighttime works will be kept to a minimum with the except flight corridors, insofar as is consistent with maintaining operations and health and safety requirements. Light spill will be contained to the greatest extent possible e.g. by using directional lighting wherever possible. If required based on the feedback of affected people an additional shielding might need to be installed. Regular monitoring of the affected people's feedback with regards to visual impacts will be provided.	Minor

14.4 Cumulative Impacts

All potential impacts on landscape and visual amenity during the construction and operation phase are presented in Section 14.3. The summary of cumulative impacts on landscape and visual amenity is presented in Table 218.

Table 218: Summary of Cumulative Impacts on Landscape and Visual Amenity

Environmental and Social Aspects	Construction Phase	Operation Phase
Cumulative Impacts	There are no known development projects in the vicinity of the Project Area. If any simultaneous activity is planned in the region, the visual disturbance and dust emission that will result from the temporary construction activities on the local receptors in the region will be assessed as a cumulative effect.	The development of a similar industrial activity in the region will permanently change the landscape character of the Project area, which is currently dominated by predominantly agricultural areas and Uchkizil Reservoir.

15. GHG EMISSIONS AND CLIMATE CHANGE

15.1 Standards and Regulations

15.1.1 National Context and Regulations

The main legislation related to climate change and green economy in Uzbekistan are given below:

- Law "On the Rational Use of Energy" No. 412-I, dated April 25, 1997 (as amended on July 14, 2020).
- Decree of the President of the RUz. "On approval of the Strategy on transition of the RUz to the "green" economy for the period 2019-2030", No. 4477, dated October 4, 2019.
- Decree of the President of the RUz, "On approval of the Concept of environmental protection of the RUz until 2030", No.5863, dated October 30, 2019.

The *Law "On the Rational Use of Energy"* aims:

- to ensure efficient and environmentally sound use of energy in its production and consumption;
- encourage the development and application of energy efficient technologies;
- extraction and production of less expensive petroleum products, natural gas, coal and other types of natural fuel;
- ensure accuracy and uniformity of measurements, as well as accounting for energy produced and consumed in terms of both quality and quantity;
- execution of supervision and control by the state over the efficiency of energy production and consumption, as well as over the state of energy equipment and energy supply and consumption systems.

Uzbekistan is a party to the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol and, the Paris Agreement, since November 2018. Uzbekistan submitted the Third National Communication (TNC) in 2016, includes three different emission scenarios until 2030.

This strategy aims to enable the adoption of comprehensive measures aimed at deepening structural transformations, modernization, and diversification of key sectors of the economy through a balanced socio-economic development of territories. The document lists seven goals to pursue. Among them are increasing energy efficiency, develop renewables, and transform the state's apparatus. Climate targets in this law Reduction in specific greenhouse gas emissions per unit of gross domestic product by 10% from the level of 2010 until 2030.

The Strategy has a framework character. It defines priority areas for both mitigation and adaptation. Its implementation will be ensured through measures included in sectoral plans and strategies.

The Strategy has the following priority areas:

- Increased energy efficiency in key economic sectors;
- Diversification of energy resources consumed and the development of RES;
- Climate change mitigation and adaptation, increased efficiency of the use of natural resources and conservation of natural ecosystems;
- Development of financial and other mechanisms to support green economy.

Implementation of the Strategy is to be ensured by the Intergovernmental Council to Promote and Implement Green Economy (composed of ministers and chairpersons of state committees). It is planned to prepare annual action plans for implementation of the Strategy. The Strategy does not include any assessment of costs of its implementation. Furthermore, no mechanism for reporting on implementation is envisaged by the Strategy. The Concept on Environmental Protection until 2030, adopted in October 2019, provides for a number of measures to improve the use of economic instruments in support of environmental protection. The Concept envisages reduction of the amount of controlled pollutants; ensuring the dependence of pollution charges on the volume of emissions and discharges and their level of hazard to the environment and public health; and the introduction of feed-in-tariffs for renewable energy. It is also planned to develop a mechanism for the economic valuation of biodiversity and ecosystem services.

15.1.2 Lender Requirements

Paris Convention

The Paris Agreement is the legally binding international treaty on climate change within the United Nations Framework Convention on Climate Change (UNFCCC) on climate change mitigation, adaptation, and finance. The convention is adopted by 196 parties. It was signed on 12 December 2015 and entered into force on 4 November 2016. The objective of the convention is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent human-induced interference with the climate. The convention's long-term goal is that to sustain the global average temperature below 2 degrees Celsius and further pursuance of 1.5 degrees Celsius. Emissions should be reduced as soon as possible to achieve the balance between human-induced emissions by sources and removal of them by greenhouse gas sinks. Under the Paris Agreement, each country must do plans and programs on mitigation of global warming.

In 2018, Uzbekistan ratified the Paris Agreement and adopted a national commitment to reduce GHG emissions per unit of GDP by 10% of the 2010 level by 2030.

Intergovernmental Panel on Climate Change (IPCC)

The IPCC is the intergovernmental body of the United Nations devoted to providing information regarding the scientific basis risks of climate change impacts driven by the human interference. IPCC covers the scientific and socioeconomically information regarding the human interference on climate change with its natural, political, and economical aspects and risks and suggest adaptation and offset strategies, by assessing the published literature and making it internationally accessible.

The Intergovernmental Panel on Climate Change (IPCC) is a panel that publishes reports on climate change and greenhouse gases, stating the situation at certain times and revealing the risks. According to the IPCC, the continuous release of GHGs increases the likelihood of the severe, common and irreversible effects causing more heating in all components of climate change and causing long term alterations. The limitation of the climate change will require significant and continuous declines in the GHG emissions that is likely to limit the climate change risks along with the adaptation.

Cumulative CO_2 emissions determine the global average surface heating on a great extent in the late 21st century and beyond. Estimate of GHG emissions varies depending upon the socioeconomic development and climate policy on a wide range. (IPCC, AR5 Synthesis Report: Climate Change 2014)

When calculating the non- CO_2 GHGs, they are calculated in terms of "CO_2 equivalent" (CO_2-e) according to their contribution to increase the greenhouse effect. CO_2 equivalent of a gas is calculated using an index so-called Global Warming Potential (GWP).

Kyoto Protocol

The Kyoto Protocol is an international treaty which extended the 1992 UNFCCC that obligates state parties to reduce greenhouse gas emissions, based on the scientific agreement that (part one) global warming is occurring and (part two) that human-made CO_2 emissions are driving it. The Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. There were 192 parties to the Protocol in 2020. The Kyoto Protocol implemented the objective of the UNFCCC to reduce the global warming by reducing greenhouse gas concentrations in the atmosphere to "a level that would prevent dangerous human caused intrusion with the climate system". The Kyoto Protocol applied to the six greenhouse gases. Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6).

The United Nations Framework Convention on Climate Change (UNFCCC)

UNFCCC is the international environmental treaty on climate change and adopted by 154 nations. It aims to stabilize the greenhouse gas concentrations up to a tolerable level that would prevent the human-induced climate threats to the ecosystem. The safety level can only be achieved within a timeframe that allows the climate adaptation and resilience. In this way, production is not threatened, and economic development will not be impeded according to the UNFCCC provisions.

International Finance Corporation/World Bank (IFC/WB)

In line with greenhouse gas and climate studies, World Bank (WB) developed a methodology, aims to enhance access to the GHG analysis, information, capacity and additional climate finance. Developing this methodology, present UNFCCC methodologies, IPCC International GHG Inventory guidelines, GEF and CDM/JI methodological frameworks, GHG Protocol Initiative Standards World Bank Environmental Department documents and methodologies applied by other international finance institutions have been utilized.

The World Bank Group agreed a Country Partnership Framework (CPF) (2016–2020) with Uzbekistan. Climate change is identified as a cross-cutting area of engagement. WBG activities for increased climate resilience focus on three areas [100];

- 1. support to agriculture to increase resilience by diversification to less water-intensive crops, introduction of water saving techniques, and modernization of irrigation systems;
- 2. ensuring all infrastructure investments, including clean and renewable energy deployment would be screened both in terms of physical resilience to likely climate change and of economic returns if climate change considerations were fully costed;
- 3. the continued promotion of the collection of better data on climate change and water flows in the Syr Darya and Amudarya basins and in support of increased consultation by riparian to manage water resources for mutual benefit.

15.2 National Context

Uzbekistan has an arid and continental climate characterized by large variations in temperature within days and between seasons. Large parts of the country (79% by area) feature flat topography either in the form of semi-desert steppes or desert zones, including desert areas in the far west that have formed as a result of the drying of the Aral Sea. The remaining south-eastern areas have a continental climate, including the area covering the largest cities of Tashkent and Samarkand, and contain high mountains forming part of the Tien-Shan and Gissar-Alai Ranges. Summers are long, hot and dry, with an average monthly temperature of 27.2°C in the hottest month (July), and with an average daily maximum of 35°C in many of the major cities. Winters are cold, with average monthly temperatures of −1°C to −3°C between December and February for the latest climatology, 1991–2020, (see Figure 177). Western areas of the country experience relatively colder winter temperatures, whereas temperatures are highest in the south, near the borders with Turkmenistan and Afghanistan. There is considerable spatial variation in precipitation levels. Many western areas receive less than 100 millimeters (mm) of precipitation per year, whereas parts of the east and south-east can receive up to 800–900 mm per year. Figure 178 shows the spatial differences of observed historical temperature and precipitation in Uzbekistan [11].

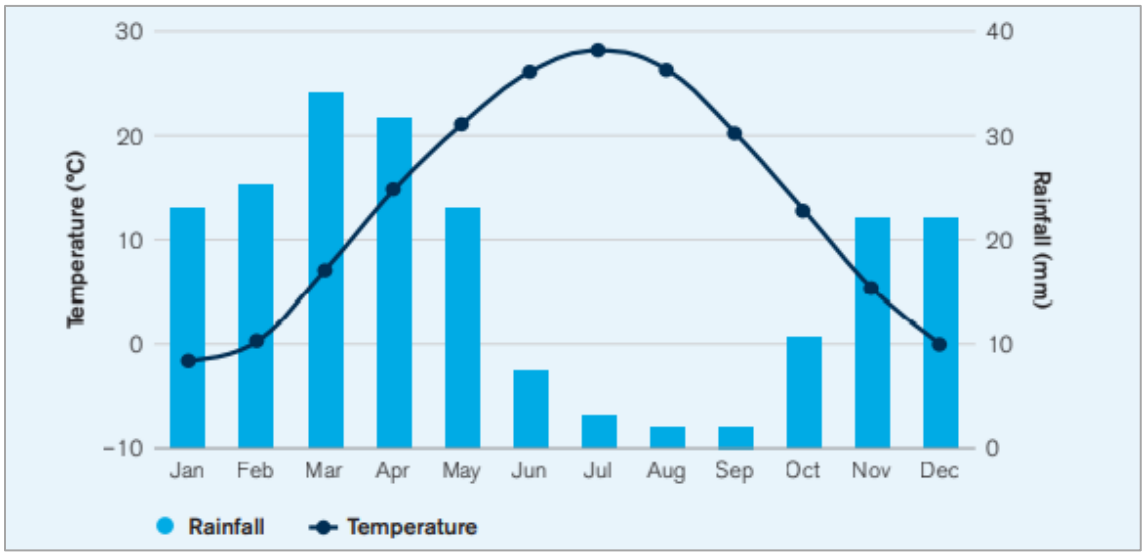


Figure 177: Average Monthly Temperature and Rainfall in Uzbekistan, 1991–2020 [11]

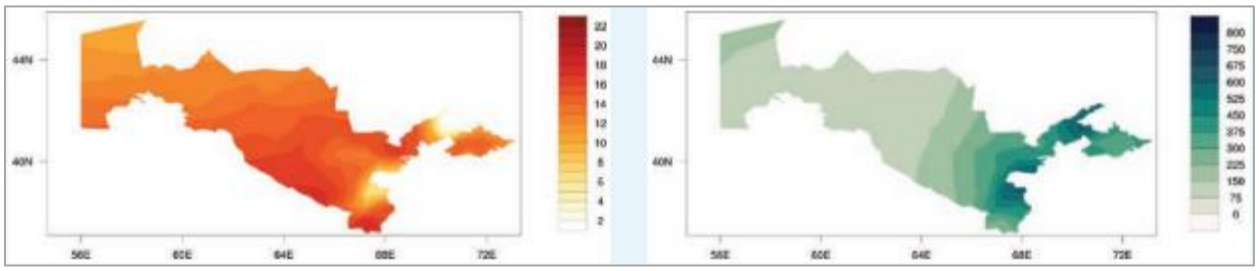


Figure 178: (Left) Annual Mean Temperature (°C), and (right) Annual Mean Precipitation (mm) in Uzbekistan Over the Period 1991–2020

Average annual air temperatures have risen steadily and significantly in Uzbekistan over the past century, albeit with notable variation from year to year. From 1950 to 2013, temperatures have risen at an average rate of 0.27°C per decade. The average annual temperature range has narrowed in Uzbekistan over the same period, with average minimum temperatures rising by 2.0°C and average maximum temperatures by 1.6°C between 1950 and 2013. The drying, or 'desiccation', of the Aral Sea located at Uzbekistan's Northwestern corner has made a minor contribution to climate warming in the local vicinity. Uzbekistan's rate of warming varied considerably by region, with the steepest rises in temperature occurring in the north and in large cities (0.30°C–0.43°C per decade), and less warming occurring in mountainous areas (0.10°C–0.14°C per decade). Warming was fastest in spring (0.39°C per decade) and autumn (0.31°C), while temperature rises were relatively modest in winter (0.13°C per decade) [11].

In contrast to the clear trend in average temperatures, average annual precipitation has not shown statistically significant changes in Uzbekistan in recent decades. A slight decrease in average annual precipitation was observed between 1950 and 2013. Observations from the Tien Shan and Gissar-Alai mountain ranges exhibit some variation between seasons, with a slight increase in winter months (December to February) being offset by slight decreases in

other months of the year. El Niño Southern Oscillation (ENSO) has a strong influence over multi-year dry and wet climate variability.

Greenhouse Gases Trends by Sector

Uzbekistan is a Non-annex-I party to the UNFCCC, and has submitted, to date, three national communications to the UNFCCC, including inventories of GHG emissions. The latest data, contained in the TNC, issued in 2016 and submitted in 2017, are updated to 2012. The inventory presented under the TNC includes data on emissions and sinks of CO_2, CH_4, N_2O and HFCs, as well as of CO, NOx, non-methane volatile organic compounds (NMVOCs) and SO_2. A new GHG inventory will be compiled in 2020–2021. The inventory does not include data on sulfur hexafluoride (SF6) and perfluorocarbons (PCFs) due to the lack of relevant data. According to the TNC, in 2012, GHG emissions per capita in the country were 6.9 t of CO2-eq, while total emissions, excluding land use change and forestry (LUCF) sinks were 205.2 Mt CO2-eq (see Table 219). In comparison with 1990, there has been a 13.7 per cent increase in overall emissions and a 21.6 per cent decrease in emissions per capita. In 2012, the energy sector accounted for 82 per cent of emissions (excluding LUCF removals) for a total of 168.1 Mt of CO2-eq., and, as such, was the greatest contributor to the country's GHG emissions. The second biggest contribution to GHG emissions comes from the agricultural sector, accounting for 11 per cent of the emissions in 2012, followed by industrial processes and waste treatment, both accounting for slightly less than 8 per cent of the total GHG emissions of the country. Figure 179 illustrates the fluctuation and GHG emission trends by sector in Mt of CO_2-eq. The historical trend of the 22-year period from 1990 to 2012 appears substantially stable, with a gentle, steady increase in emissions, which are being consistently dominated by the energy sector.

Table 219: GHG Emissions and Removals by Sector, 1990, 1995, 2000, 2005, 2010, 2012, Mt CO_2-eq

	1990	1995	2000	2005	2010	2012
Energy	151.2	157.9	172.4	169.2	164.1	168.1
Industrial processes	8.1	5.3	4.9	6.2	7.9	7.8
Agriculture	17	16.7	16.2	16.1	19.9	21.6
LUCF	-1.6	-1.4	-1	0.4	-3.1	-2.9
Waste	4.1	4.3	4.5	4.7	7.3	7.7
Total (including LUCF removals)	**178.8**	**182.8**	**197**	**196.6**	**196.1**	**202.3**
Total (excluding LUCF removals)	**180.4**	**184.2**	**198**	**196.2**	**199.2**	**205.2**

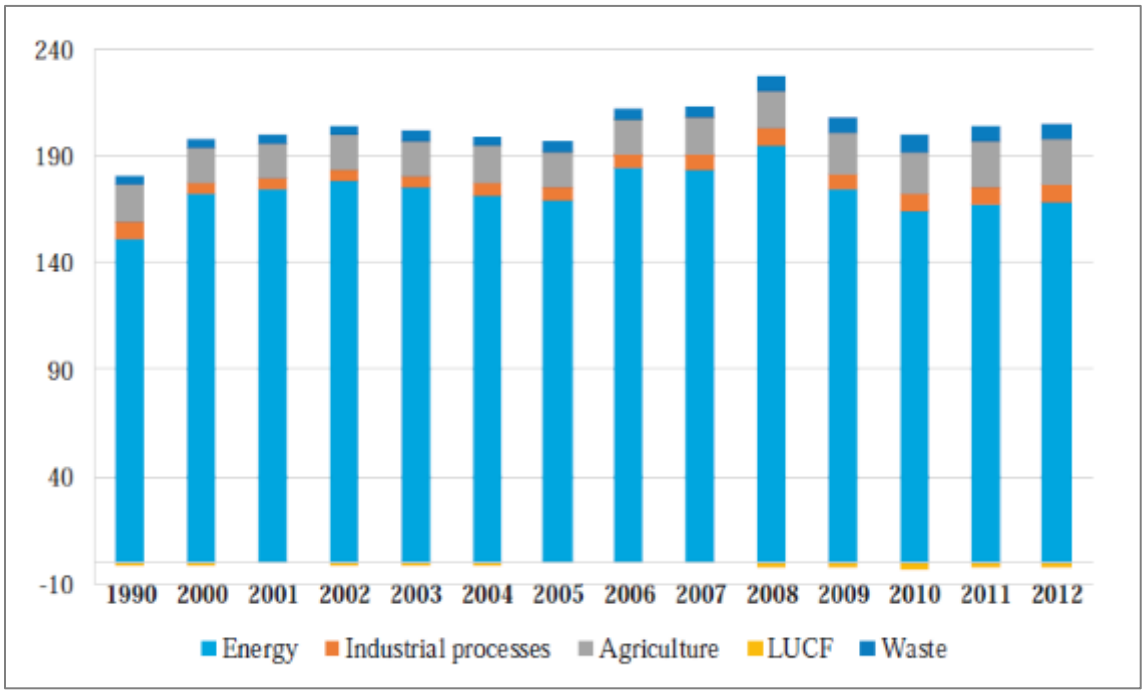


Figure 179: Total GHG Emissions by Sector, 1990, 2000–2012, Mt of CO2-eq

In 2012, CO_2 emissions accounted for 51 per cent of the overall GHG emissions of the country. Historically, they have accounted for about half the total emissions since 1990 (see Figure 180). CH4 emissions increased substantially, from 30 per cent of total emissions in 1990 to 43 per cent of total emissions in 2012 (converted to CO_2-eq.). The third most represented GHG is N_2O, accounting for 5 per cent of total emissions in 2012. In addition to this, the GHG inventory reports negligible quantities of emissions from HFCs (less than 0.1 per cent of the total emissions when converted to CO_2-eq.).

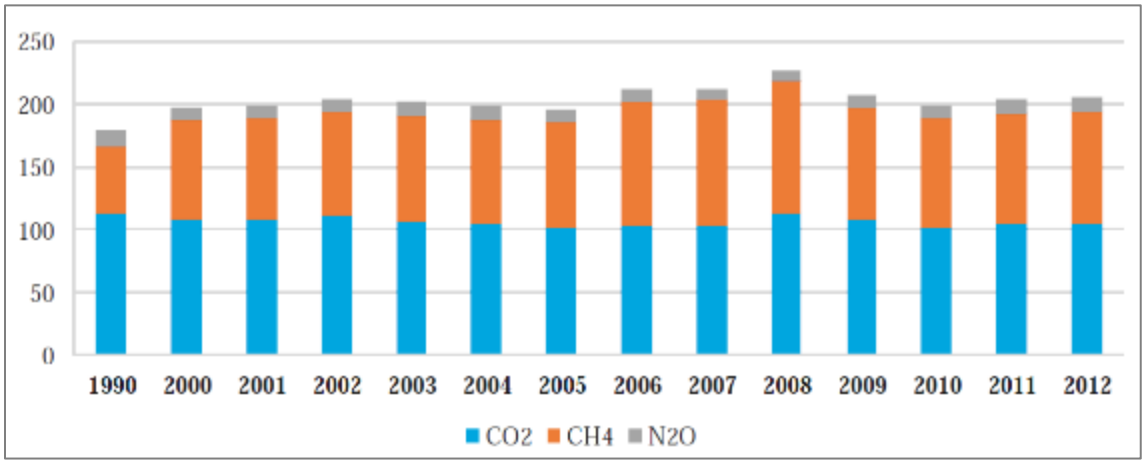


Figure 180: Total GHG Emissions by Gas, 1990, 2000–2012, Mt of CO_2-eq

Energy is the highest emitting sector in the country, emitting 168.1 Mt CO2-eq. in 2012 and thus accounting for 82 per cent per cent of total GHG emissions of the country (excluding LUCF removals). The contribution of the sector to overall emissions has increased slightly over the years, with an increase of 11.2 per cent in 2012 compared with 1990.

Approximately 75–80 per cent of the electricity in Uzbekistan is produced using natural gas produced in Uzbekistan. Within the energy sector, most emissions come from fuel combustion, accounting for 58 per cent of emissions in 2012, whereas the remaining 42 per cent is due to fugitive emissions. The fuel combustion category includes fuel combustion by energy industries and by manufacturing and construction industries and fuel combustion for transport. On the other hand, the "fugitive emissions" category includes fugitive emissions due to coal mining and processing, and fugitive emissions in the oil and gas sector. It is worth noting that GHG emissions from methane leakage alone account for more than 68.237 Mt CO2- eq. per year in 2012, with an increasing trend from 43.628 Mt CO2-eq. per year in 1990. Methane leakage is a significant issue for the country. Even though many project interventions, including those financed under the Clean Development Mechanism (CDM), have sought to address the issue, it is a growing source of emissions in the country, with its contribution to overall emissions having increased from 22.9 per cent in 1990 to 33.2 percent in 2012 (see Figure 181).

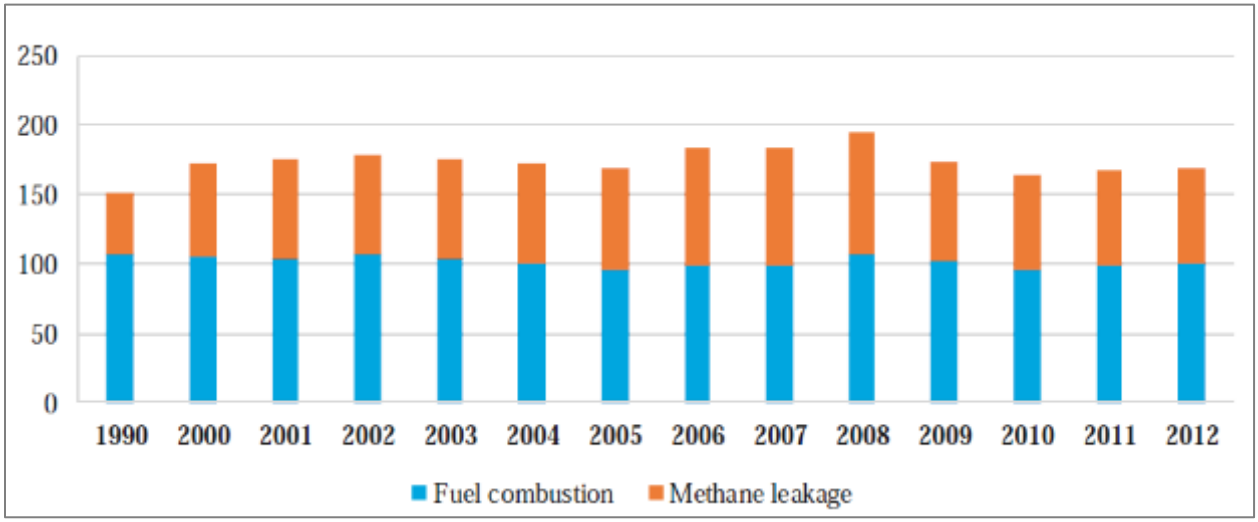


Figure 181: GHG Emissions from The Energy Sector, 1990, 2000–2012, Mt CO2-eq

15.3 Climate Change Impacts and Mitigation

15.3.1 GHG Emissions

During the construction and operation phases, significant amount of direct and indirect GHG gases (namely CH_4, CO_2, N_2O, SF6, HFCs, PFCs and NF_3) are released due to earthworks, cement and steel use, maintenance activities, stationary combustion of natural gas, vehicles and equipment that works with diesel fuel. Accordingly, scope of emission has been identified in parallel to the Figure 182.

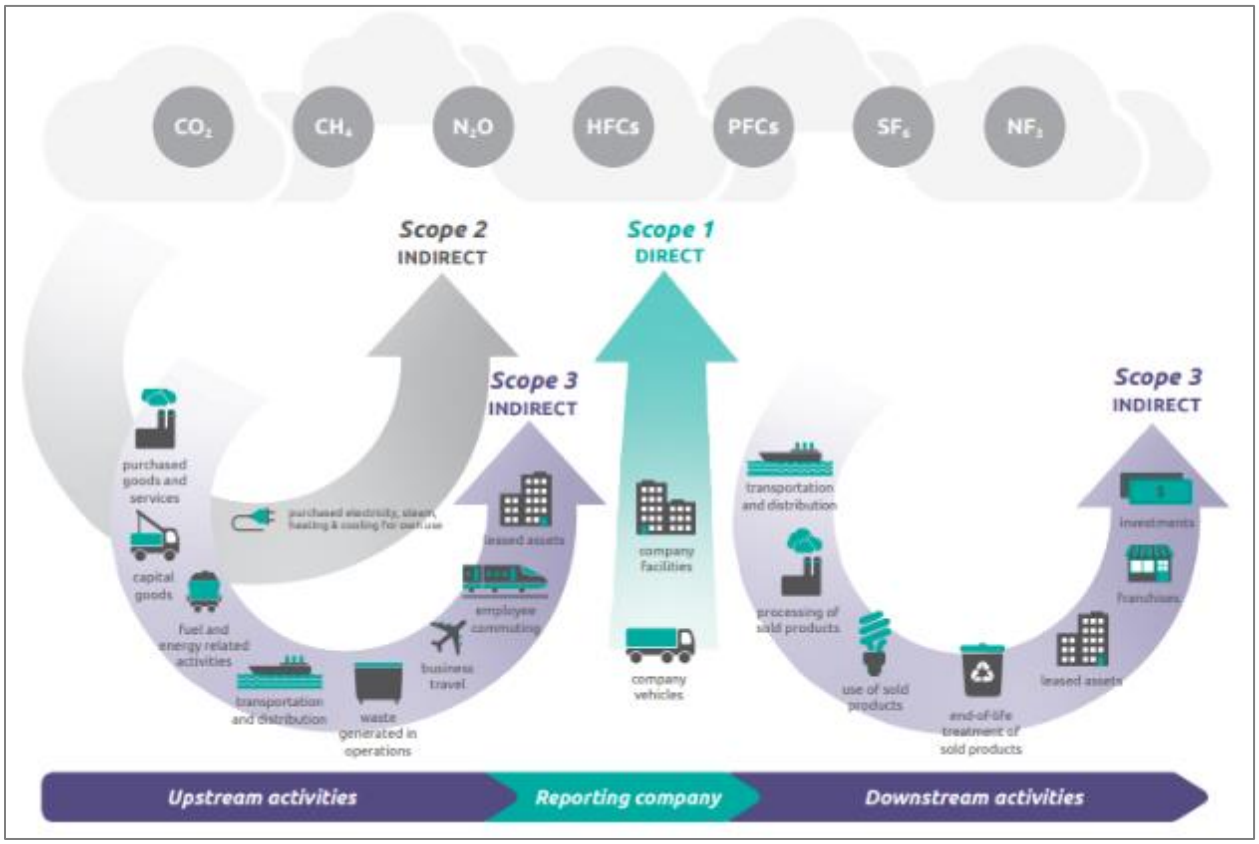


Figure 182 Illustration of Scope of Emissions

Greenhouse gases of the project through its life cycle calculated by establishing a system boundary with cradle to gate approach. Having considered only on-site emissions, **all GHG emission estimations are calculated in CO2 equivalent in line with the IPCC Guidelines for National Greenhouse Gas Inventories[17] as per ISO-14064 standard. The ISO-14064 is the one of the GHG accounting methodologies recommended by the IFIs through their harmonized approach to GHG Accounting published in November, 2015[18].**

[17] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 2, Stationary Combustion.

18 International Financial Institution Framework for a Harmonised Approach to Greenhouse Gas Accounting, November 2015, available at: https://www.worldbank.org/content/dam/Worldbank/document/IFI_Framework_for_Harmonized_Approach%20to_Greenhouse_Gas_Accounting.pdf

15.3.1.1 GHG Calculation for Construction Phase

As per the figure above, scope of emission to be generated during construction activities are classified in Table 220.

Table 220: Scope of Emissions specific to the Project Construction Phase

Type of Emission	Emission Source	Is it able to calculate?
Scope 1 Emissions (direct)	Stationary combustion sources by fuel combustion of construction vehicles	Yes, with primary and secondary data
	Fuel consumption during transportation of materials, products, waste (if any) within the site	Negligible
	Transportation of employees with company vehicles	Negligible
	Leakage from air-conditioning and refrigeration units (fugitive emissions)	Negligible
Scope 2 Emissions (indirect)	Purchased Electricity, steam, heat and cooling in the temporary offices	Yes, with primary and secondary data
Scope 3 Emissions (indirect)	Material Supply	Not adequate information
	Flight of Staff	Not adequate information
	Water Consumption	Yes, with primary and secondary data
	Waste disposal	Not adequate information
	Site access of personnel, visitors by private vehicles and site visits	Not adequate information

As defined in the above table, due to the lack of knowledge, only stationary combustion by fuel combustion and purchased electricity for the temporary offices could be calculated. The amount of emissions that will be caused by such activities are given in the following section.

GHG Calculation approach follows the IPCC Guidelines for National Greenhouse Gas Inventories - Stationary Combustion (2006)[19] (hereinafter IPCC Guideline).

Following equation will be used to calculate GHG emissions resulted by abovementioned activities.

$$GHG\ Emission\ =\ Activity\ Data\ *\ Emission\ Factor$$ (Tier 1)

GHG Emission from Stationary Combustion of Construction Vehicles

Activity Data will be calculated from total diesel fuel consumption in tons whereas emission factors will be extracted from IPCC Guideline.

During the construction phase, it is assumed that only fuel to be used for the vehicles will be diesel fuel. According to the IPCC Guideline, CH4, N2O and CO2 are expected to generate due to combustion of diesel fuel.

The fuel consumption information and expected emission types are given in Table 221.

Table 221: Activity Data

Item	Value/Amount	Units
Annual Diesel Volume Use	89,790	L
Density of Diesel Oil	0.832	kg/L
Annual Diesel Volume Use	= 89,790 L * 0.832 kg/L = 76,463.4	kg
Net Calorific Value	43 (default)	TJ/Gg
Activity Data	= 76,463.4 * 10-6 * 43 =3.2879262	TJ
Expected Emissions	CH4, N2O, CO2	-

Table 222: Emission Factors

CO2 kg CO2/TJ			**CH4 kg CH4/TJ**			**N2O kg N2O/TJ**		
Lower	**Default**	**Upper**	**Lower**	**Default**	**Upper**	**Lower**	**Default**	**Upper**
72600	**74100**	**74800**	**1**	**3**	**10**	**0.2**	**0.6**	**2**

[19] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 2, Stationary Combustion

GHG emission = Activity Data * Default Emission Factor, so;

- CO_2 Emission = 3.2879262 * 74100 = 243635.3314 kg CO_2
- CH_4 Emission = 3.2879262 * 3 = 9.8637786 kg CH_4
- N_2O Emission = 3.2879262 * 0.6 = 1.97275572 kg N_2O

In order to calculate CO2-equivalent, global warming potential of the expected GHG emissions should be used which is given in the table below.

Table 223: Global Warming Potentials

Item	Global Warming Potential
CO2	1
CH4	28
N2O	265

Accordingly, the expected GHG emissions in CO2-equivalent is calculated below.

- From CO_2: 243635.3314 kg CO2 * 1 = 243635.3314 kg CO_2 equivalent
- From CH_4: 9.8637786 kg CH4 * 28 = 276.1858008 kg CO_2 equivalent
- From N_2O: 1.97275572 kg N2O * 265 = 522.7802658 kg CO_2 equivalent

Annual total GHG emission generated from stationary combustion of diesel fuel is approximately **244.5 tons** of CO_2 equivalent.

GHG Emission from Purchased Electricity

In order to calculate GHG caused by electricity purchasing, electricity to be used during the construction activities should be estimated. It is expected that the the number of personnel is designated as about 2048 people, the purchased electricity can be calculated using electricity consumption per capita.

In Uzbekistan, the electric power consumption per capita is 1645 kWh in 2014[20].

Total electricity consumption in operation phase for one year = Electric power consumption per capita x total staff number

[20] The most recent data extracted from World Bank data base, accessible at: https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?locations=UZ

= 1645 kWh/capita-year x 2048 staff = 3368960 kWh/year

According to the IFI 2021 Harmonized Grid Emission factor (GEF) data set21, the GEF Factor of Uzbekistan for electricity use is 0.467 kg CO2 / kWh.

GHG Emission = Activity Data x Emission Factor, so;

CO2 Emission from purchased electricity = 3368960 kWh x 0.467 kg CO2/kWh = 1,573,304.32 kg CO2/year = 1573 tons CO2/year.

The transmission and distribution losses are ignored.

GHG Emission from Water Supply

The total water consumption during the construction is estimated as 29347.88 m³/year (please see Chapter 8), which includes preparation of concrete and cement, irrigation for dust emission, household needs, cooking, and commissioning activities.

In line with the Greenhouse Gas Emission Calculator of UNFCCC[22], water emission factor is 0.14900 kg CO_2/m^3.

GHG Emission = Activity Data x Emission Factor

CO2 Emission = 29347.88 m3/year x 0.14900 kg CO2/m3 = 4373 kg CO2/year = 4.3 tons CO2/year.

The total estimated GHG emission for construction phase is summarized in the table below.

Table 224: Summary of GHG Emissions Estimated for Construction Phase

Item	Estimated GHG in tons of CO2 equivalent (for 1-year activity)
Scope 1 – combustion of fuel	244.5
Scope 2 – purchased electricity	1573
Scope 3 – water supply	4.3
Annual Total	**1822 tons of CO2 equivalent**

[21] Available at: https://unfccc.int/sites/default/files/resource/IFI%20Default%20Grid%20Factors%202021%20v3.1_unfccc.xlsx

[22] Available at: https://unfccc.int/documents/271269

15.3.1.2 GHG Emission during the Operation Phase

Natural gas is the most effective solution in fossil fuel-based energy production due to its high efficiency in terms of being in clean fuel category and producing low greenhouse gas. Despite natural gas power plants are more environmental-friendly power plants than coal-thermal power plants, according to the IPCC guideline, stationary combustion of natural gas in the energy industries emits CH4 and N2O as well as CO2.

Moreover, emissions from the use of vehicles, purchased electricity, material supply etc. are also expected during the operation phase of the Project from the delivery vehicles to the plant and those of the employees. The expected emissions are summarized in the below table.

Table 225: Scope of Emissions specific to the Project Operation Phase

Type of Emission	Emission Source	Is it able to calculate?
Scope 1 Emissions (direct)	Stationary combustion sources by fuel combustion of operation units	Yes, with primary and secondary data
	Fuel consumption during transportation of materials, products, waste (if any) within the site	Negligible
	Transportation of employees with company vehicles	Not adequate information
	Leakage from air-conditioning and refrigeration units (fugitive emissions)	Negligible
Scope 2 Emissions (indirect)	Purchased Electricity, steam, heat and cooling in the temporary offices	Yes, with primary and secondary data (for only purchased electricity)
Scope 3 Emissions (indirect)	Material Supply	For only natural gas supply
	Flight of Staff	Not adequate information
	Water Consumption	Yes, with primary and secondary data
	Waste disposal	Not adequate information
	Site access of personnel, visitors by private vehicles and site visits	Not adequate information

GHG Emission from Stationary Combustion of Operation Units

As similar with the construction phase calculations, emission factors in IPCC guideline and yearly fuel use will be considered to estimate those GHG emissions with Tier 1 equation.

Table 226: Activity Data

Parameter	Unit	Value
Operating Time (nominal)	hours	8,000
Generated power	MWe	1,600
	GWh	12,800
Fuel use	Nm^3/year	2,264,000,000
	Sm^3/year	2,388,293,600
Density of natural gas	kg/Sm^3	0.72
	Gg/year	1719.6
Net Calorific Value of	TJ/Gg	48 (default)
Activity Data	TJ	82539.4

Table 227: Emission Factors of GHG

CO2 kg CO2/TJ			CH4 kg CH4/TJ			N2O kg N2O/TJ		
Lower	**Default**	**Upper**	**Lower**	**Default**	**Upper**	**Lower**	**Default**	**Upper**
54300	**56100**	**58300**	**0.3**	**1**	**3**	**0.03**	**0.1**	**0.3**

GHG emission = Activity Data * Default Emission Factor, so;

- CO2 Emission = 82539.4 * 65100 = 4630461845 kg CO2
- CH4 Emission = 82539.4 * 1 = 82539.4 kg CH4
- N2O Emission = 82539.4 * 0.1 = 8253.942682 kg N2O

In order to calculate CO2-equivalent, global warming potential of the expected GHG emissions should be used which is given in the table below.

Table 228: Global Warming Potentials

Item	Global Warming Potential
CO2	1
CH4	28
N2O	265

Accordingly, the expected GHG emissions in CO2-equivalent is calculated below.

- From CO_2: 4,630,461,845 kg CO_2 * 1 = 4,630,461,845 kg CO_2 equivalent

- From CH_4: 82,539.4 kg CH_4 * 28 = 2,311,103.951 kg CO_2 equivalent
- From N_2O: 1.97275572 kg N_2O * 265 = 2,187,294.811kg CO_2 equivalent

Total GHG emission generated from operation of the plant is approximately **4.63 x10^6 tons** of CO2 equivalent/year for 8000 hours operation. This calculation shows the maximum amount of greenhouse gas that can occur under the worst-case conditions, and in real operating conditions, the amount of greenhouse gas to be used will be lower if the plant is stopped at various times or will not always operate at full load.

GHG Emission from Purchased Electricity

Although there is no accurate forecast for electricity consumption of the plant during operation, since the number of personnel is designated as about 300 people, the purchased electricity can be calculated using electricity consumption per capita.

Those 300 staff are expected to work 8 hours per shift and 365 days a year. In Uzbekistan, the electric power consumption per capita is 1645 kWh in 2014[23].

Total electricity consumption in operation phase for one year = Electric power consumption per capita x total staff number

= 1645 kWh/capita-year x 300 staff = 493500 kWh/year

According to the IFI 2021 Harmonized Grid Emission factor (GEF) data set24, the GEF Factor of Uzbekistan for electricity use is 0.467 kg CO2 / kWh.

GHG Emission = Activity Data x Emission Factor, so;

CO2 Emission from purchased electricity = 493500 kWh x 0.467 kg CO2/kWh = 230,648.47 kg CO2/year = 230.6 tons CO2/year

The transmission and distribution losses are ignored.

GHG Emission from Natural Gas Supply

As mentioned above, the total natural gas consumption in the plant is estimated 2,388,293,600 Sm3/year.

[23] The most recent data extracted from World Bank data base, accessible at: https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?locations=UZ

[24] Available at: https://unfccc.int/sites/default/files/resource/IFI%20Default%20Grid%20Factors%202021%20v3.1_unfccc.xlsx

According to the Greenhouse Gas Emission Calculator of UNFCCC[25], emission factor associated with extraction, refining, and transportation of raw fuel sources to the plant for natural gas is 0.34593 kg CO2/m3.

GHG Emission = Activity Data x Emission Factor

CO2 Emission = 2,388,293,600 Sm3/year x 0.34593 kg CO2/m3 = 826,182,405.05 kg CO2/year = 826.182 tons CO2/year.

GHG Emission from Water Supply

According to the water consumption calculations, the standard volume of water consumption during the operation of the combined cycle power plant is estimated as 600.0 thousand m³/year, which includes water consumption of gas turbines, household and drinking, kitchen, cleaning activities.

In line with the Greenhouse Gas Emission Calculator of UNFCCC[26], water emission factor is 0.14900 kg CO2/m3.

GHG Emission = Activity Data x Emission Factor

CO2 Emission = 600,000 m3/year x 0.14900 kg CO2/m3 = 89400 kg CO2/year = 89.4 tons CO2/year

The total estimated GHG emission for operation phase is summarized in the table below.

Table 229: Summary Table of GHG Emission for Operation Phase

Item	Estimated GHG in tons of CO2 equivalent (for 1-year activity)	Kg CO2/MWh
Scope 1 – combustion of fuel	4.63 x10^6	362.106
Scope 2 – purchased electricity	230.6	0.018
Sub-Total of Scope 1 and 2	**4.635 x 10^6**	**362.124**
Scope 3 – natural gas supply	826,182	64.546
Scope 3 – water supply	89.4	0.007
Annual Total (Scope 1,2,3)	**5.46 x 10^6 tons of CO2/year**	**426.670 kgCO2/MWh-year**
Total Emission (Scope 1,2,3) during operation phase (25 years)*	5.46 x 106 x 25 = 136.5 x 106 tons = 0.136 Gigatons CO2	10666.74 kgCO2

[25] Available at: https://unfccc.int/documents/271269

[26] Available at: https://unfccc.int/documents/271269

*Emissions are calculated by assuming that content and amount natural gas, purchased electricity amount and water demand will not change through the project life cycle in order to estimate maximum GHG emission. If technological investments will made in future through low-carbon economy, the GHG emissions may reduce accordingly.

15.3.2 Mitigation Measures

During the construction phase, major GHG emitters will be stationary combustion of diesel fuels of construction vehicles and equipment (direct), purchasing electricity and water supply (indirect). Also, there will be GHG emissions generated by material supply, waste disposal, which could not be estimated due to lack of knowledge. Emissions generated in construction phase can be mitigated by following but not limited measures:

- Do not keep open vehicles when they are not used,
- Keep GHG data of material supplied to the site,
- Develop a management plan to use resources efficiently,
- Use suppliers who guarantee their carbon footprint, and choose the suppliers who have less carbon footprint compared others,
- Use recycled materials,
- Comply waste management hierarchy: prevent at source, reuse, recycle and recover,
- Prefer local companies to supply materials,
- Prefer railways and roads to supply materials rather than airways,
- Organize trainings and workshops for site staff about resource use and waste management.

During the operation phase, stationary combustion of natural gas, purchased electricity, water consumption are the main sources of the GHG emissions. In addition, transfer of operation staff, material supply and waste transportation are other GHG emission sources which could not be estimated due to lack of knowledge. Following but not limited measures could be applied to mitigate operation-related GHG emissions:

- Follow the technological developments through Best Available Technologies to reduce fuel and water consumption,
- Install renewable energy sources to use in offices independently from local electrical grid. For instance, covering roofs with solar panels for the office buildings (after risk assessment against explosion etc.),
- Keep GHG data of material supplied to the site,
- Develop a management plan to use resources efficiently,
- Use suppliers who guarantee their carbon footprint, and choose the suppliers who have less carbon footprint compared others,
- Use recycled materials,
- Comply waste management hierarchy: prevent at source, reuse, recycle and recover,
- Prefer local companies to supply materials,
- Prefer railways and roads to supply materials rather than airways,
- Organize trainings and workshops for operation staff about resource use and waste management.

15.3.3 CO_2 Reduction Estimation

15.3.3.1 Current Average CO2 Emission Level of TPPs in Uzbekıstan

11 TPPs in Uzbekistan, including 3 CHPPs, are the main source of power generation. The capacity of modern energy efficient generating units is 2825 MW, or 25.6 per cent of aggregate TPP capacity [64].

GHG emissions decreased by 4.7% compared to the 1990 level and amounted to 144.4 mln t CO_2-e, including for the period for 12.9GW [65]. Additionally, Uzbekistan grid's carbon intensity is 506 kg/MWh [66].

15.3.3.2 Decommissioning Plan Indication

Obsolete and worn TPP assets shall be decommissioned as new generating assets are brought online. Total capacity of equipment to be decommissioned that is beyond its economic life shall reach 5900 MW by 2030.

It is seen that, there is approximately 1400 MW TPP decommissioning plan until 2024 and 5900MW existing TPP decommissioning plan until 2030. (see Table 230) [64].

In Table 230 you can find the decommissioning plants in Uzbekistan by 2024 and the total MW decommissioning by 2030.

Table 230: Existing Decommissioning Plan

			Decommissioning					
Plant (TPP)	Commissioning year	Capacity (MW)	2021	2022	2023	2024	Total MW by 2024	Total MW by 2030
Navoi	1966	50	Decom.				160	
	1967	60	Decom.					
	1971	50	Decom.					
Takhiatash	1967	100	Decom.				310	
	1968	100	Decom.					
	1974	110	Decom.					
Tashkent	1967	165		Decom.			330	
	1698	165		Decom.				
	1966	150			Decom.		305	
	1967	155			Decom.			
	1965	150				Decom.	300	
	1965	150				Decom.		
		Total	480	330	305	300	1405	5900

As stated in Section 14.3.3.1 that the current CO_2 emission of the energy sector of Uzbekistan is 144 million tons per year.

With the 1400MW decommissioning to be carried out until 2024, when the calculation is made according to the current operating efficiency (506kg/MWh), it is predicted that there will be a 5.7 mln t CO_2/y emission reduction and this figure will increase to 24 mln t CO_2/y by 2030 according to the 5900MW decommissioning plan (see Table 231).

Table 231: CO2 emissions of the current situation decommissioning plan and the Project

TPP PLANTS	POWER (MW)	CO_2 EMISSIONS t CO_2/year*	CO_2 INTENSITY kg/MWh
Current Situation of the TPP in Uzbekistan	**12,900**	**144 mln**	**506**
Decommissioing Plants by 2024	**1,400**	**5,7 mln**	**506**
Decommissioing Plants by 2030	**5,900***	**24 mln**	**506**
SCE-QUVVAT 1600MW CCPP Project	**1,600**	**4.17 mln**	**326**

**According to data of old TPP Projects Assumption 8000h/y*

15.3.3.3 Cumulative CO2 reduction

By 2017, GHG emissions decreased by 4.7% compared to the 1990 level and amounted to 144.4 mln t CO2-e, including for the period. 2013-2017 by 4%. This is due to the systematic elimination of natural gas leaks in the oil and gas industry, as well as to improvement of energy efficiency in all industries [R2].

CO2 emission comparison of the SCE-QUVVAT 1600MW CCPP Project and the existing TPPs in Uzbekistan and the TPPs to be decommissioned by 2030 is given in Table 232.

As a result; the net reduction of CO2 emissions emerged from the project will be approximately 36% higher than compared to existing TPP facilities in Uzbekistan, which will contribute to climate change mitigation together with the decommissioning of obsolete power plants.

You can find the graph of CO2 emission reduction with total decommissioning values until 2024 and 2030 with two scenarios (Scenario 1 and 2) in Figure 183.

- Scenario 1 = Without SCE / No Decommissioning
- Scenario 2 = SCE / Decommissioning plan activated

Considering that the annual CO_2 emission of the Project is 4.1 mln t CO_2/y, according to the total decommissioning data to be made until 2024 and until 2030 in both scenarios, it is predicted that the CO_2 emission originating from the Project unit efficiency (%60) will reduce the annual Uzbekistan CO_2 (144mln t/y) emission. (see Table 232).

Table 232:Comparison of the Current Situation and The Project

TPP PLANTS	CO_2 EMISSIONS	
	≈Decommissioning t CO_2/year*	≈Cumulative t CO_2/year
Current Situation of the TPP in Uzbekistan	-	144 mln
Decommissioing Plants by 2024 (-) SCE-QUVVAT	5,7 mln	*142,4mln
Decommissioning Plants by 2030 (-) SCE-QUVVAT	24 mln	**124,1mln

* **144-5,7+4,1**(total CO_2/y emission in Uzbekistan (-) decommissioning by2024 (+) the Project CO_2 emission)

** **144-24+4,1**(total CO_2/y emission in Uzbekistan (-) decommissioning by2030 (+) the Project CO_2 emission)

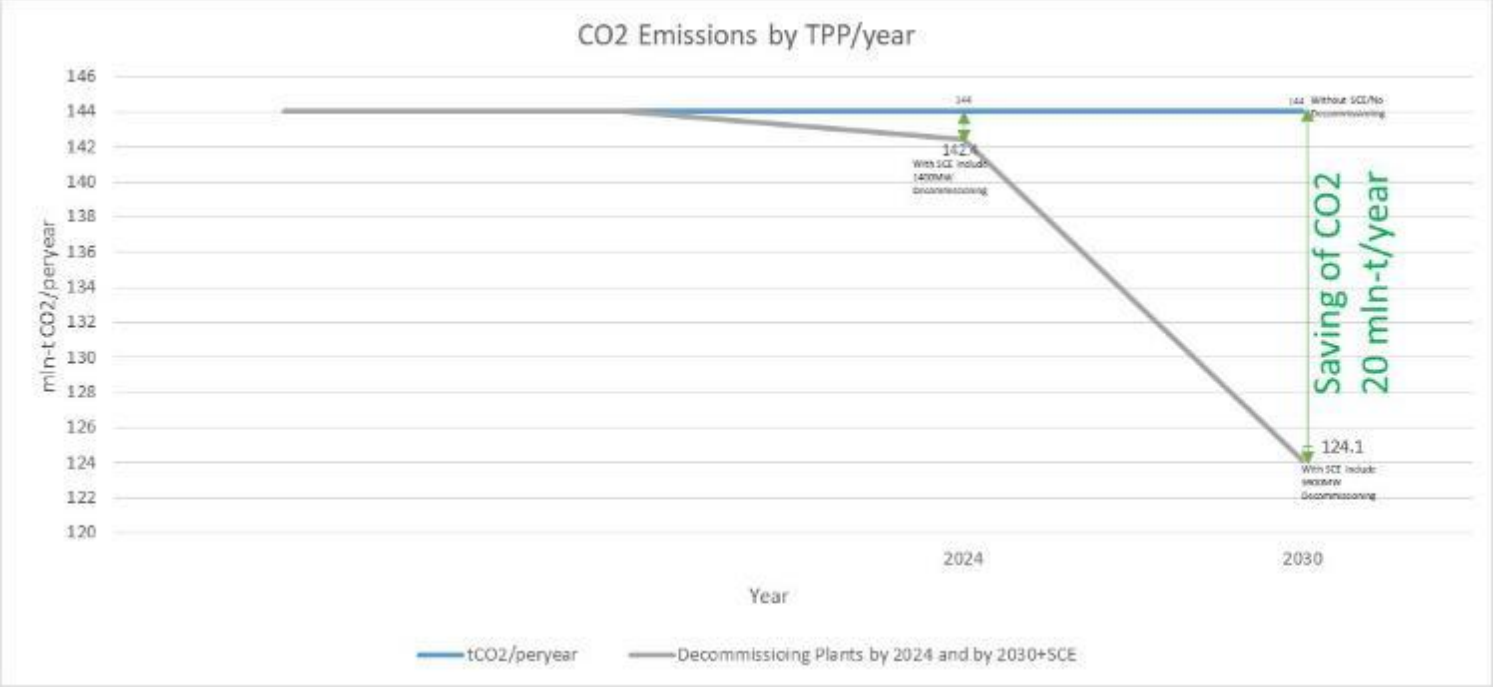


Figure 183:CO2 Emission by TPP/year

15.4 Climate Risk Assessment

According to the Equator Principle 4, where the project combined Scope 1 (direct) and Scope 2 (indirect electricity) emissions exceed 100,000 tCO2e, a climate risk assessment (physical and transition) is needed in line with the Climate Physical Risk and Climate Transition Risk categories of the Task Force on Climate-Related Financial Disclosure (TCFD). Since the

operational GHG emissions are exceed this limit defined in the principle, the climate risk assessment of the project is developed in this chapter aligning with the TCFD requirements. This chapter aims to identify physical and transition risks caused by climate change and to develop adaptation recommendations to boost climate resilience of the Project.

A full climate change risk assessment is also provided as supplementary document.

15.4.1 Physical Risk Assessment

15.4.1.1 Hazard Identification

Climate change makes most countries vulnerable to several risks such as floods, heat waves, tropical cyclones, drought, decreases in food and water security, etc. Projects, therefore are under several significant climate-related risks such as physical and transitional risks.

Asian Development Bank has assessed climate change impacts on CCGTs as air temperature, water temperature, water availability, floods, heat waves, and storms, which will likely create physical risks to the project in terms of energy production efficiency, personnel safety, maintenance costs.

All of those hazards are identified in detail in the table below specific to the efficiency of CCGT, personnel safety, and maintenance and upgrade costs.

Table 233: Hazard Identification

Climate Change Parameter	Sub-Hazard	Hazard
Increased air temperature (heat waves, mean temperature and extreme temperature increases)	**Increase fuel usage due to increase in turbine heat rate (Soh Young In et.al., 2022)**	**Reduces efficiency**
	Load of the Plant may be limited by maximum condenser pressure	
	Increases life-cycle costs of buildings	**Increased maintenance and upgrade costs**
	Increases heat-related illnesses of personnel	**Reduces personnel safety due to health threat**
Water-related risks (water availability, drought, and water temperature)	**Water Scarcity and water temperature can cause cooling water curtails.**	**Reduces personnel safety due to health threat and increased maintenance and upgrade costs**
Changes to rainfall intensities and increased	**Damage on the main and auxiliary facilities and office buildings**	**Reduces personnel safety due to health threat**

Climate Change Parameter	Sub-Hazard	Hazard
likelihood of flooding and flash flooding		**Increased maintenance and upgrade costs**
Extreme Weather Events	**Sudden plant downtime or repair expenses**	**Increased maintenance costs**

The abovementioned climate change parameters that may become a risk for the project have been assessed in the Chapter 15.4.1.2 with desktop-based scenario analysis.

15.4.1.2 Scenario Analysis

TCFD recommends a scenario analysis to understand and quantify the risks using hypothetical projections. Scenario analysis is one of the milestones for making decisions and developing strategies by companies.

In order to understand which climate change parameter is a concern in Uzbekistan, the scenario analysis is performed for the Surkhandarya Region and World Bank Group's Climate Change Knowledge Portal (CCKP)[27] is used as main data source. In that portal, the future climate projections have been developed with GHG emission projections, which are Representative Concentration Pathways (RCP) 2.6, RCP 4.5, RCP 6.0 and RCP 8.5 for medium and long terms by CMIP5 and CMIP6 approaches.

[27] Available at: https://climateknowledgeportal.worldbank.org/country/uzbekistan/climate-data-projections

Table 234: Climate Future Scenarios in Uzbekistan, Surkhandarya Region

Climate Driver	Reference Data (2004)	Projected Data - Medians				Projected Change (%) (Reference Data – Projected Data)/Reference Data * 100			
		2040		2100		2040		2100	
		RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
Mean Temperature, °C (chronic)	16.18	17.49	17.67	18.81	21.93	8%	9%	16%	36%
Extreme Temperature, °C (chronic)	23.25	24.64	24.80	26.09	29.40	6%	7%	12%	26%
Number of Hot Days >40°C (acute)	30.79	46.55	47.52	60.88	99.41	51%	54%	98%	223%
Number of Ice Days (Tmax<0) (acute)	3.76	2.93	2.93	1.56	0.44	-22%	-22%	-59%	-88%
Precipitation Amount, mm (chronic)	324.46	376.45	332.75	360.78	307.36	16%	3%	11%	-5%
Average Largest 5-day Cumulative Rainfall, mm (acute)	38.37	42.95	39.33	43.84	40.82	12%	3%	14%	6%
Days with Precipitation > 20 mm (acute)	0.32	0.49	0.40	0.89	1.23	53%	25%	178%	284%

Main climate drivers are colored in line with the following color scale.

Color Scale	≤0% change	≤5% change (tolerable)	≤10% change (distressing)	≤20% change (intense)	>20% ch. (very intense)

It is understood from the above table that the mean temperature, extreme temperature, number of hot days above 40°C, average largest 5-day cumulative rainfall and days with precipitation above 20 mm parameters will likely significantly increase. Also, decreases in number of ice days and average precipitation amount are expected.

The Climate Risk Country Profile Report of Uzbekistan has performed disaster risk rating for the climate-related natural hazards as demonstrated in the below table.

Table 235: Climate-Related Natural Hazards

Flood (0 - 10)	Tropycal Cyclone (0-10)	Drought (0-10)	Vulnerability (0-10)	Overall Risk Level (0-10)	Rank (1-191) (1st is the most at risk)
6.3	0	6.6	1.9	3.1	112

According to the Global Facility for Disaster Reduction and Recovery, water scarcity is expected to increase although there is no consistent data and cyclones do not need to be considered in the projects while urban flood and river flood are must to consider in project planning.

Overall, weather conditions in the country are expected to become hotter and drier, with more frequent and more intense heatwaves, droughts and modifications in precipitations patterns leading to an increase of related extreme weather events such as heavy rains, floods and mudflows.

15.4.1.3 Physical Risk Analysis

Assystem's physical risk analysis approach depends on the vulnerability and probability analyses. Therefore, firstly vulnerability analysis is conducted by following assessment matrix considering exposure and sensitivity. For exposure, RCP8.5 scenarios are preferred to be in the safe zone while sensitivity is assessed in line with the hazard potential defined in Section 15.4.1.1. Since the decreases in number of ice days and average precipitation amount is forecasted, they are not considered.

Table 236: Vulnerability Matrix

Exposure / Sensitivity	Low (1)	Medium (2)	High (3)
Low (1)	**Low**	**Low**	**Medium**
Medium (2)	**Low**	**Medium**	**High**
High (3)	**Medium**	**High**	**Very High**

Where the sensitivity represents whether the climate change parameter will affect the project operation while the exposure represents the changes in the future scenarios. Accordingly, the vulnerability assessment is completed as follows.

Table 237: Vulnerability Analysis Results

Climate Drivers	Vulnerability
Mean Temperature, °C	**Medium**
Extreme Temperature, °C	**Medium**
Number of Hot Days >40°C	**High**
Average Largest 5-day Cumulative Rainfall, mm	**Medium**
Days with Precipitation > 20 mm	**Very High**
Water Scarcity	**High**

In line with the Vulnerability Analysis, risk assessment is completed by the risk matrix given below.

Table 238: Risk Matrix

Vulnerability / Probability	Low (1)	Medium (2)	High (3)	Very High (4)
Low (1)	**Minor**	**Minor**	**Modarate**	**Major**
Medium (2)	**Minor**	**Modarate**	**Major**	**Major**
High (3)	**Medium**	**Major**	**Major**	**Major**

Table 239: Risk Analysis Results

Climate Drivers	Risk in 2040	Risk in 2100
Mean Temperature, °C	Minor	Major
Extreme Temperature, °C	Minor	Moderate
Number of Hot Days >40°C	Moderate	Major
Average Largest 5-day Cumulative Rainfall, mm	Minor	Moderate
Days with Precipitation > 20 mm	Moderate	Major
Water Scarcity	Moderate	Major

15.4.1.4 Minimization of Physical Risks

Increasing the climate resilience of the project against the identified climate risks is a significant and indispensable step to ensure the sustainability of the project during its lifetime. The hazards designated in Section 15.4.1.1 and related risks that arise from those hazards could be minimized with adaptation measures. Assystem developed measures to address climate-related physical risks. Several measures are represented in the table below together with a summary of the physical risk chapter and residual impact analysis. It should be noted that technological development and best available technologies should be followed to increase adaptive capacity and increase resilience against climate change.

Table 240: Summary Table of the Climate-Related Physical Risks, Adaptation Measures and Residual Risks

Climate Drivers	Projected Impact		Hazard	Risk Magnitude		Preliminary Scoping of Adaptation Measures (Asian Development Bank, 2012) (Asian Development Bank, 2012)	Initial Assessment for Residual Risks	
	2040	2100		2040	2100		2040	2100
Mean Temperature, °C	Distessing Increase	Very Intence Increase	Increase surface water temperature which will be used in the plant, and may create additional costs	Minor	Major	• Use a free-cooling option (nonrefrigerated system similar with heat exchangers) • Upgrade heat exchanger to improve cooling water process • Increase flow rate to increase heat transfer capacity • Retain the existing pump design and open the throttle • Add a backup pump unit specific to dry season • Revise management of coolant discharge by reducing the proportion of coolant waters entering at the water intake. • Redesign the intake (the percentage of coolant waters entering the intake may be reduced by moving the intake structure further into the center of the river channel) • Redesign the discharge structure • Improve the discharge channel (discharge further into the center of water source to increase mixing, but these may affect other uses of the water source) • Increase retention time in the discharge channel to reduce coolant water temperature	Negligible	Moderate
Extreme Temperature, °C	Distessing Increase	Very Intence Increase	Decrease in generation efficiency, increase fuel usage due to increase in turbine heat rate Increases heat-related illnesses of personnel Load of the Plant may be limited by maximum condenser pressure Increases life-cycle costs of buildings Increases heat-related illnesses of personnel Increase fuel usage due to increase in turbine heat rate	Minor	Moderate	• Build concrete-sided buildings instead of metal • Build shady spots for operation units • Change the shift hours in line with the cooler hours • Construct resting rooms in underground/or surface with adequate ventilation at optimum temperature • Install inlet air cooling (evaporative coolers or regrigeration/chiller coolers) • Compensate for the reduced air density by increasing the flow rate, as this can maintain the design mass flux	Negligible	Minor
Number of Hot Days >40°C	Very Intence Increase	Very Intence Increase		Moderate	Major		Minor	Moderate

Climate Drivers	Projected Impact		Hazard	Risk Magnitude		Preliminary Scoping of Adaptation Measures (Asian Development Bank, 2012) (Asian Development Bank, 2012)	Initial Assessment for Residual Risks	
	2040	2100		2040	2100		2040	2100
Average Largest 5-day Cumulative Rainfall, mm	Tolerable	Disstressing	Damage infrastructure and supply chain disruption due to floods and flash floods Sudden plant downtime or repair expenses Affect health and safety of personnel	Minor	Moderate	• Develop and implement higher structural standards for new or renovated buildings can resist water leakages • Re-schedule shift times of the personnel	Negligible	Minor
Days with Precipitation > 20 mm	Very Intence Increase	Very Intence Increase	Damage infrastructure and supply chain disruption due to floods and flash floods, Affect health and safety of personnel	Moderate	Major	• Reduce dependency on supply chain with storage of materials and equipment • Construct shelters at high altitudes ensuring personnel safety to use in heavy precipitations	Minor	Moderate
Water Scarcity	No consistent projections, but it is expected to increase.		Affect availability of freshwater for cooling Affect health and safety of personnel	Moderate	Major	• To follow technological development to reduce water consumption in the plant and make solutions to withdraw less water from source and consume less water internally (once through or recirculating system) • Increase volume of water treatment works and/or develop new water sources, and use treated water • Install reverse osmosis system and link the system with wastewater treatment • Redesign cooling facilities (water recovery from condenser and heat exchangers, reduction of evaporative losses, secondary or wastewater usage, construction of dry cooling towers) • Restore/afforest/reforest land • Install rainwater storage tanks to use any rainwater in the plant operation (may linked to reverse osmosis mechanism) • Use sensored faucets in personnel spaces	Minor	Moderate

15.4.2 Transition Risks

Changes in governmental policies for lower-carbon economy, change in customer behavior, supply chain disruptions, technological developments may arise due to the climate change, namely creates transition risks, and these risks may cause financial losses. This chapter aims to establish an understanding of transition risks and management strategy for addressing those risks.

15.4.2.1 Identification Transition Risks

TCFD addresses climate-related transition risks as policy and legal, technology, market and reputation risks. Considering Uzbekistan government strategies, and the project type, following risks have been identified for the project in line with the risks defined by TCFD.

Table 241: Transition Risks (Task Force on Climate-related Financial Disclosures, 2017)

Risk Group	Reminder Notes	Climate-Related Risks	Potential Financial Impacts
Policy and Legal Risks	• As stated in Section 15.1.1, governmental strategy covers development of RES, increased efficiency of the use of natural resources, supporting green economy, which may cause carbon trading regulations, carbon taxes. • Around the world, new regulatory steps may be performed in order to reduce use of fossil fuels including natural gas, and these regulations may reflect the national strategies.	• Increase pricing of GHG Emission • Enhanced emission-reporting obligations • Mandates on and regulation of existing products and services • Exposure to ligitation	• Increased operation costs • Write-offs, asset impairment, and early retirement of existing assets due to policy changes • Increased costs and/or reduced demand for products and services resulting from fines and judgements • Closing-off the plant (additional risk specific to the project type)
Technology	• Equipment and other technologies used in the plant may have to change in line with the lower emission technology.	• Substitution of existing products and services with lower emissions options • Unsuccessful investment in new technologies • Costs to transition to lower emissions technology	• Write-offs and early retirement of existing assets • Reduced demand for products and services • Research and development (R&D) expenditures in new and alternative technologies • Capital investments in technology development • Costs to adopt/deploy new practices and processes

Market	• New developments, regulative changes, investments etc. may reduce dependency on fossil fuel including natural gas, and depending on its availability, it may totally destroy the CCGTs in the market. • Due to extreme weather events, supply chain may disrupt and raw material costs and accessibility may affect.	• Changing customer behavior • Uncertainty in market signals • Increased cost of raw materials	• Reduced demand for goods and services due to shift in consumer preferences • Increased production costs due to changing input prices (e.g., energy, water) and output requirements (e.g., waste treatment) • Abrupt and unexpected shifts in energy costs • Change in revenue mix and sources, resulting in decreased revenues • Re-pricing of assets (e.g., fossil fuel reserves, land valuations, securities valuations)
Reputation	• Understanding of the developers, users, and lenders are under change through green approaches. These may cause adverse impacts on the project revenues, material supply, and loan opportunities for further investments in the plant.	• Shifts in consumer preferences • Stigmatization of sector • Increased stakeholder concern or negative stakeholder feedback	• Reduced revenue from decreased demand for goods/services • Reduced revenue from decreased production capacity (e.g., delayed planning approvals, supply chain interruptions) • Reduced revenue from negative impacts on workforce management and planning (e.g., employee attraction and retention) • Reduction in capital availability

15.4.2.2 Transition Risk Mitigation

The identified climate-related transition risks could be minimized with a well-established management strategy from bottom to top with appropriate metrics, strategies and efficient governance. TCFD recommends address the transition risks with 4 core elements showed in the Figure 184.

Figure 184: Core Elements identified by TCFD (Task Force on Climate-related Financial Disclosures, 2017)

In line with the above figure, following steps are recommended for the Project operators.

- Step 1: Designate a team that includes top of management, climate-related personnel, quality-related personnel, and finance-related personnel, and any staff deemed necessary.
- Step 2: Identify climate-related responsibilities and roles for each team member clearly.
- Step 3: Review the climate-related transition risks assessed above, revise them or add any other risks for the project.
- Step 4: Develop strategies and goals to address climate-related financial climate risks for short, medium and long term.
- Step 5: Designate metrics and targets to fulfil developed strategies and goals.
- Step 6: Decide how to monitor and oversees progress, accordingly designate a regular meeting schedule.
- Step 7: Regularly review the metrics, targets, strategies, and update them, if needed with the guidance of the management team.
- Step 8: Regularly review the team activities with KPIs.
- Step 9: Develop a report template to report all climate-related activities including improvement in metrics and targets, monitoring findings etc.

15.4.2.3 Metrics and Targets Recommendations

Following metrics and targets may applied specific to the project in line with the TCFD recommendations (Task Force on Climate-related Financial Disclosures, 2017).

Table 242: Examples for Metrics and Targets

Group	Climate-Related Category	Recommended Metric	Benefit
Revenues	GHG Emission	GHG estimation covering Scope 1, Scope 2 and Scope 3, MT of CO2e	This target may lead to understand emission sources of the project, and in line with the findings, GHG emissions could be reduced by focusing the problematic one. Also, this ensures transperancy and hence good reputation.
Expenditures	Risk Adaptation & Mitigation	Expenditures for low-carbon alternatives	This step easer adaptation to the low carbon economy requests may come from governmental authorities. In addition, thanks to this step, the project will become lower-GHG emitter within CCGTs in the country, which also improve reputation.
		Reducing in water dependency (%)	Water stress can cause shortage in water access, increase cost of supply, and affect the stakeholders' understanding for project that may create pressure on the operations. Therefore, together with technological investment, the water dependency could be decreased over the years and could be monitored in the internal reports.
Assets	Risk Adaptation & Mitigation	Investment in low carbon alternatives	This metric will indicate the level to which future earning capacity of core business might be affected.

These examples can be multiplied considering project-specific financial risks born with operational activities.

16. SOCIO-ECONOMICS

16.1 Introduction

16.1.1 Purpose

The Republic of Uzbekistan (Uzbekistan) has an area of 448,978 km² and is located between the Amudarya and Syrdarya rivers. Uzbekistan has underground resources such as oil, gas, coal and uranium.

In recent years, Uzbekistan has implemented large-scale reforms to boost its energy sector [63]. The government of Uzbekistan has approved a strategy of supply electric power for ten years from 2020 until 2030 [64]. This strategy illustrates priority given by the government to the development of electric power industry, increase electricity production in order to supply population's growing demand and foster economic growth of the country. The proposed project might contribute to the strategy of supply electricity power for further ten years, which includes: (i) modernization and reconstruction of existing power plants; (ii) construction of modern ones using energy-efficient technologies. In line with these plans, an agreement between Uzbekistan government and Dutch company Stone City Energy (Investor) was signed on the construction of a new thermal power plant in Surkhandarya region on the basis of public-private partnership. It is considered to construct a CCPP in Angor District Surkhandarya region, just on the north – eastern shore of the Uchkizil water reservoir.

The project benefits include:

- Retrenchment natural resources: The project aims to save 1.1 billion cubic meters of natural.
- Improved generation efficiency: The project will achieve a minimum of 60 percent efficiency. This will improve Uzbekistan's overall energy generation efficiency.
- Reduced greenhouse gas emission: The project will reduce greenhouse gas emissions per kWh of energy generated in Uzbekistan.
- Improved energy reliability: The plant represents a major investment in baseload generation capacity in Uzbekistan.

16.1.2 Importance of Social Impact Assessment

The Social Impact Assessment (SIA) is the study where the social impacts of the industrial projects are identified and assessed. It can also be applied to policies, plans and programmes. SIA is used to forecast and prevent negative consequences, as well as to find possibilities to improve benefits for local communities and society as a whole. The involvement of impacted communities and other stakeholders in the process is one of the major concepts and practices of SIA.

As a good international practice SIA required by the International Finance Institutions (IFI's) to assess the social, economic and cultural impacts of industrial activities on local population and communities. The results of the assessment then will be converted into implementation plan over the period of the project. This is especially important for the industrial projects, whose activities frequently encroach on the pollution of water, land and air that local people depend on for their traditional livelihood activities. Thus, it helps to avoid potential negative impacts on critical natural resources, such as water and forests, as well as impacts on cultural resources. However, SIA process also helps to identify ways that local communities could benefit from a proposed development, for example, through infrastructure development, job creation or create better live conditions for the local people.

The purpose of this Social Impact Assessment is to obtain relevant data to establish basic indicators "before" the implementation of the Project. Also, the assessment materials will serve as the basis for the development of socio-economic and gender design elements of the Project of the construction in Surkhandarya region of Uzbekistan. The Assessment will contribute to the development of a monitoring and evaluation strategy, as well as a framework for the Project impact assessment.

The main objectives of this SIA in this project prospective as follows:

- To conduct surveys that includes basic information necessary for a qualitative and quantitative assessment of the results and indicators of the Project impact;
- Assessment of baseline conditions (existing conditions) prior to the development of the Project through review of available data and conducting surveys;
- Assessment of the social impacts of the proposed project during the construction and operation phases;
- Assessment of the risks for various social groups, especially vulnerable groups (low-income families, women, children, etc.);
- Assessment of socio-economic factors and develop proposals to mitigate/eliminate negative consequences;
- Review of compliance obligations, regulations and standards that requires International Finance Institutions such as World Bank (WB), International Finance Corporation (IFC);
- To engage with key stakeholders and Project affected people to disclose Project information, study outcomes, gain lay knowledge about the local social context and seek feedback on Project.

Although the assessment results will an important part of the feasibility study of this project but it also might be used as separate document of the proposal to IFI's.

16.1.3 Scope

This part of the report presents the scope of the study, presenting the requirements of three international financial institutions on social assessment, namely World Bank, International Finance Corporation and Asian Infrastructure Investment Bank. The requirements for the social aspects of each financial institution are presented in their own documents, the so-called frameworks, which are always accompanied by environmental aspects.

World Bank Requirements on Social Assessment

The World Bank Environmental and Social Framework (ESF) displays the adherence of World Bank to sustainable development. The aim of the Bank is ending extreme poverty and promoting prosperity by means of a Bank Policy and a set of Environmental and Social Standards. It needs to be highlighted that environmental and social aspects always come together as environmental problems simultaneously are considered as the problems for society. Therefore, the general idea on the Bank's ESF is described following Environmental and Social Standards which are obligatory requirements that apply to the Borrower and projects. The Standards present the requirements for Borrowers relating to the identification and assessment of environmental and social risks and impacts associated with projects. Later, only social risks and impacts are listed to define the general idea to the requirements of World Bank on Social Assessment. This section is described according to the World Bank's Environmental and Social Framework document [67].

The World Bank ESF encompasses:

- World Bank's Vision for Sustainable Development - aspirations of the Bank regarding environmental and social sustainability;
- World Bank Environmental and Social Policy for Investment Project Financing - the mandatory requirements that is relevant to the Bank;
- World Bank's Environmental and Social Standards - mandatory requirements that is relevant to the Borrower and projects.

As Vision for Sustainable Development and Environmental and Social Policy for Investment Project Financing are directed to the World Bank, presenting its objectives, commitments, role and responsibilities related to environmental and social sustainability, Environmental and Social Standards refer to the Borrower itself, providing guidance on how to identify environmental and social risks and impacts. Thus, Environmental and Social Standards are considered as the collection of requirements which needs to be developed by the Borrower.

The Environmental and Social Standards (ESSs) establish the requirements for Borrowers on identification and assessment of environmental and social risks and impacts associated with projects. The ten ESSs establish the standards that the Borrower and the project will meet through the project life cycle, as follows:

ESS 1:	•Assessment and Management of Environmental and Social Risks and Impacts;
ESS 2:	•Labor and Working Conditions;
ESS 3:	•Resource Efficiency and Pollution Prevention and Management;
ESS 4:	•Community Health and Safety;
ESS 5:	•Land Acquisition, Restrictions on Land Use and Involuntary Resettlement;
ESS 6:	•Biodiversity Conservation and Sustainable Management of Living Natural Resources;
ESS 7:	•Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities;
ESS 8:	•Cultural Heritage;
ESS 9:	•Financial Intermediaries;
ESS 10:	•Stakeholder Engagement and Information Disclosure.

-Environmental risks and impacts; -Social risks and impacts; -Risks and impacts of both.

The ESSs are designed to manage the risks and impacts of a project, and improve their environmental and social performance. Particularly, Standards ESS2, ESS4, ESS5, ESS7, ESS8 and ESS10 directly relate to social aspects of the project which shows its crucially in the sustainable development.

Environmental and Social Standard ESS1 relates to all projects for which Bank investment project financing is required. ESS1 establishes the importance of:

- The Borrower's existing ESF to address the risks and impacts of the project;
- An integrated environmental and social assessment to identify the risks and impacts of a project;

- Effective community engagement through disclosure of project-related information, consultation and effective feedback; and
- Management of environmental and social risks and impacts by the Borrower throughout the project life cycle.

ESS2–10 determine Borrower's duties in finding and addressing environmental and social risks and impacts that may require particular attention. Overall, these standards set objectives for prevention, minimization, reduction and mitigation of risks and impacts or establishes measures for compensation of impacts. Therefore, the clear approach that addresses to every 10 standards need to be provided in the appropriate environmental and social assessment by the Borrower.

According to the nature and scale of the project, different tools can be used for the assessment. The tools which are suggested the World Bank itself are - Environmental and social impact assessment (ESIA), Environmental and social audit, Hazard or risk assessment, Cumulative Impact Assessment, Social and conflict analysis, Environmental and social management plan (ESMP), Environmental and social management framework (ESMF), Regional ESIA, Sectoral ESIA, Strategic Environmental and Social Assessment (SESA). Moreover, project's explicit features may necessitate the Borrower to develop specific methods and tools for assessment, for example Biodiversity Action Plan, Cultural Heritage Management Plan, Indigenous Peoples Plan, Livelihood Restoration Plan, Resettlement Plan and further plans as agreed with the Bank.

Thus, Framework includes provisions on grievance redress and accountability to deal with the complaints from stakeholders and people affected by the project. A Bank-supported project is required to include a number of mechanisms for addressing concerns and grievances arising in connection with a project.

The social risks and impacts which the Bank will take into account in its due diligence are project-related and include the following:

- Threats to human security through the escalation of personal, communal or interstate conflict, crime or violence;
- Risks that project impacts fall disproportionately on individuals or groups who, because of their particular circumstances, may be disadvantaged or vulnerable;
- Any prejudice or discrimination toward individuals or groups in providing access to development resources and project benefits, particularly in the case of those who may be disadvantaged or vulnerable;
- Negative economic and social impacts relating to the involuntary taking of land or restrictions on land use;
- Risks or impacts associated with land and natural resource tenure and use, including (as relevant) potential project impacts on local land use patterns and tenurial arrangements, land access and availability, food security and land values, and any corresponding risks related to conflict or contestation over land and natural resources;
- Impacts on the health, safety and well-being of workers and project-affected communities;
- Risks to cultural heritage.

The Bank expects that application of these standards will support Borrowers to reach their goal to reduce poverty and increase prosperity which will consequently improve the environment. The standards are anticipated to:

- Support Borrowers in achieving good international practice relating to environmental and social sustainability;
- Assist Borrowers in fulfilling their national and international environmental and social obligations;
- Enhance nondiscrimination, transparency, participation, accountability and governance; and
- Enhance the sustainable development outcomes of projects through ongoing stakeholder engagement.

Performance Standards (IFC) for Social Assessment

IFC's Sustainability Framework expresses the Corporation's commitment to sustainable development by avoiding and mitigating adverse impacts and by managing risks. The Framework consists of:

- IFC's Policy on Environmental and Social Sustainability – commitment to sustainable development, roles, and responsibilities related to environmental and social sustainability;
- IFC's Access to Information Policy - commitment to transparency and good governance on its operations, and outlines the Corporation's institutional disclosure obligations regarding its investment and advisory services;
- IFC's Performance Standards - for clients, providing guidance on how to identify risks and impacts.

As Policy on Environmental and Social Sustainability and Access to Information Policy are directed towards Corporation itself, Performance Standards are directed towards clients, providing direction on risks and impacts identification. The standards are designed to assist in avoidance, mitigation, and management of risks and impacts of the project financed. Moreover, it includes stakeholder engagement and disclosure obligations of the client in relation to project-level activities. Therefore, development of Performance Standards developed by client is considered as the mandatory document for IFC financing. As IFC is the sister organization of World Bank, its Performance standards is very similar to the Environmental and Social Standards of World Bank, which has been presented earlier. The standards on Performance standards were described based on the report IFC Performance Standards on Environmental and Social Sustainability [68].

However, IFC has eight Performance Standards (PS) for establishing standards that the client is to meet throughout the life cycle:

-Environmental risks and impacts; -Social risks and impacts; -Risks and impacts of both;

Specifically, Standards PS2, PS4, PS5, ESS7 and ESS8 directly relate to social aspects of the project evidencing its crucially in the sustainable development.

Similarly, to ESS1 of the World Bank, PS1 is relevant to all the projects that has environmental and social impact and establishes the importance of:

- integrated assessment of environmental and social impacts of the project;
- effective community engagement through disclosure of project-related information, consultation; and
- management of environmental and social risks and impacts by the client throughout the project life cycle.

PS2-8 establish objectives and requirements to avoid and minimize the risks and impacts of the project identified in PS1. While all relevant environmental and social risks and potential impacts are needed to be considered as part of the assessment in PS1, PS 2-8 describe potential environmental and social risks and impacts that need specific attention. As environmental or social risks and impacts are clarified, the client is ought to manage them through future Environmental and Social Management System (ESMS) coherent with PS 1.

Asian Infrastructure and Environmental and Social Policy

The objective of this overarching policy is to facilitate achievement of these development outcomes, through a system that integrates sound environmental and social management into Projects. The overarching policy comprises Environmental and Social Policy (ESP), and Environmental and Social Standards (ESSs) and Environmental and Social Exclusion List. The ESP sets out mandatory requirements for the Bank and its Clients relating to identification, assessment and management of environmental and social risks and impacts associated with Projects supported by the Bank.

Environmental and Social Standards

The environmental and social standards (ESSs) set out more detailed mandatory environmental and social requirements, as described below.

Environmental and Social Standard 1 (ESS 1). The ESS 1 aims to ensure the environmental and social soundness and sustainability of Projects and to support the integration of environmental and social considerations into the Project decision-making process and implementation. ESS 1 is applicable if the Project is likely to have adverse environmental risks and impacts or social risks and impacts (or both). The scope of the environmental and social assessment and management measures are proportional to the risks and impacts of the Project. ESS 1 provides for both quality environmental and social assessment and management of risks and impacts through effective mitigation and monitoring measures during the course of Project implementation. The ESS 1 defines the detailed requirements of the environmental and social assessment to be carried out for any project to be financed by the Bank.

Environmental and Social Standard 2 (ESS 2). The ESS 2 is applicable if the Project's screening process reveals that the Project would involve Involuntary Resettlement (including Involuntary Resettlement of the recent past or foreseeable future that is directly linked to the Project). Involuntary Resettlement covers physical displacement (relocation, loss of residential land or loss of shelter) and economic displacement (loss of land or access to land and natural resources; loss of assets or access to assets, income sources or means of livelihood) as a result of: (a) involuntary acquisition of land; or (b) involuntary restrictions on land use or on access to legally designated parks and protected areas. It covers such displacement whether such losses and involuntary restrictions are full or partial, permanent or temporary. The ESS 2 defined detailed requirements of resettlement planning of the projects involving involuntary resettlement.

Environmental and Social Standard 3 (ESS 3). The ESS 3 is applicable if Indigenous Peoples are present in, or have a collective attachment to, the proposed area of the Project, and are likely to be affected by the Project. The term Indigenous Peoples is used in a generic sense to refer to a distinct, vulnerable, social and cultural group possessing the following characteristics in varying degrees: (a) self-identification as members of a distinct indigenous cultural group and recognition of this identity by others; (b) collective attachment to geographically distinct habitats or ancestral territories in the Project area and to the natural resources in these habitats and territories; (c) customary cultural, economic, social or political institutions that are separate from those of the dominant society and culture; and (d) a distinct language, often different from the official language of the country or region. In considering these characteristics, national legislation, customary law and any international conventions to which the country is a party may be considered. A group that has lost collective attachment to geographically distinct habitats or ancestral territories in the Project area because of forced severance remains eligible for coverage, as an Indigenous People, under ESS 3. The ESS 3 defines the detailed requirements of People planning, in case such groups are present in the project area and are likely to be affected by the project.

The Project triggers not only the local environmental and social laws and regulations, but also the ESP and ESS of AIIB. Under the scope of the Project, only ESS 1: Environmental and Social Assessment and Management will be applicable. Standards on Involuntary Resettlement (ESS2) and Indigenous Peoples (ESS 3) is not be triggered under the scope of the Project.

As a conclusion, safeguard policies of all the International Financial Institutions have iterative manner, and there are numerous similarities between the safeguard policies of the World Bank, IFC and AIIB. Even though the requirements were named differently (ESS – World Bank, PS – IFC, –AIIB ESP), their commitment to address to social impact and risks hold similar priorities. The main concentration of all three financial institutions is paid into - stakeholder engagement, vulnerable groups, disclose sufficient information about the risks and impacts, provisions on grievance redress and accountability, promotion of gender equality, address to climate change etc.

16.1.4 Definition of Project Impact Area

16.1.4.1 Project Area

The Project area means all areas proposed to be disturbed, altered, or used by the proposed activity or the construction of any proposed structures. This section provides wider explanation of project location at three levels: country, regional and districts respectively.

The Republic of Uzbekistan is situated between the rivers of Amudarya and Syrdarya and occupies 448,9 thousand square km. The territory borders on Kazakhstan in the north, on Kyrgyzstan and Tajikistan in the east and southeast, on Turkmenistan in the west, and on Afghanistan in the south [70].

There are 14 territorial and administrative divisions-regions in Uzbekistan. One of them is Surkhandarya Province that covers 20.1 thousand square km (4.48% of the total area of the Republic of Uzbekistan) [71]. Surkhandarya Province borders with the Republic of Tajikistan on the north and north-east, Afghanistan on the south (the border stretches along the Amudarya), and Turkmenistan on the south and west.

The Project will be constructed in Angor District of Surkhandarya Province, about 14 km from the Termez City, which is located on southeast of the Country. The project area is located on the north-eastern coast of the Uchkizil reservoir.

The relief of the project area is gently undulating, flat, with a general slope to the south, complicated by eolian forms in the form of hilly and ridge sands. The proposed location of the Project is provided in Figure 185.

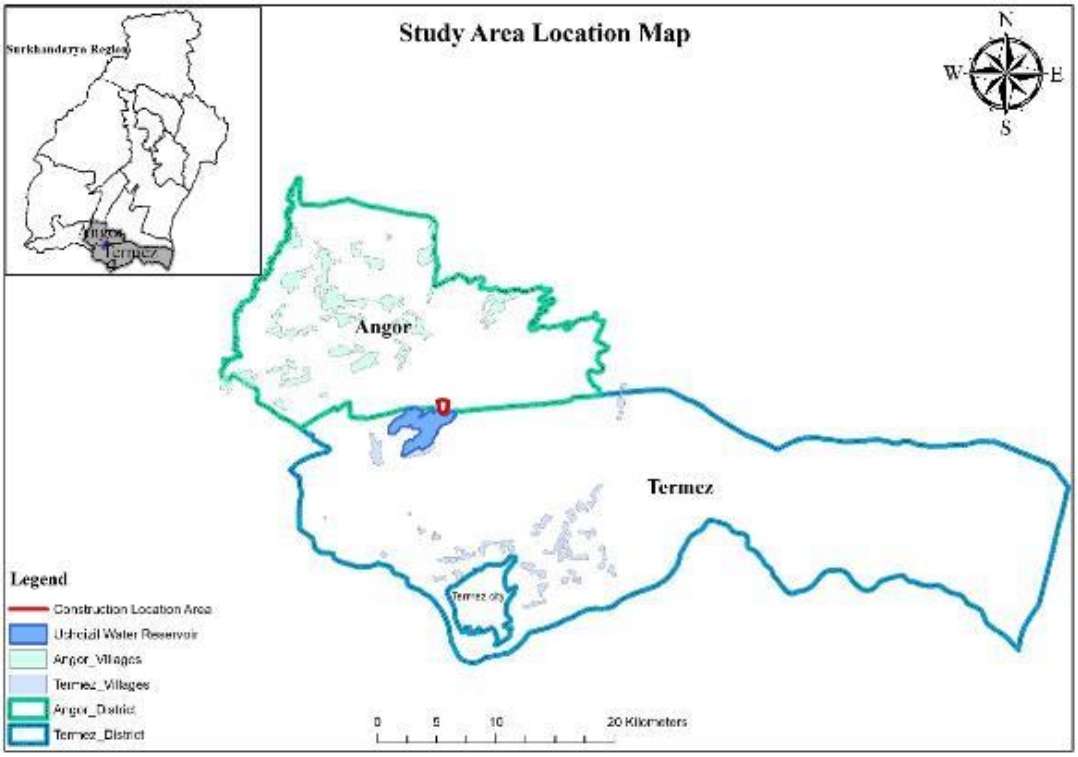


Figure 185: Project Location Map – Local Context

The Project impact area is located within Angor and partly Termez districts. Angor District has 36 settlements of which 12 towns including total 23.2 thousand households. There are 29 mahallas (settlements) and 7 towns in Termez District, which includes 19.2 thousand households. The nearest residential settlement, Uchkizil Village is located approximately 2.0 km away from the Project area, which meets the requirements of Sanitary norms and rules for the protection of atmospheric air in populated areas of the Republic of Uzbekistan [72]. Distance to the regional center - the city of Termez - 14 km (see Table 243) [72].

Table 243: Distance of the Settlements and Buildings from The Project

ID	Type	Distance to Project	Description
Reservoir	Hydrotechnical	0.1 km	Uchkizil Reservoir
M-39 numbered highway	Road	0.5 km	Highway between Tashkent-Termez
Canal	Hydrotechnical	0.8 km	Zang Canal
Bio Tehno Eko LLC	Industrial	0.25 km	Waste processing enterprise
Village	Residential	2.0 km	Uchkizil Village
Village	Residential	2.0 km	Kattakum Village
Railway	Road	7.0 km	Railway line Kagan-Termez-Dushanbe
City	Residential	12.0 km	Termez city

Project Impact Area

The Project impact area is defined as a place where a Project can positively and negatively affect social life, economic infrastructure and the environment.

It is considered that significant effects are unlikely to occur beyond the study area, due to the significance of effect decreasing as the distance from the Project increases. As such, it is considered selected AoI is sufficient to identify those receptors likely to be significantly affected by the Project based on previous project experience and the proffessionel judgement of the Consultant.

There is no large community and settlement within a radius of 5 km of the Project area. Key aspects of the vicinity of the project boundary:

- uncultivated and unused lands in the north, west, and east,
- Uchkizil Reservoir in the south,
- one of the tributes of the Zang Canal that discharges into Uchkizil Reservoir in the west at a distance of 450-550 meters,
- M-39 main road in the north, northeast and,
- the main railway line Kagan-Termez-Dushanbe in the south at a distance of 7 km.

Although the AoI is selected as an area covering 5-km radius from the project area, to assess other nearby settlements such as Termez, 5-10 km buffer area is considered in this Chapter.

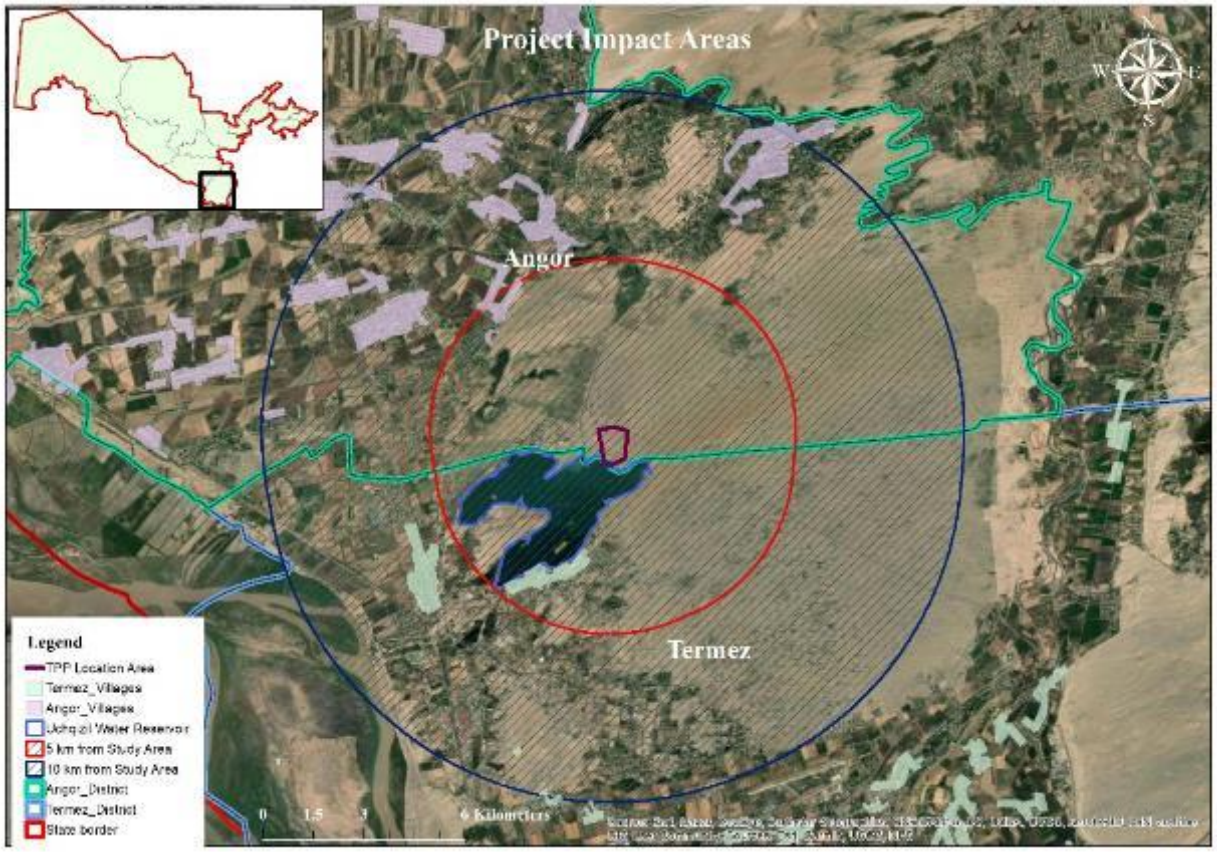


Figure 186: Project Impact Area 5 and 10 km Radius

As mentioned earlier, although out of AoI, there area 16 settlements within 10 km area in Angor and Termez Districts. Name, population and households of these settlements are presented in Table 244.

Table 244. Settlements located within 10 km

No	Settlements (Mahalla)	Population	Household
1	**Bahor**	4,120	680
2	**Dehqonbirlashuv**	2,594	478
3	**Ilgor**	3,100	645
4	**Karvon**	3,708	623
5	**Kattakum**	5,334	1,004
6	**Kayran**	4,712	792
7	**Khalqobod**	4,545	804
8	**Madaniyat**	2,650	510
9	**Markaz**	3,100	485
10	**Namuna**	3,414	556
11	**Orol**	4,178	725

No	Settlements (Mahalla)	Population	Household
12	**Qoshtegirmon**	3,631	631
13	**Tallashqon**	3,574	538
14	**Uchkizil**	4,582	894
15	**Zang Gilambop**	2,173	342
16	**Zartepa**	4,460	770
	TOTAL	**59,875**	**10,477**

16.2 GENERAL BASELINE SOCIO-ECONOMIC DATA

16.2.1 Social Structure

The administrative management system in Uzbekistan is comprised of two main bodies, central and local. Local government has three pillars as regional, district and city administration. Although, the community self – governments are not a body of central public administration system but they exist and operate locally.

The system of local government has been established according to the Law on Local Public Administration, adopted on 2 September 1993. Activities and responsibilities of Local government are specified in the seven chapters and twenty articles of the law. Article 1 states that the local representative authorities at the regional, district and city levels are the local councils, whose full name in Uzbek is "Councils of People's Deputies." Another article of the Constitution of Uzbekistan presents information about local councils at all levels are headed by a chairman, or hokim (hokim is translated as deputy ruler). Regional, district and city hokims also act as the head of the local executive branch or hokimiyat. In general, the authorized state structure consists of three distinct levels: the republican level (first), province-level (second), and district-level (third).

16.2.1.1 Province level

In particular, the Surkhandara regional hokimiyat is the (second level) main authorized executive body in the region. Tasks and functions of Surkhandarya province hokimiyat are a comprehensive analysis of trends in socio-economic development of Surkhandarya provice, Termez city and districts, analysis of the dynamics of the main economic indicators, monitoring and implementation of structural and institutional changes, monitoring of local budgets; Development of proposals for the integrated development of the region, the city of Termez and districts; Socio-economic development of the regions, attracting investments and introducing innovations in the province economy, effective organization of economic free and industrial zones as well as development of tourism. These and many other tasks and functions are being covered by Surkhandarya province khokimiyat on coordination of economic policies and take responsibility for implementing government programs (national – regional), projects, President's and Cabinet Ministers resolutions at the local level. In addition, in terms of the socio-economic aspect, regional hokimiyat in Surkhandarya introduces systematic monitoring of trends in socio-economic development, carries out social and economic reforms, timely identifies the causes of local challenges and makes decisions to eliminate these issues. The detailed administrative structure of Surkhandarya's hokimiyat is given in "*Annex 3 Organigram of Surkhandarya Province Hokimiyat*"

16.2.1.2 District level

It should be noted that provincial Hokimiyat in Surkhandaya manages other district-type hokimiyats. Since Surkhandarya region is divided into 13 districts, hokimiyats in each district is only highest state executive body that implements the government policy within their administrative borders. They are as follows in Table 245.

Table 245: 13 districts of Surkhandarya Region

#	Name of hokimiyat
1	Denau
2	Shurchi
3	Sherobod
4	Jarkurgan
5	Saraosiyo
6	Muzrabod
7	Qumqorgon
8	Uzun
9	Angor
10	Boysun
11	Qiziriq
12	Oltinsoy
13	Termez

As for administrative management the district based hokimiyats (third level) operate identical manner as province hokimiyats (second level). It has following functions and duties in terms of social and economic development:

Duties

- Comprehensive analysis of trends in socio-economic development of the district, monitoring of implementation of local budget and structural and institutional changes;
- Creation of an effective system for monitoring the implementation of socio-economic development programs in the regions
- Improve education, health, agriculture and construction spheres in the district
- Functions
- Development of specific measures to address social economic challenges in the district
- Implementation and monitoring programs in the field of social economic development of the district
- Organizes the hearing of the hokim's report on important issues of socio-economic development of the district

16.2.1.3 Community of self-government

In Uzbekistan local government is usually supplemented by self-government community organization as Mahalla at the third level. In current day mahalla is defined as an organization which aims to

resolving local issues according interests of local people, traditions, language and ethnic background [73].

According to article 7 of the Law on Community Self-government, bodies of community self-government include citizen assemblies of villages, kishlaks as well as those of mahallas within cities, villages, kishlaks or auls [75]. It should be noted that both kishlaks and auls are rural settlements in the country and having different communities living there. For example, in Karakalpakstan almost all rural settlements have "aul" identification because of their culture and traditions while in Fergana valley use kishlak term for the description of the settlement.

However, as a result of recent socio-economic reforms in the country, mahallas became more active than before as a self-government structure [76].

In particular, according to the decree of the president of the Republic of Uzbekistan № PF-5938 of February 18, 2020 «on measures to restore the socio-spiritual environment in society, further support of the Institute of the mahalla, as well as to bring the system of working with family and women to a new level», the status of the meetings of local citizens has been set [77].

According to information collected by field survey new positions in the mahalla management system, including the positions of the chairman of the gathering of citizens on the issues of law enforcement, family, women's and socio-spiritual issues, beautification, farmland and entrepreneurship were introduced.

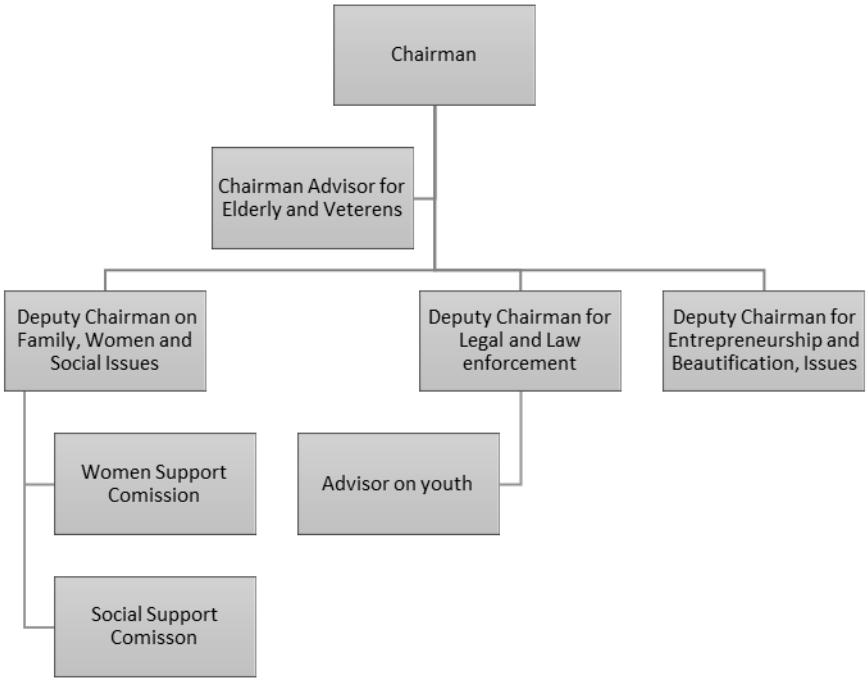


Figure 187: The Typical Administrative Structure of Mahalla (Source: from data collected in the field)

According to field survey data, the establishment of a separate ministry in the country, which deals with the issues of mahalla and family at the state level, which has become a close assistant to the meetings of citizens in this regard, the work on supporting the mahalla system has reached a new level.

The ministry works as an important organization in the direction of taking the activities of the mahalla system, which is directly working with the people, forming as an important social institution, to a new level, increasing its status, developing the activities of the Citizens ' Assembly, supporting the family, women and the elderly, protecting their rights and legitimate interests, comprehensive support of families in need [76].

16.2.2 Demography

16.2.2.1 Past and Current Population

As of July 1, 2021, the resident population of Uzbekistan amounted to about 34,9 million people and since January 2020 has increased by 653.7 thousand people. The permanent population growth rate was 1.9% [78].

In January-July 2021, 390.7 thousand new born children were registered. At the same time, during this period, the number of deaths of citizens amounted to 79.7 thousand people.

As of April 1, 2021, the permanent population of Surkhandarya province is 2,693 thousand people (7, 2% of Republic) (see Figure 188). The population increased by 605 thousand people compared to the 2010. In particular, the urban population was 1,709.6 thousand people (36.2% of the total population), the rural population – 971.2 thousand people (63.8 %).

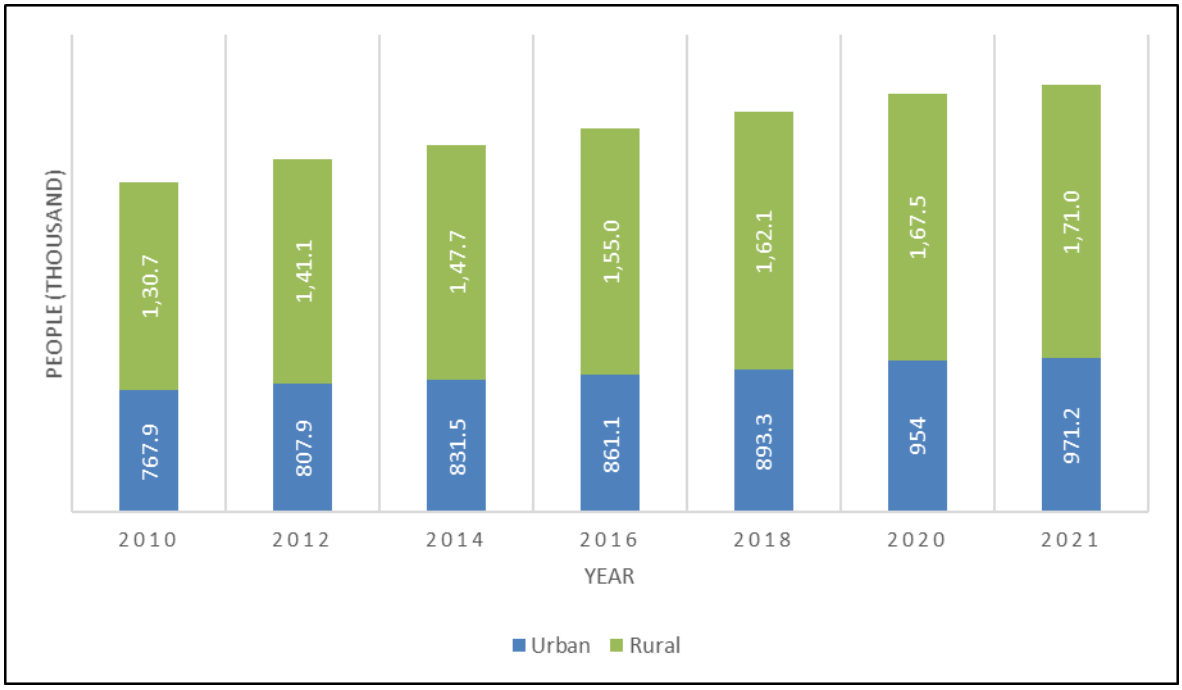


Figure 188: Dynamics of Urban and Rural Population in Surkhandarya Province [78]

At district level, Figure 189 illustrates past and current population as well as dynamics of urban and rural population in Angor and Termez Districts. Since the project is located on the territory of the two above-mentioned districts, the demographic analysis was integrated [79].

The permanent population in Angor and Termez Districts has grown significantly from 189.2 thousand in 2010 to 230.8 thousand in 2018. In 2020, the population in the two districts slightly decreased to 209.2 thousand.

According to UzStat, at present there are 134.7 thousand (5% of the Surkhandarya region's population) people living in Angor, and 78.6 thousand people in Termez District.

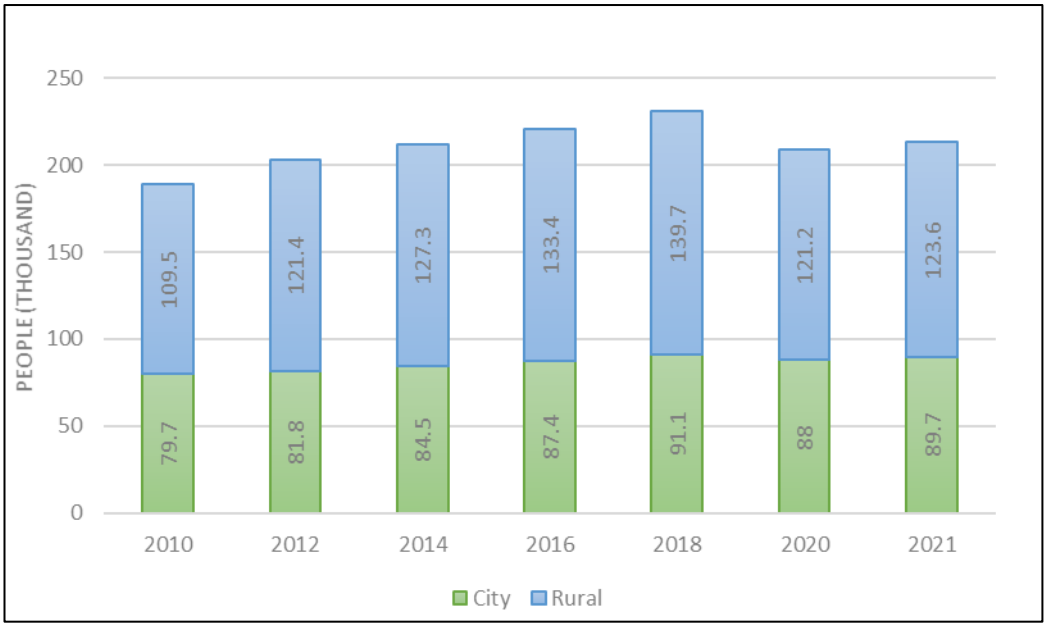


Figure 189: Dynamics of Urban and Rural Population in Angor and Termez Districts [79]

As for January, 2021 the population density throughout the Republic of Uzbekistan amounts to 74.1 people per 1 square km.

16.2.2.2 The population density in Surkhandarya Province

The districts with highest population density are Devon, Altinsai, Angor and Kizirik [80]. Proportion of male and female citizens is almost similar with a slight excess of males (see Figure 190).

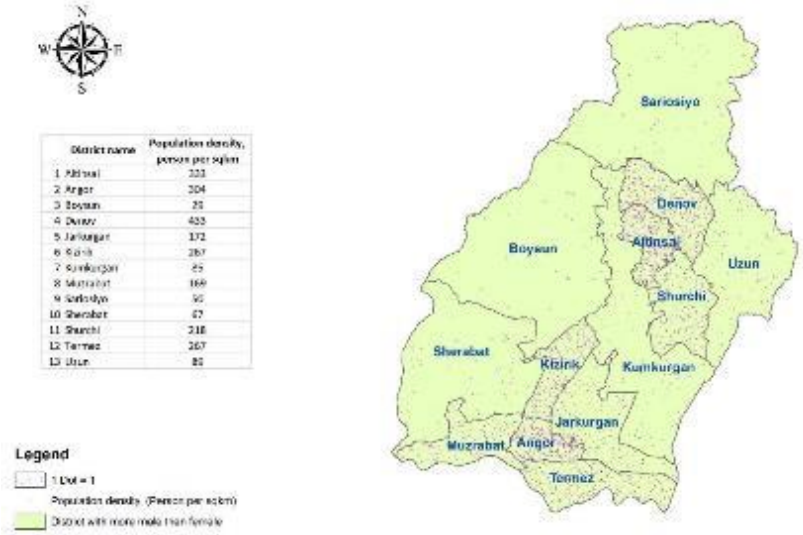


Figure 190: Population Density and Gender By District in Surkhandarya Province [80]

16.2.2.3 Change in Population

Internal and external migrations

According to a study of authors', Uzbekistan has a significant demographic growth and large labor force. In the context of population growth and unemployment, there is another issue - labor migration which observed during the field survey.

According to the Ministry of Labor, about 1.3 million are currently working in Russia, and about 200 thousand Uzbeks in Kazakhstan [81]. With the recent statistics of International Organization for Migration, a total number of emigrants in Uzbekistan at mid-year 2020 was 2 million and net migration rate in the 5 years prior was minus 44.3 thousand.

Due to economic difficulties in Uzbekistan, labor migration to Russia, Kazakhstan, the United Arab Emirates (UAE), Turkey, the Republic of Korea and Europe has been increasing over the last years [82].

In addition, in 2020, the number of immigrants reached 191.2 thousand people, and emigrants - 203.7 thousand people at country level. Emigrants are when people leave either district, province or country of origin, and immigrants when they arrive at their destination [78].

According to State committee of Uzbekistan on statistics in January-June 2021, the number of emigrants was 10,689 people, and the number of immigrants was 992 people from foreign countries (see Table 246). Majority of Uzbekistan residents (2,669 people) emigrated to Russia, Kazakhstan (7,013 people), Tajikistan and Kyrgyzstan. The largest share of arrivals from abroad to the Republic of Uzbekistan (in% of their total number) is accounted for by arrivals from Kazakhstan (35.9%), Tajikistan (21.6%), the Russian Federation (17.1%) and Kyrgyzstan (6.3%), the smallest - from Turkmenistan (4.0%) and other countries (15.1%) [83].

Table 246: Number of Immigrants and Emigrants in 2021 (January -June) [83]

Countries	Immigrants	Emigrants
AZERBAIJAN	5	21
ARMENIA	6	4
BELARUS	0	28
KAZAKHSTAN	356	7,013
KYRGZYSTAN	62	175
MOLDOVA	2	5
RUSSIA	170	2,699
TAJIKISTAN	214	233
TURKMENISTAN	40	81
UKRAINE	28	103
ISRAEL	5	77
USA	9	15
OTHERS	95	235
TOTAL	992	10,689

At the regional level in Surkhandarya Province in January 2020, the number of immigrants amounted to 8.5 thousand people, or 4.4% of the total republican and 19.5 thousand people emigrated from the region (9.5% of the total). Net migration rate is 11.06 thousand at regional level (see Figure 191). The highest net migration rate observed in Oltinsoy (- 327 people), Kumkorgan (- 340 people) and Sariosiyo (- 320 people) Districts [79].

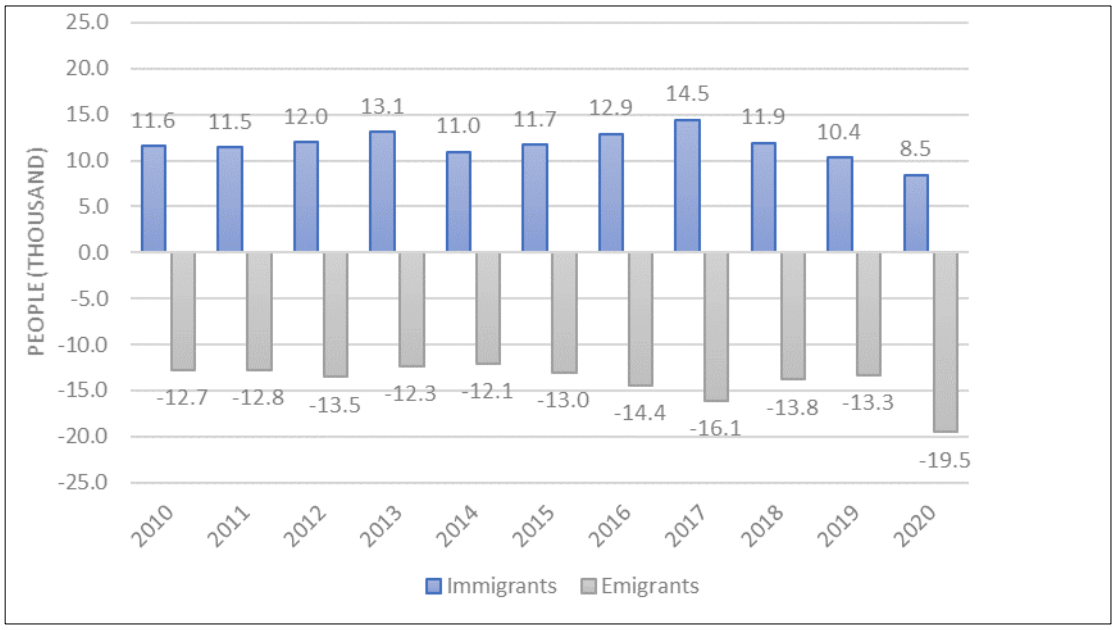


Figure 191: The Number of Immigrants and Emigrants in Surkhandarya Province [79]

One of the positive impacts of the migration is reducing pressure on the labor market at local level as well as receipt of income from remittances (from 4.8 to 6 billion US dollars annually) [81].

The net migration level in Angor and Termez Districts is not significant among other regions. As Figure 192 shows the number of immigrated people fluctuated from 2010 (1.2 thousand people) to 2016 (1.04 thousand people). In 2017, both immigration (2.6 thousand people) and emigration (-1.6 thousand people) rates were peaked. The population that moves from these two areas between 2018 and 2020 has declined slightly. At present, the net migration rate is minus 245, or 2.2% of the total number of emigrated from the region [79]. Most of the district population moves within the region, which can be described as internal migration. According to the population, the main reason for such internal migration is the return to the hometown and the moving of the population in the process of urbanization in cities.

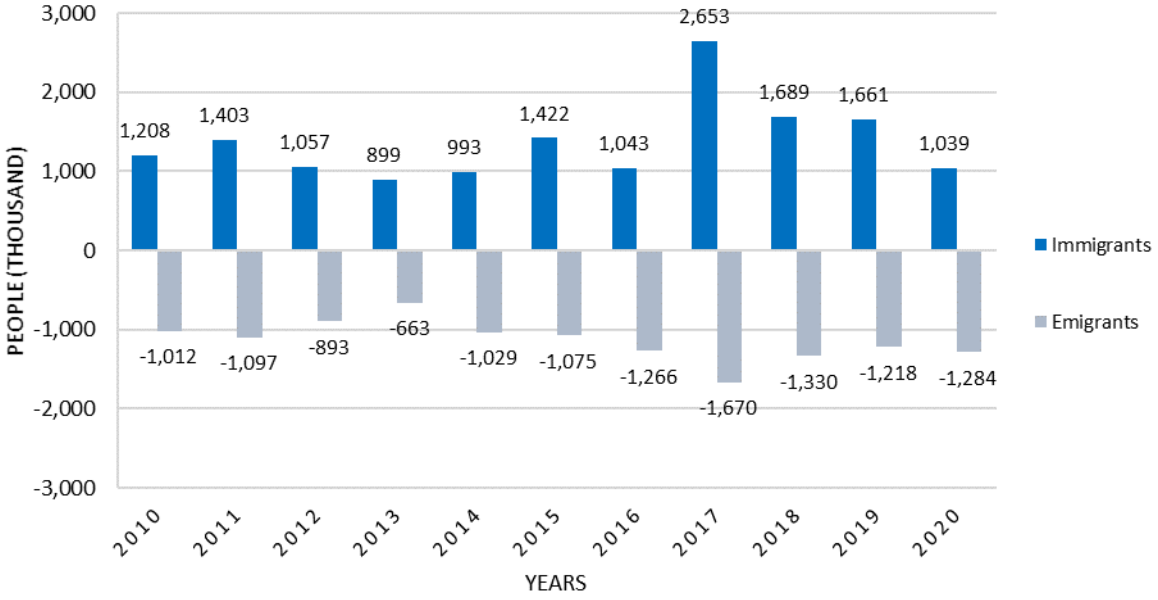


Figure 192: Number of Immigrants and Emigrants in Angor and Termez Districts [79]

16.2.3 Population Distribution

16.2.3.1 Distribution of Population by Age Groups and Gender

According to State Committee on Statistics, there are slightly more males in Uzbekistan -50.4 % of the population, females, respectively - 49.6% of the total number of citizens in 2021. As for 2021, in Surkhandarya Province the number of female population is 1.32 million (49.5%) and 1.35 million (50.5%) male population [78].

The age composition of the population is analyzed on the basis of an international standard four-year interval (see Figure 193). It should be emphasized that in 2020the highest representative of the population are children from zero (0) to four (9) years [84]. About ten (10) percent of the population is between the ages of 30 and 34. The population aged 60 and over makes up only 6.8% of the total population, but this figure in developing countries ranges from 25% to 30% [85].

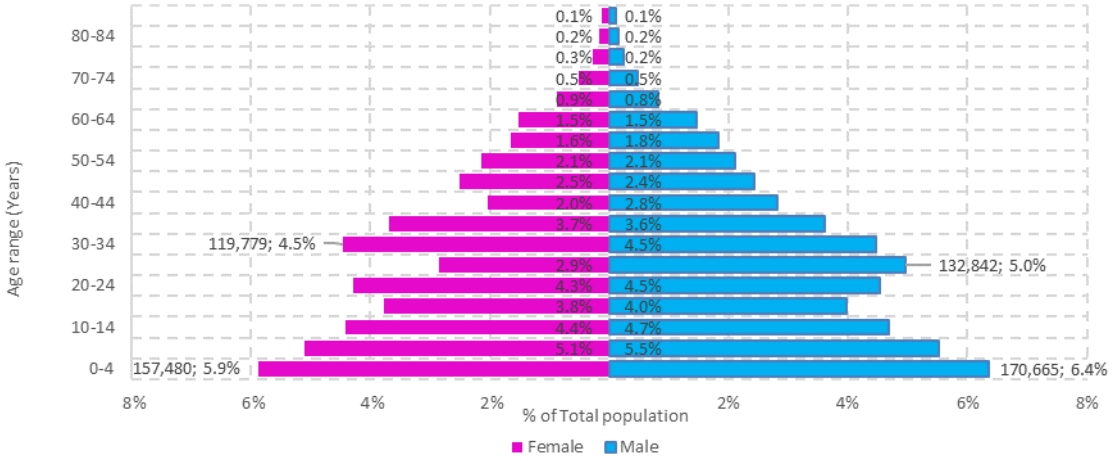


Figure 193: Disaggregation of Population by Age Groups and Gender in Surkhandarya Province [84]

Figure 194 shows distribution of population by age groups and gender in Angor and Termez districts. Almost no difference between the number of male (50.1%) and female (49.9%) of the population. 22 thousand residents or 10.3 percent of the total population of Angor and Termez Districts aged 25 to 29 years. The largest representation of women between the ages of zero (0) to four (4) years, which amounted to 13.3 thousand people [84].

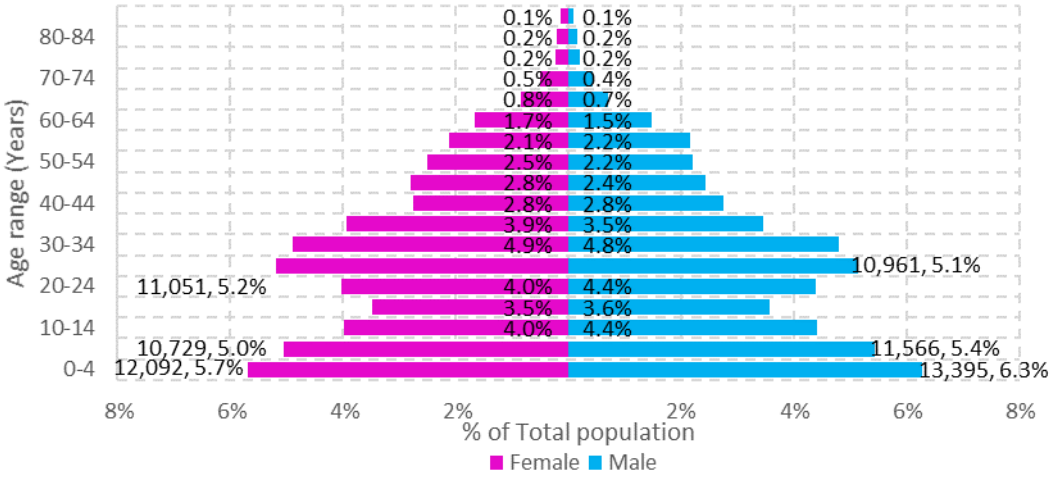


Figure 194: Disaggregation of Population by Age Groups and Gender in Angor and Termez Districts [84]

16.2.4 Education

16.2.4.1 Education system in Uzbekistan

The education system in Uzbekistan is one of the important drivers of transformation in the country's society and economy. Although the education system at all levels is in a flux stage however the Government of Uzbekistan (GoU) is committed to improving its education system in the context of its wider reform program. For instance, the education reforms aim to expand access to preschool

education while also restructuring the offerings for general secondary and secondary specialized education. The government of Uzbekistan aimed to reach 100 percent enrollment in preschool education for students aged 5–6 (or 7 depending on the birth date) by the end of this year [85].Along with this important initiative, the GoU is reinviting General Secondary Education (GSE), wherein students will have 11 years of compulsory education and multiple pathways to enter the labor market or higher education. These reforms have significant implications for improving student learning outcomes. Starting from the 2017/18 academic year GoU has changed its requirements for general secondary education and expanded compulsory GSE from 9 to 11 years of schooling (see Figure 195). Until these changes, GSE in Uzbekistan contained nine years of compulsory education from 1 to 9 grades. However, for students who want to continue their education in academic lyceums instead of GSE schools for grades 10 and 11 the study program for academic lyceums has been condensed to two years. In other words, compulsory GSE could involve 11 years in a GSE school or 9 years in a GSE school plus 2 years in an academic lyceum. Starting from the last academic year, graduates of grade 11 can choose to continue their studies in Secondary Specialized Vocational Education (SSVE) or apply to a university. The transformation of the economy and undergoing reforms in education sector have positively impacted to the Higher Education system (HE). As a result of these measures higher education graduates with more diverse skills set and fields of study are being implemented based on labor market demand [85].

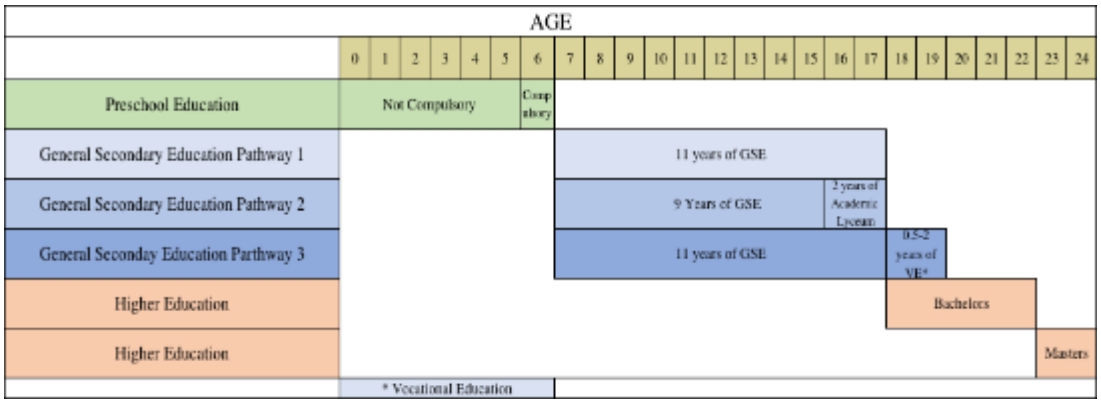


Figure 195: Education System Structure [85]

Based on statistics of 2020/2021 academic year, there are 6,960 preschools, 10,090 GSEs, 1,117 SSVEs and 119 HEs operating in the country (see Table 247). Particularly, data on provincial level illustrates that only 8 percent of the total number of preschool educations in the republic falls on Surkhandarya region while proportions for GSE, SSVE and HE accounted at 9%, 3% and 6 % respectively [86].

In the case of district level, 32 preschools, 44 GSE and 5 SSVEs are operating in Angor district, while the 31 preschools, 28 GSEs and 1 SSVE in Termez district. It should be noted that there is no higher education institute in Angor district while there are two branches of higher education in Termez province [86] which makes Termez district more attractive in terms of created facilities for those who are pursuing higher education.

Table 247: Number of Educational Facilities in Surkhandarya [86] in comparison with Uzbekistan [87] in 2020/2021 academic year

Education facilities	Preschool	GSE	Secondary Specialized Vocational Education	Higher Education
Surkhandarya region	546	920	31	7

Education facilities	Preschool	GSE	Secondary Specialized Vocational Education	Higher Education
Angor	32	44	5	0
Termez	31	28	1	2
Total Education Entities in the Republic	6,960	10,090	1,117	119

16.2.4.2 Educational Facilities

According to data from the 2020/2021 academic year, the average student-teacher ratio in all levels of Uzbekistan's education is about 12:1, which is lower than the averages for countries such as the United Kingdom (16:1), the Netherlands (18:1), Finland (17:1), and Romania (14:1) [88]. Moreover, this ratio varies across regions, however ratio was observed in Surkhandarya region (nearly 11:1) in preschool, (nearly 9:1) in GSE and SSVE and (18:1) in higher education. As for district level, student ratio in both Angor and Termez districts' GSE and SSVE education indicates (about 12:1), while preschool sector increases this ratio up to (25:1) and (27:1) in Angor and Termez districts accordingly (see Figure 196) [89][90].

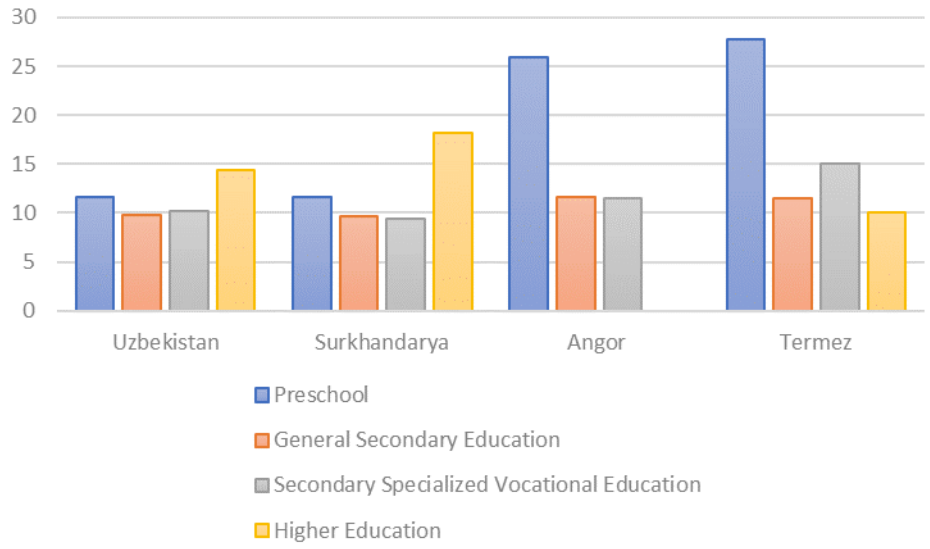


Figure 196: Student – Teacher Ratio in Education level. Source: (State Committee of the Republic of Uzbekistan on Statistics)

As it was mentioned above Uzbekistan government set up the plan to reach out 100 percent enrollment in preschool education for students aged 5–6 (or 7 depending on the birth date) by the end of this year [85]. The preschool enrollment rate in urban areas is approximately 46 percent [91], compared to 23 percent in rural areas, but substantial variation arises between regions. For example, in Tashkent City, almost 80 percent of children are enrolled in preschool, while this rate for Surkhandarya region is only 12 percent as the lowest enrollment rate in the republic. These are average figures for 2018/2019 academic year (see Figure 197).

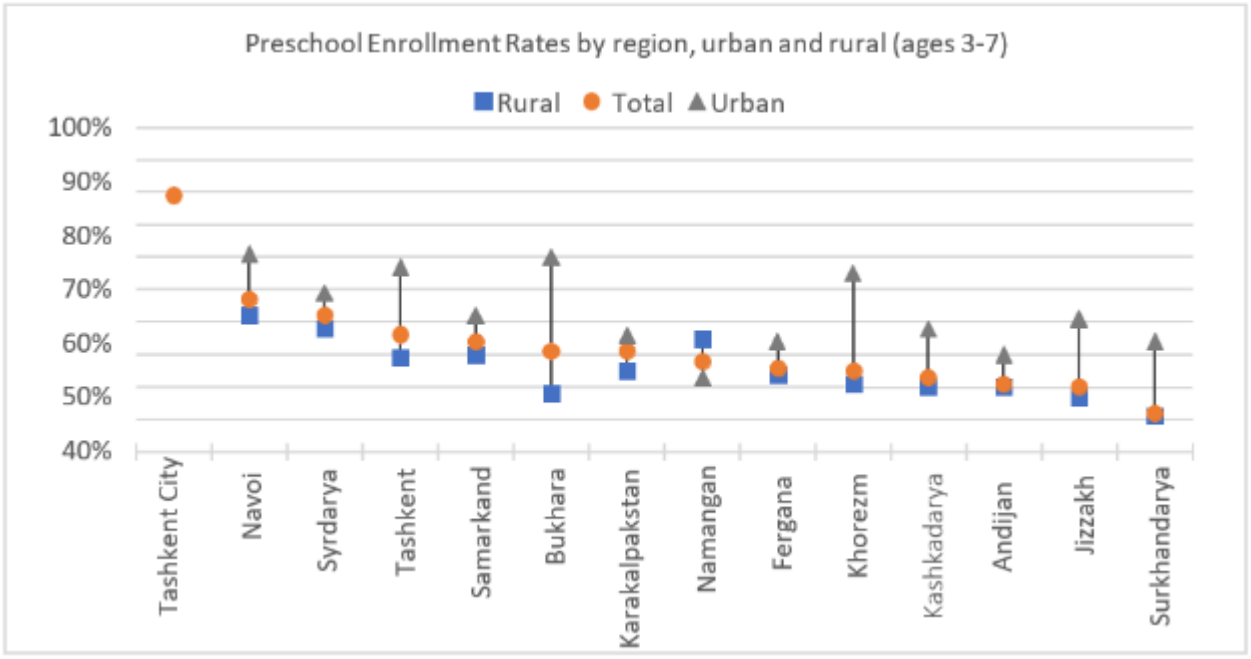


Figure 197: Preschool Enrollment Rates by Region, Urban and Rural (ages 3-7) [85]

16.2.4.3 Distribution of Educational Facilities by Levels

Overall, education facilities in Surkhandarya province, Angor and Termez districts are evaluated as in a good condition. This delineation of the three different conditions (Excellent, Good, Unsatisfactory) contains the condition of the building and adjacent infrastructure, material and technical equipment including education materials, teachers working condition and their salaries (see Figure 198). So, Figure 198, (a) shows the status of GSEs located in Angor district in 2020/2021 academic year according to the data collected from Angor khokimiyat. An absolutely identical data was collected on conditions of GSEs in Termez district (see Figure 198 b).

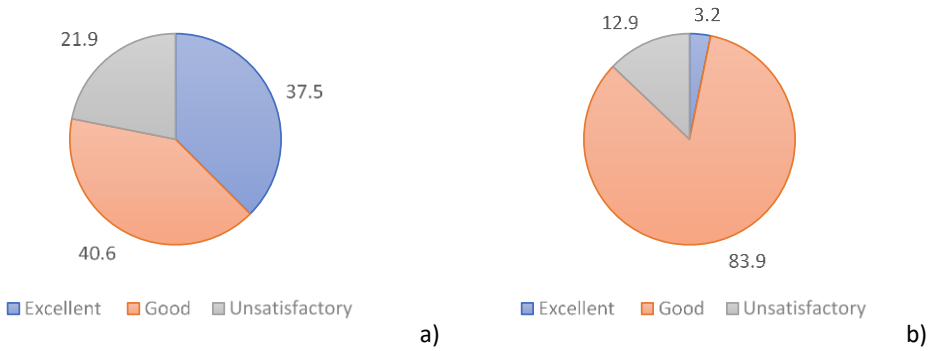


Figure 198: Condition of the GSEs in Angor (a) and Termez district (b) [89][90]

It is worth noting that secondary schools under the "good" category in Termez district almost twice more than same schools in Angor district. However, the total number of secondary schools in Angor - 44 and in Termez district - 28. Taking into account the fact that Uzbekistan has a rapidly growing young population with an average increase of 1.8 people under the age of 19 [83], this situation is

expected to create additional challenges not only for the GSE, but also for the education system as a whole.

As a conclusion, the implementing by the government reforms have significant implications for improving student learning outcomes, but also pose relevant challenges for implementation and resource allocation. These challenges already appear at province and especially at the district level. Although preschool enrollment is increasing constantly in recent years, it remains at approximately 30 – 40 percent, which is low by international standards. Preschool is considered as the weakest part of the education in the selected districts because families who wish to enroll their children in public preschools must pay fees (around US$6 to US$28 per child per month in full-day groups), mostly to cover the costs of meals. The fees charged by nonpublic preschool education institutions are paid by families and can range from US$175 to US$300 per child per month [85]. Due to the high rate of unemployment and low-income source the above-mentioned pay fees are not affordable for a population of selected districts. Another issue can be related to the physical conditions of the GSEs and SSVEs in the districts. For example, based on data collected for this report it was revealed that there are not enough sports facilities for the school and college-age students in both Angor and Termez districts which potentially can negatively impact on health of students and worsen their academic performance.

16.2.5 Health

Uzbekistan has a public healthcare system and a small scaled private health sector. Cities in Uzbekistan are serviced by family polyclinics, while rural areas are serviced by rural medical centers. Pharmacies in Uzbekistan are privately owned and operated. A total of 14.8 trillion Uzbek soums (1,427 million USD, exchange rate for November 5, 2020) have been allocated from the state budget for the healthcare system in 2020. Funds allocated from the state budget in 2020 increased 1.2 times compared to last year and 1.6 times compared to 2018. This means that 12.2% of the total state budget expenditures and 2.3% of GDP were spent on health care [92].

The health of the population is considered as one of the indicators of the standard of living of the population. Therefore, the health sector and common diseases are going to be presented in two levels: provincial (Surkhandarya) and district (Termez and Angor). The comparison of the rates is given in country, province and district level.

Between 1991 and 2020, life expectancy in Uzbekistan increased from 66.4 years to 73.4 years, while in Surkhandarya it was 73.3 on average, females - 75.5 and males -71.3 years [93]. Reported maternal mortality ratio in the same years in the country level reduced 3.5 times—from 65.3 to 18.5 per 100,000 live births, but in Surkhandarya it was 36.2 in 2020 which is the second highest rate among provinces after Syrdarya. Infant mortality reduced 3.8 times to 9.3 cases per 1,000 live births, and in the province level, it was 8.6 [94].

16.2.5.1 Most Common Diseases

Diseases of the circulatory system, mainly ischemic heart disease and cerebrovascular disease are the most common causes of death in Uzbekistan (see Figure 199 and Figure 200) [101] [102]. In country, 78% of all deaths are due to non-communicable diseases. In 2017, circulatory system diseases (69%), including ischemic heart disease, arterial hypertension and its complications (myocardial infarction, cerebral hemorrhage) took the first place in the overall standardized cause of death by sex and age. They were followed by malignant tumors (8%), diabetes (3%) and chronic respiratory diseases (3%) [102]. The changes of the causes of death in 10 years between 2009-2019 have not changed significantly [101]. Noteworthy change has been seen in decrease of tuberculosis infection (see Figure 199).

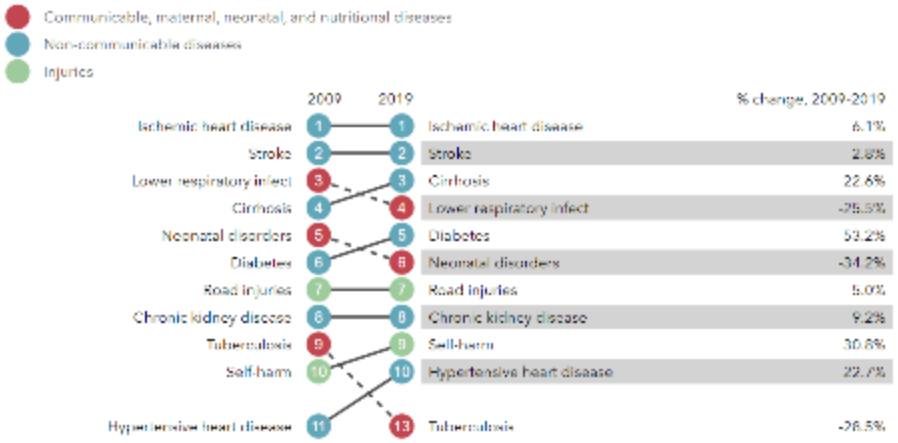


Figure 199: The Causes of The Most Deaths in Uzbekistan [94]

What relates to the provincial level, in 2020, 11.9 thousand deaths were registered in Surkhandarya, of which 62.3% were due to diseases of the circulatory system, 5.9% due to tumors, 4.0% due to accidents, poisoning and injuries, 4.5% from digestive diseases, 7.4% from respiratory diseases, 1.5% from infectious and parasitic diseases, and 14.4% from other diseases.

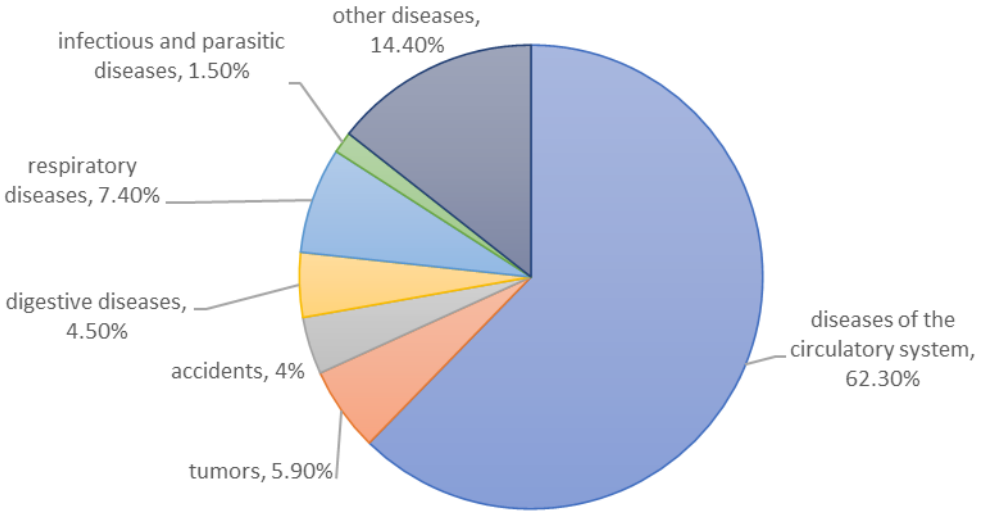


Figure 200: Distribution by Main Causes of Death in Surkhandarya (in % of total deaths)

Diseases and morbidity rates for 10 thousand people in Angor and Termez districts are provided in Table 248. According to the statistical data, the most common diseases in the districts where study area is located are diseases of the stomach and intestines (182.1 infected per 10,000 population) and iodine deficiency (80.75 infected per 10,000 population) [89][90].

Table 248: Diseases and Morbidity Rates for 10 thousand people in Angor and Termez districts [89][90]

Name of the disease	Termez	Angor	Average
Infectious diseases:			
- Acquired Immune Deficiency Syndrome (AIDS)	8.9	9.4	9.15
- jaundice	0	175.8	87.9
- flu	0	0	0
- measles	0.09	0	0.045
- chickenpox	0	0	0
- others	0	0	00
Non-communicable diseases:			
- diabetes mellitus	43.7	6.5	25.1
- iodine deficiency	129.7	31.8	80.75
- diseases of the stomach and intestines	26.6	337.6	182.1
Other illnesses	1,609.8	0	804.9

The common diseases in the area can be seen in detail in the example of Angor district. Here the most common diseases are diseases of blood and blood-forming organs, respiratory diseases, diseases of nervous system and circulatory diseases. The total number of registered diseases for 2018, 2019 and 2020 with average comparison can be found in the Figure 201 [103].

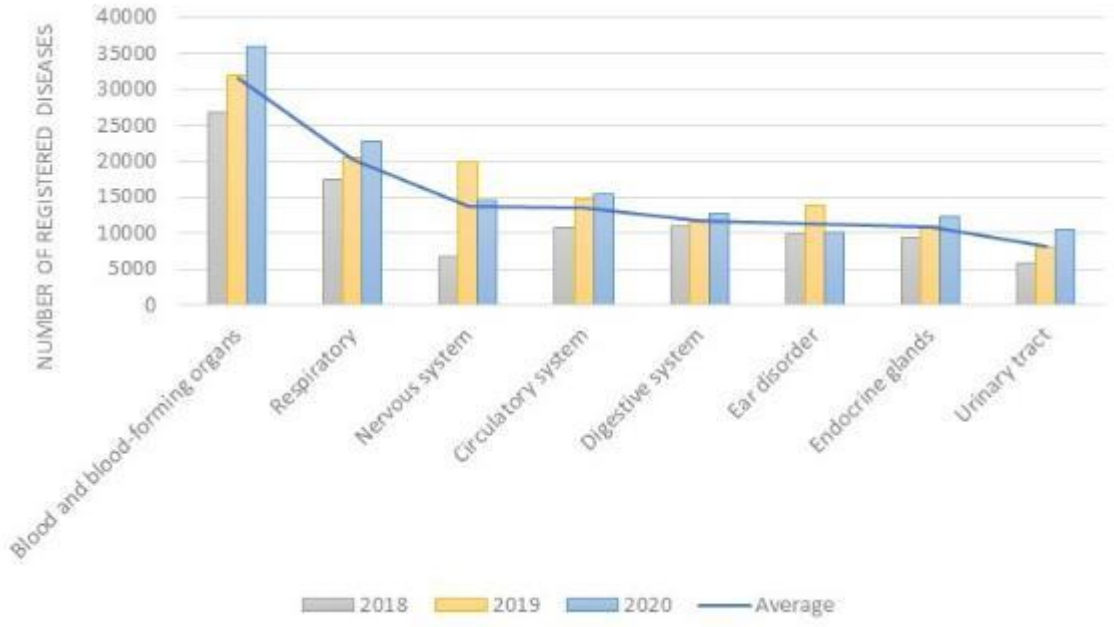


Figure 201: The total Number of Registered Diseases for 2018, 2019 and 2020 with average comparison in Angor district [102]

The number of registered deaths of children under 1 year of age was 0.6 thousand, of which 58.1% were perinatal cases, 22.3% were respiratory diseases, and 14.0% were congenital anomalies and 5.6% died from other diseases.

16.2.5.2 Disabilities and Elderly

Based on the statistics of 1 January, 2014, the number of people with disabilities in Uzbekistan 16 years old or more were 581,869, which was approximately 2% of the whole population. A ratio of male and female was rather unbalanced, in other words, male was 60% and female was 40%. Regarding the disability group, more than 70% of people with disabilities belong to Group 2, while Groups 1, the most severe group, is only less than 10% [104].

In the district level, in the study area which includes Termez and Angor districts, the number of people with disabilities was 4,378, which was approximately 2% of the whole population. Regarding the disability group, Group 1 was 14%, Group 2 - 76.5%, Group 3 - 9.4% [89][90].

Table 249: Disabled People in Angor and Termez [89][90]

P	Termez	Angor
Total number of disabled people, person	2,007	2,371
Share of disabled people from the district population, %	2.5	1.8
including by disability group:		
- Number of group I disabled people	289	326
- Number of group II disabled people	1,508	1,843
- Number of group III disabled people	210	202
Number of children with disabilities, person	352	402
Share of children with disabilities from the total number of children in the district, %	0.8	0.9

Under current law of Uzbekistan which is Law of the Republic of Uzbekistan "on state pension of citizens" 03.09.1993, N 938-XII, the right to an old-age pension is granted to men at the age of 60 and at least 25 years of service, and to women at the age of 55 and at least 20 years. As of February 1, 2021, 3 million 845 thousand 462 people in the country will receive pensions and benefits.

Therefore, in this assessment, people who reached their pension age according to the law of Uzbekistan are taken as elder person (see Table 250). According to the statistics, total 3,724,594 people have reached pension age, and ratio of males and females are 36% to 64% respectively. The share of elder people from total population in Uzbekistan is 11%.

Both in provincial and district level, shares of elder people in the total population showed almost the same amount – 9%.

Table 250: Elder Population According to Their Gender, And Share In Total Population in 2021 [83]

	Males	Females	Sum	Total population	Share of elder people
Surkhandarya region	87,215	147,465	234,680	2,680,800	9%
Angor	3,925	7,262	11,187	134,700	8%
Termez	2,687	4,802	7,489	79,200	9%
Total in the Republic	1,331,528	2,393,066	3,724,594	34,558,900	11%

16.2.5.3 Health Facilities

In 2019, there were about 1,205 hospitals with 153.4 thousand beds in the country, of which 57 hospitals with 8.5 thousand beds in Surkhandarya region [87]. Specifically, Termez had 7 hospitals in total with 868 beds while Angor had only one hospital with 265 beds [86](see Table 251).

Table 251: Number of Hospitals and Beds in Country, Province and District Level [86] [87]

	Hospitals	Beds
Surkhandarya	57	8,500
Termez	7	868
Angor	1	265
Uzbekistan	1,205	153,400

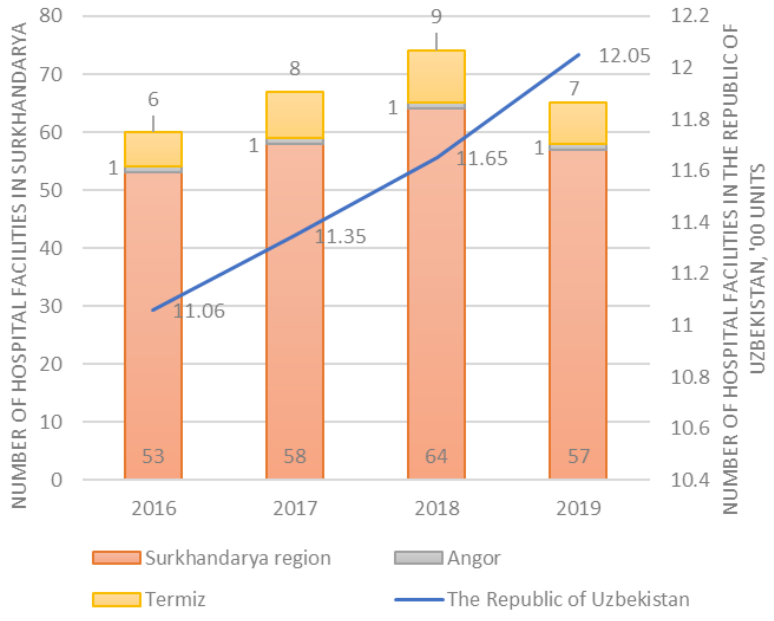


Figure 202: Number of Hospital Facilities in Surkhandarya in Comparison with Uzbekistan in 2016-2019 [86] [87]

Table 252: Number of Medical Workers in the Republic of Uzbekistan by specialty, thousand people [86] [87]

	2015	2016	2017	2018	2019
Surkhandarya region	**3.5**	**3.9**	**3.9**	**4.2**	**4.1**
Angor	**0.2**	**0.1**	**0.1**	**0.1**	**0.1**
Termez	**0.1**	**0.2**	**0.2**	**0.2**	**0.2**
Total physicians in the Republic	**83.4**	**84.1**	**85.4**	**89.8**	**91.9**
Surkhandarya region	**21.7**	**22.0**	**22.0**	**22.1**	**22.5**
Angor	**1.1**	**1.1**	**1.1**	**1**	**1**
Termez	**1.1**	**1.0**	**1.1**	**0.7**	**0.7**
Total nurses in the Republic	**336**	**341**	**348**	**356.7**	**365.7**

In the country level, from 2015 to 2019, the number of physicians increased by 10% to 91,900, and nurses by 9% to 365,700 (see Table 253) [87]. Doctor-population ratio is another important indicator for assessing the health care sector. World Health Organization standard for doctor-population ratio is 1:1000. In terms of population ratios, physicians made 27.6 per 10,000, and nurses 109.9 per 10,000 people.

In the province level, the number of physicians was 4,100 and nurses 22,500 [87]; population ratio, 15.9 physicians for 10,000 people and 87.6 per 10,000 were serving in 2019.

In the case of district level, 25.2 physicians and 88.4 nurses are serving for 10,000 people in Termez district, while only 7.4 physicians and 74.2 nurses are serving for 10,000 people in Angor district [86].

According to the passport of both districts, developed and provided by related Hokimiyats [89][90], Termez district does not have any ambulance transports, while Angor has 10 vehicles. However, Angor district owned 86% of total calls of ambulance. Nevertheless, 96% of deaths from calls for emergency medical care happened in Angor district (see Table 253).

Table 253: Districts' Ambulance Service in Termez and Angor districts in 2021 [89][90]

	Termez	Angor	Total
Number of workers and employees of ambulance service, which of	97	115	212
Medical doctors	23	19	42
Nurses	74	96	170
Number of ambulance transports	-	10	10
hence, need repair	-	3	3
Distance from ambulance to the farthest village in the district, km	70	25-30	25-70
The number of ambulance appeals during 2020	57,020	370,189	427,209
hence, by phone call	54,233	34,425	88,658
Deaths from calls for emergency medical care	2	63	65

	Termez	Angor	Total
hence, death of children	-	-	0

As a conclusion, health sector in district level needs improvement. The common diseases in country, province and district level are diseases of blood and blood-forming organs, respiratory diseases, diseases of nervous system and circulatory diseases. In the district level, the number of people with disabilities was 4,378 which is 2% of total population. As World Health Organization standard for doctor-population ratio is 1:1,000, Angor district does not follow the requirement having 0.7: 1,000, while Termez does 2.5: 1,000. The ambulance service has a need on high performance vehicles with speed capacity.

16.2.6 Social Services

Surkhandarya has wide range of cultural facilities, including cultural organizations and centers, study courses, theatres, worship areas, cultural heritage sites and museums (see Table 254). Particularly, 123 cultural organizations and centers have been functioning in 2021 which has 1,720 courses with more than 20 thousand participants [34]. The main purposes of the centers are:

- Further develop national culture in the Republic of Uzbekistan,
- Improve the quality of cultural services to the population,
- Meet their cultural needs and ensure meaningful leisure,
- The formation of exemplary programs embodying national values,
- Traditions and customs of creative communities,
- Preservation and development of art,
- Organization of various clubs, studios, courses, hobby clubs, amateur art groups and
- Creation of favorable conditions for their activity.

There also two theaters and two museums have been functioning in the province. Most interesting part is that the province has 561 cultural heritage sites which explains the area's importance in social development history [105].

Table 254: The list of Cultural Facilities in Surkhandarya province [105]

	Cultural Facilities and Participants	#
1	**C**ultural organizations and centers**	**123**
2	**Number of courses**	**1,720**
3	**Number of participants**	**20,554**
4	**Number of theatres**	**2**
5	**Number of cultural heritage sites**	**561**
6	**Number of cultural and recreational parks**	**17**
7	**Number of museums**	**2**
8	**Visits to museums**	**15,378**
9	**Number of children's music schools**	**22**

16.2.6.1 Public Institutions and Social Services

In Termez and Angor districts there are also cultural and educational institutions like the library which is also called as information resource center, museum and recreational park. However, cinemas and theaters are absent in both districts (see Table 255) [89][90]. The international publications indicated the roles of theaters and cinemas in community development and their benefits to human well-being. However, any standard for assessing social life conditions based on cultural institutions are lacking for implementing in the study area.

Table 255: Cultural and Educational Institutions of The District in Angor and Termez districts [89][90]

	Termez	Angor
Number of information resource centers	1	1
Annual visit to the library by person	8,500	45,808
Number of museums (branches)	1	-
Number of theatres	-	-
Number of cinemas	-	-
Number of cultural and recreational parks in the district	1	1

16.2.6.2 Worship Areas

The U.S. government estimates that 88% of Uzbekistan's population is Muslim, while the Ministry of Foreign Affairs estimates 93-94% of the population is Muslim [106]. Statistics provided by Termez khokimiyat [90] showed that the area, where 39,900 residents out of 79,200 are men (only men in Islam pray in mosques), owns only one mosque with a capacity of 3,000 people. There are 3 mosques in Angor with a population of 134,700 people, of whom 67,400 are male, where 3,500 people can simultaneously worship (see Table 256) [89].

Table 256: Religious Institutions in Angor and Termez districts [89][90]

	Termez	Angor
Total number of religious institutions	1	3
hence, mosques	1	3
Average daily attendance at mosques	400	200
including the number of people performing the Eid prayer in the mosque	3,000	3,500

16.2.6.3 Recreational and Touristic Sites and Areas

According to data provided by khokimyats of districts, Termez is considered as one of Central Asia's oldest towns, and district has many historical and archeological monuments. The cultural areas depict experience of the area of Zoroastrianism, Buddhism and Islam. Some of the cultural heritage areas belong to the history of I-V centuries. Among these places is the Fayaztepa Buddhist building which is also included to United Nations Educational, Scientific, and Cultural Organization (UNESCO).

Figure 203: The Mausoleum of At-Tirmidhi

Most famous place of Termez for both local and international visitors is Mausoleum of Khoja Abu Isa Muhammad Imam Termez (see Figure 203).

Angor district also has 20 historical, archeological monuments which belong to I-XIII centuries. Some of the oldest relate to Kushan Empire including remains of fortress and warehouse (I-IV centuries). According to the status of these historical heritages, the objects have protection symbols. However, the roads to the monuments are in need of repair [89][90].

16.2.6.4 Leisure Facilities and Sports Facilities

The social development of the area can be witnessed by the presence of sport and leisure facilities. Termez district has 56 sport facilities, including 26 stadiums and 30 gyms, while Angor has two - one stadium and one gym. The number of sport courses and participants are consequently significantly higher in Termez district (see Table 257) [89][90]. Some facilities like swimming pools, tennis and basketball courts are absent in the area. The percentage of population who are engaged in sport activities are 11% or 8,742 people in Termez, and 0.7% or 1,042 in Angor.

Table 257: Sports and Health Facilities in Angor and Termez Districts in 2021 [89][90]

Type of facility	Termez	Angor
Total sports facilities:	56	2
- Stadiums	26	1
- Gyms	30	1
Number of sports courses	247	14
The number of participants in them	8,742	1,042
Swimming pools	0	0
Tennis courts	0	0
Small football fields with artificial turf	14	0
Children and youth sports schools	1	1
The number of trainees in them	976	1,042

The impacts of sport facilities and sport schools can be seen in the achievements of youth. Total 105 youth has participated till present in different regional (Championship of Uzbekistan among juniors and girls), national (Uzbekistan Cup, Championship of Uzbekistan) and international contests. The leading sport types are national wrestling, sambo and box. The achievements of district athletes can be assessed by their participation at the Asian championships, namely 10th Asian Championship in Pune, Republic of India and the 18th Asian Games are held in Jakarta and Palembang, Indonesia [89][90].

The existence of courses that mostly focus on wrestling makes wrestling a prominent sport. The lack of swimming pools, tennis courts and basketball courts may be the reason for the uncertain progress of other sports in the region.

Presence of leisure facilities which included ecotourism facilities and health facilities is another indicator which is included in the assessment. In the coast of Qizilsuv reservoir where the Project is going to be constructed, two facilities are located in the side of Termez district (exact location of Project is in the side of Angor district). They are "Termez Marvaridi" recreation area and "Termez Marvaridi" Sanatorium [89][90]. The sanatorium occupies a vast area of 7.5 hectares and can simultaneously accommodate 160 people.

Table 258: Ecotourism Facilities, Health Facilities, Other Specific Items in Angor and Termez Districts [89][90]

	Termez	Angor
Recreation Area	"Termez Marvaridi" recreation area	-
Sanatorium	"Termez Marvaridi" Sanatorium	-
Children's camps	-	-


Figure 204: "Termez Marvaridi" Sanatorium

As a conclusion of social services part, Surkhandarya has wide range of cultural facilities, including cultural organizations and centers, theatres, worship areas, cultural heritage sites and museums. In the district level, Termez and Angor districts have numerous cultural heritage sites which has an ancient historical background. However, cultural institutions, in the way that cinema and theaters are absent in the area. Finally, sport facilities are focusing more individual sport types like wrestling and boxing rather than team sports such as basketball and football.

16.2.7 General Economic Structure and Sectors

As for December 2020, in Surkhandarya region, annual gross regional product (GRP) amounted to 24,003.6 billion soums increased by 14% compared to 2010 and higher than 4.4% from 2019. Growth circumstances of GRP were growth rates in agriculture, forestry and fisheries - 105.6% (share in the GRP structure - 50.4%), industry - 113.9% (7.8%), construction - 107.1% (8.8%). GDP of the region exceeded $1.3 billion and makes up 4% of Uzbekistan's total GDP (see Figure 205) [78].

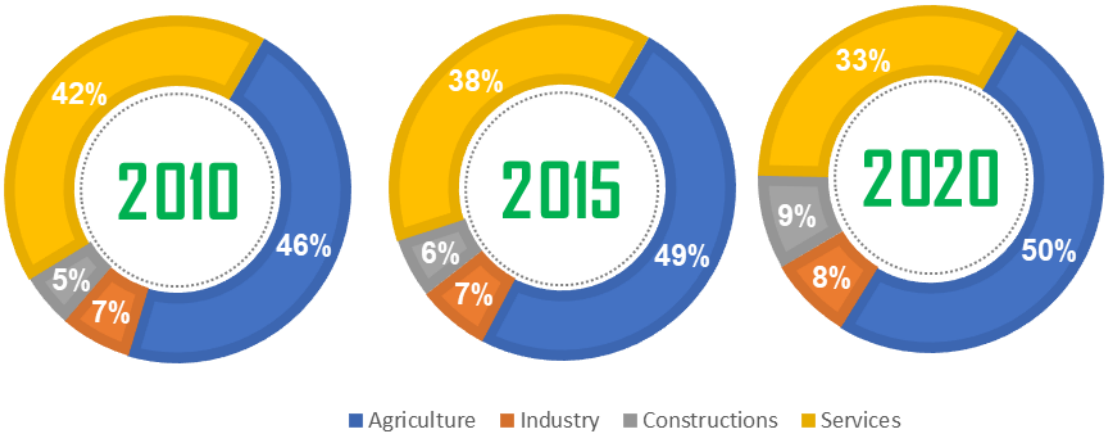


Figure 205: Composition of Surkhandarya GDP by Sector from 2010 to 2020 [78]

Overall, Figure 206 demonstrates the changes in the GRP composition by the sectors of economy (agriculture, industry, constructions and services) in the period 2010 – 2020 in Surkhandarya Province.

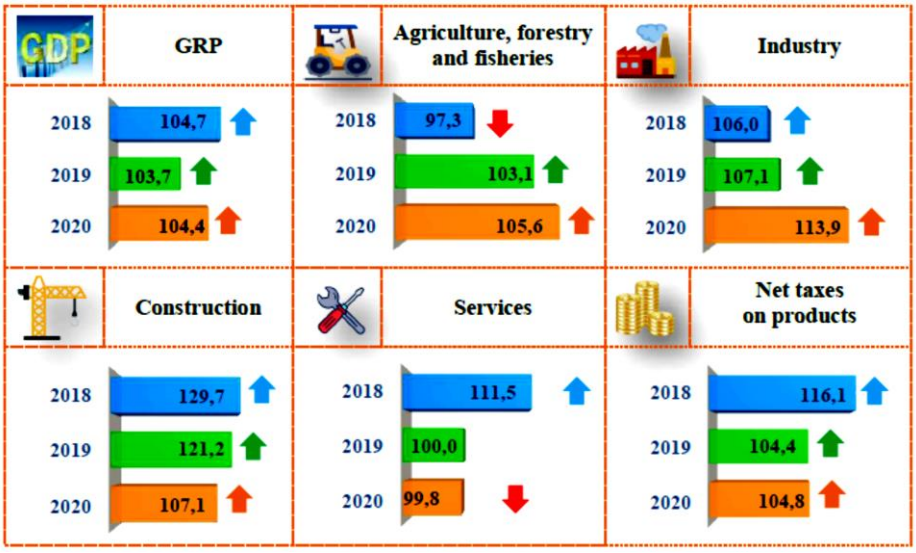


Figure 206: GRP Growth Rates For 2018-2020 In % To the Previous Year [78]

In 2020, compared to 2015, the share of agriculture increased to 50%, while the construction sector rose dramatically to 9%. GRP per capita amounted to 9,040.6 thousand SOM in 2020 and increased by 2.2% compared to 2019. Services in the region declined last year due to COVID-19 restrictions, but the industry sector continues to grow (see Figure 207).

The region is one of the most agriculturally developed regions and provides over 9% of total agricultural production of the country.

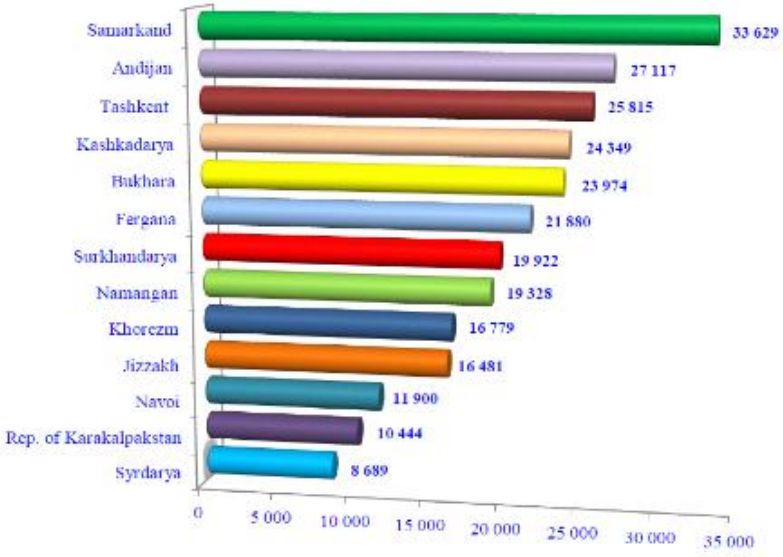


Figure 207: The volume Of Products (Services) In Agriculture, Forestry and Fisheries by Region, Forestry And Fisheries by region in 2020, billion SOM [78]

16.2.7.1 Agriculture

Agriculture is an important sector of Uzbekistan's economy, the share of agriculture in GDP is about 25.5% and employing about 27% of the labor force.

Over the past five years, the agricultural sector in Uzbekistan has developed dramatically in the context of elimination of quotas and price controls in 2020-2021. At the moment about 70 % of sown area was allocated to cotton and winter wheat. However, most of the farmers already shifted from state ordered crops to higher-value fruit and vegetable cultivation.

Despite of this, cotton and wheat crops occupied over 63 percent of total sown area in Surkhandarya Province. There are 101.8 thousand croplands in Termez region, of which 76.2% are cotton and wheat. Cotton and wheat were less spread in Angor District, occupying less than 10 percent of sown land (see Table 259).

Since the main source of income is agriculture, it is very important to have land for farming in rural areas. As for statistics, on average in Uzbekistan there is 0.23 hectares of sown area per one rural resident. In the Surkhandarya region, with the highest rural population density, one person can have access to 0.15 hectares of land.

Table 259: Selected Indicators of Agriculture in 2020

	Total sown area, 1,000 ha	Total population, 1,000 persons	Share of rural population, %	Share of cotton & wheat in sown area, %	Sown area per rural inhabitant, ha/capita
Uzbekistan	3,373.0	34,900.0	49.3	70.0%	0.20
Surkhandarya Province	255.0	2,693.0	63.8	65.5%	0.15
Angor District	155.3	134.6	51.0	9.8%	0.23
Termez District	10,183	78.6	69.7	76.2%	0.19

Large number of orchards, melons cultivated areas, vineyards and pastures in household land plots provides indication of the value of agriculture as one of the important practices and livelihoods of local residents of the region. In general, the Figure 208 shows the capacity of agricultural production in Surkhandarya Province in 2020.

Surkhandarya region annually agricultural produces about one million tons of vegetables on the Uzbek market, which is 10% of the total production. The dry and hot climatic conditions of the region will make it possible to produce 307.5 thousand tons of the melon per year, in other words 14% of the total melon yield (see Figure 208).

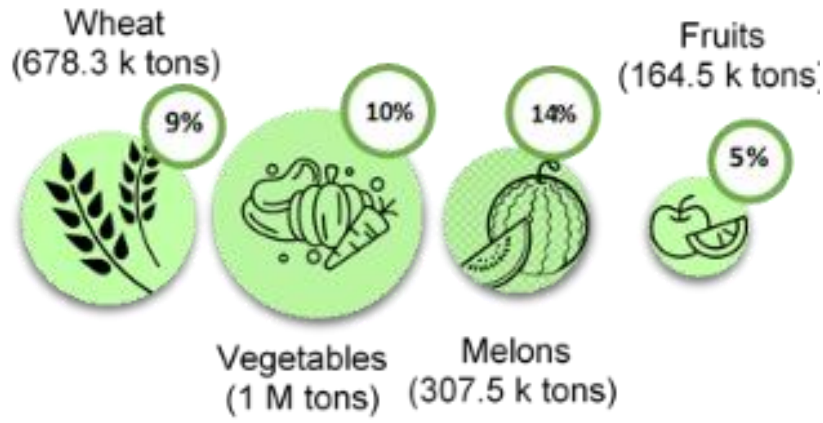


Figure 208: The Volume of Agricultural Production in Surkhandarya Province in 2020 [78]

16.2.7.2 Husbandry

In Termez and Angor districts there are 134 farms which are involved in animal breeding and / or animal product production. Two animal farms are taking more than 80% of the total farms (see Figure 209). They conduct fishery activities within 71 fish farms, and cattle breeding within 39 cattle farms or 53% and 29% of 134 farms, respectively. Consequently, the land for the development of these two types of activity takes on the largest share: 1,572.9 ha for fish farming and 2,520.5 ha for cattle breeding [89][90].

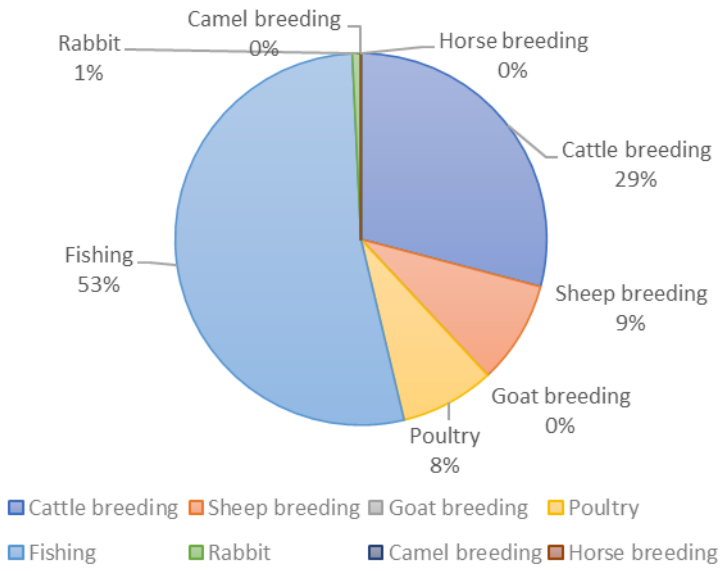


Figure 209: Share of Farms Depending on The Livestock Type [89][90]

As far as labor resources are concerned, nearly 700 people were employed in livestock sector in 2020 in two districts. As it is seen from Figure 210, poultry farming is the leading activity for job provision to locals with 289 employees, whereas cattle breeding and fish farming become other important employers in the sector. However, the animal farms of rabbit, camel, goat and horse breeding are lacking in both districts – Termez and Angor (see Figure 210) [89][90].

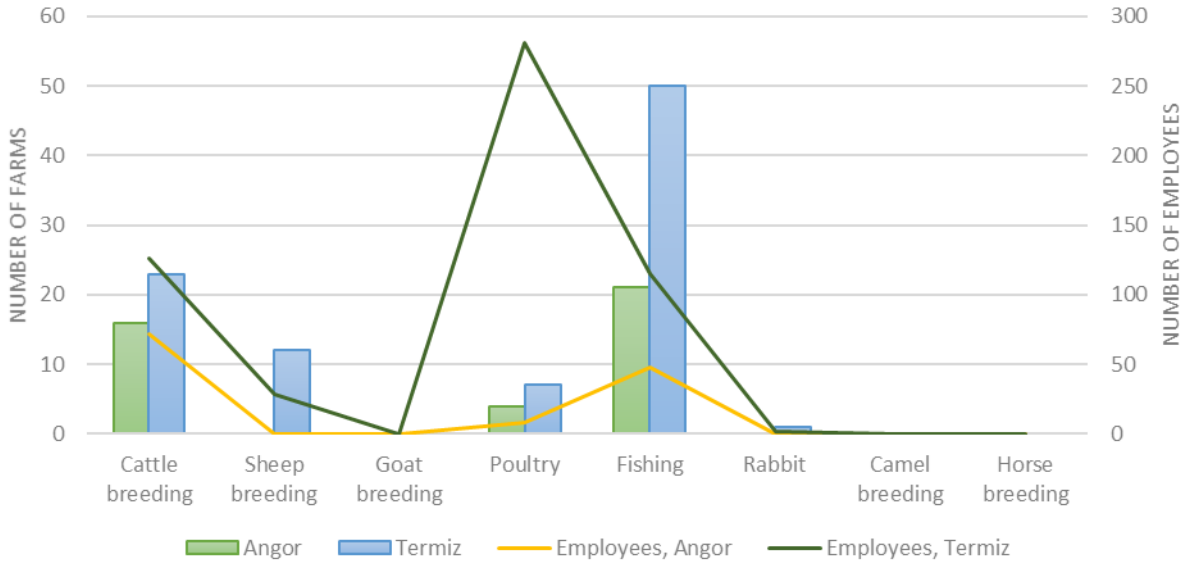


Figure 210: Livestock Sector in Angor and Termez Districts [89][90]

There are more than 86,000 heads of cattle, which provided 17,000 tons of meat and 81,000 tons of milk in 2020 in both districts. The poultry with 713,000 heads supplied with more than 120,000 thousand eggs, about 121 tons of animal fiber was received from 130,000 heads of sheep and 31,000 heads of goat (see Table 260 and Table 261) [89][90].

Table 260: The Number of Livestock Heads [89][90]

	Termez	Angor	Total
Cattle	46,428	39,662	86,090
Sheep	83,043	46,650	129,693
Goats	-	31,110	31,110
Horses	119	195	314
Poultry	479,300	233,600	713,000

Table 261: Livestock Production in Termez and Angor [89][90]

Type of product	Unit	Termez	Angor	Total
Meat (live weight)	tons	7,945	9,257.3	17,202.3
Milk	tons	40,014	41,269.4	81,283.4
Eggs	thousand pcs	98,644	21,481.4	120,125.4
Animal fiber	tons	76.4	44.6	121
Fish	tons	899.7	275.1	1,174.8

As it has been mentioned earlier in this husbandry part, fishery is the foremost practiced form of farming in Termez and Angor with 71 farms. The sector is involving 163 employees. The area of fish ponds is either artificial pool or natural water. Both districts are highly dependent on natural water reservoirs – 78% of fish ponds in Termez and in Angor whole fish farms are located in natural water reservoirs. As it has been stated in international papers, the environmental impact of the hydroelectric may affect to fishery and aquatic biodiversity. Therefore, there is a possibility of planned construction to have an impact to the fishery sector which are grown in natural water reserves.

Table 262: Fishery Farms in Termez and Angor districts in 2020

	Termez	Angor	Total
Number of fish farms	50	21	71
Number of employees in fishery	115	48	163
Fish pond area (ha)	1,351	269	1,620
artificial pools	290	-	290
natural water	1,061	269	1,330
Grown fish (tons)	1,178	275	1,453
in artificial pools	848	-	848
in natural water	80	275	355

As a summary of husbandry part, livestock is important part of sustaining the study area. There, three types of livestock farming are widely practiced and also employs the most labor share in Termez and Angor districts, namely fishery, cattle breeding and poultry. Most importantly, the impact of planned project to the fishing industry in the area needs to be focused specifically as fishery mostly depends on natural water reserve.

16.2.7.3 Industry and Commercial

Uzbekistan is the main producer of machinery and heavy equipment in Central Asia. The republic manufactures machines and equipment for cotton cultivation, harvesting, and processing and for use in the textile industry, irrigation, and road construction. This emphasis on making machinery also makes ferrous and nonferrous metallurgy important. In 2020, Uzbekistan produced industrial products worth 367.1 trillion SOM, the share of the processing industry was 83.0% (304.7 trillion SOM).

As demonstrated in Figure 211 the volume of products manufactured by mining and quarrying enterprises in January-December 2020 amounted to 33.0 trillion SOM, or 9.0% of the total industry. Water, electricity, gas, steam supply, sewerage and the country's industries include crude oil and natural gas productions amounted to 2.2 trillion SOM (0.6% of the total industry).

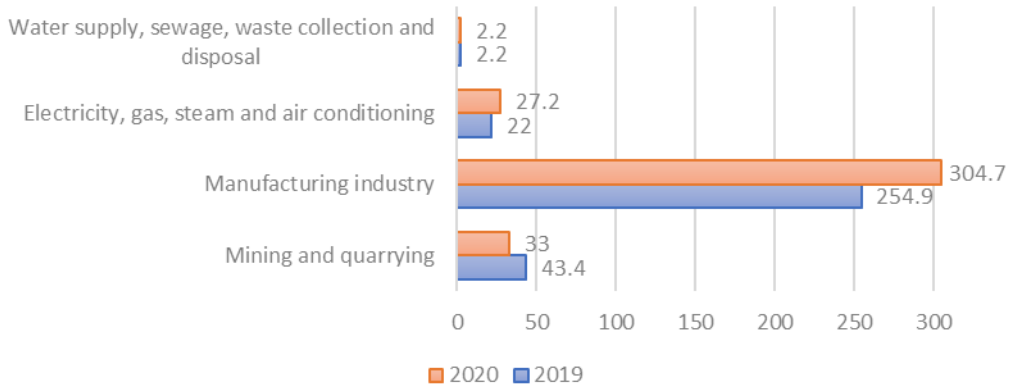


Figure 211: The Share of Value Added to The Industry of Uzbekistan from 2019 to 2020

Table 263 shows the indicators of industrial production in Angor and Termez Districts and its share at the regional level in 2020. The volume of industrial production of Surkhandarya Province is 5.5 trillion UZS, which is only 1.5% of the republican production volume. As for 2020, enterprises of Angor district produced industrial products amounted 123.6 billion SOM (2.2 % of the regional total) and 151.8 billion SOM respectively, in Termez district.

Table 263: Industrial Production in Angor and Termez Districts in 2020.

	Industrial production (billion soums)	Share at the republican/ regional level
Surkhandarya Province	5,515.9	1.5% (republican)
Angor District	123.6	2.2% (regional)
Termez District	151.8	2.8% (regional)

In the structure of production in the region, the largest share falls on manufacturing enterprises (89%) – 4,929.3 billion SOM. Water supply, sewerage, waste collection and disposal sector made very minor share (1.4 %) in the industry (see Figure 212) [78].

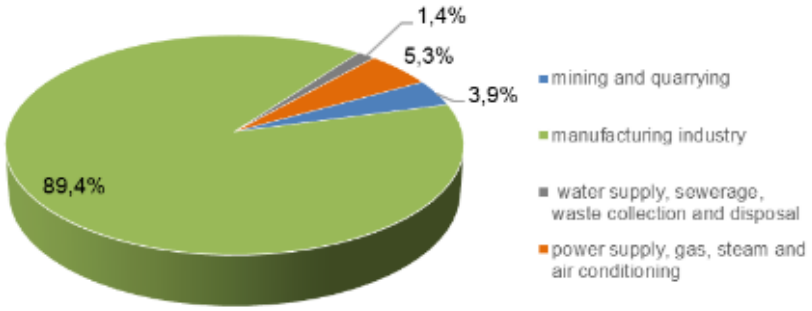


Figure 212: Composition of Industrial Production in Surkhandarya Province in 2020

Region has well developed textile industry (cotton ginning and consumption, textiles), food industry (food products and beverages), construction materials industry and flour-milling industry (see Figure 213) [107].

Figure 213: Production Capacity of Surkhandarya Region by The Sectors Of Industry in 2020 [107]

According to United Nations Development Programme (UNDP) [107], the volume of industrial output in Surkhandarya region reached $289 million. The biggest industry is natural gas and oil production with the 511 million USD (see Figure 213). Two of three largest coal deposits of the country are located in Surkhandarya region. These are coal strip mines Shargun and Baysun, from which high-quality coal is extracted.

There are 49 joint ventures and foreign enterprises in Angor and Termez [89][90]. Afghanistan is the leading country with the largest number of foreign companies at the district level. 32 enterprises or 65% of the total are joint ventures or foreign enterprises of Afghanistan. In addition, Russia, Turkey, Kazakhstan and China also own by 2 businesses in the area. According to the directions, 13 companies are engaged in fruit and vegetable growing, production of building materials - 10 companies, retail

and 6 companies are engaged in wholesale trade in food and clothing. Similarly, livestock related organizations are also owned by 6 international companies (see Figure 214).

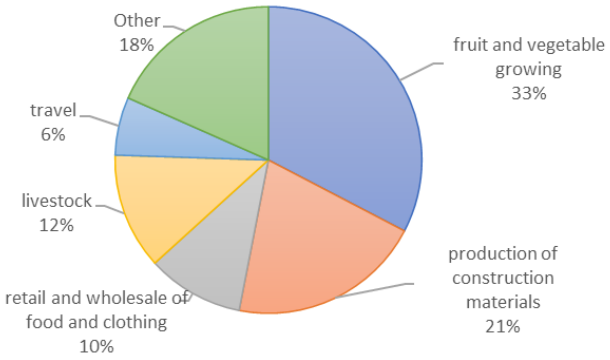


Figure 214: International Companies Functioning in Termez and Angor in 2020 according to their directions [89][90]

Consumer goods has special place in the livelihood. In general, Figure 215 illustrates the changes of consumer goods from 2010 to 2020 in Angor and Termez Districts and its comparison with the regional level [89][90]. The products made in the region have grown significantly 160.5 per capita to 1,589.7 per capita over the past decade (between 2010 and 2020).

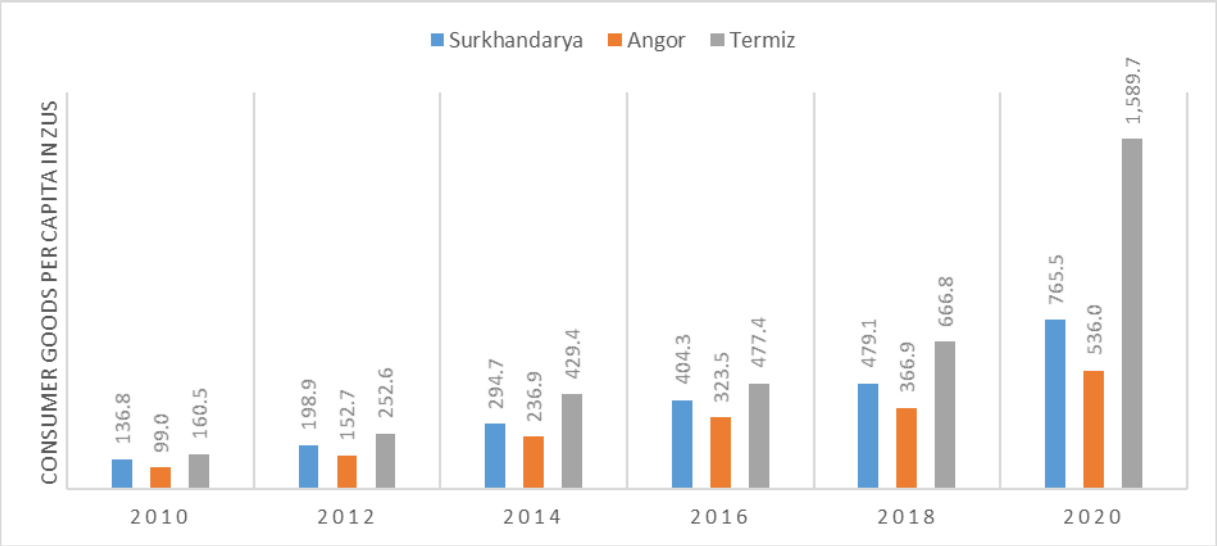


Figure 215: Consumer Goods Per Capita in Angor and Termez Districts and its Comparison With Regional Level [89][90]

16.2.7.4 Transportation and Logistics

Uzbekistan has the highest road density in Central Asia, with 41 km of roads per 100 km² area. The total size of the road network is 185,000 km, of which 42,700 km are common use public roads. Common use roads are functionally divided into international roads - 3,981 km, national roads - 14,100 km, and regional roads - 24,614 km. For the most part, Uzbekistan has achieved basic road connectivity and only a few remote regions lack all-weather road access. About 95% of the network is paved and less than 5% is gravel and earth surfaced. At the end of 2017, nearly two-thirds of the

common use roads were assessed as being in good or excellent condition. This assessment is based on biannual visual inspections, which are highly subjective and may not be based on a consistently applied metric. Much road deterioration is due to aging infrastructure, which needs both structural and safety upgrades. Lastly, Uzbekistan has 83 cars per 1,000 people in 2018 [108].

In the province level, transport infrastructure of Surkhandarya is fairly developed. Length of railways crossing the territory of the region is 372.5 km. There are more than 10 railway stations in the region. Railway route (or line) Taguzar - Boysun – Kumkurgan connects the south of Uzbekistan with the center of the country and Kazakhstan. There is the main passageway running between Termez and Tashkent. There are 2,844 km of automobile roads in the region, including international and national. There is also Termez Cargo Center is large logistical terminal, located in Termez district of the region at the close proximity to the border with Afghanistan. This terminal provides transport and logistical services, including customs checks, loading and offloading, goods storage at warehouses of the terminal, as well as processing of transit cargo for intermodal transportation (rail - truck) to and from Afghanistan highways [107].

Transportation part of two districts is going to describe the sector by analyzing public-private vehicles share, public transport provision, number of private vehicles per 1,000 population and the conditions of roads.

According to the Khokimiyat of Angor district, there are 2,149 vehicles in 2020 to serve the local population, including private vehicles and vehicles of legal entities and/or enterprises. Of these, 75% of transport is private, 25% belongs to enterprises [89]. There are 7,657 vehicles in Termez district to serve the local population. Of these, 90% of transport is private, and 10% belongs to enterprises (see Figure 216) [90].

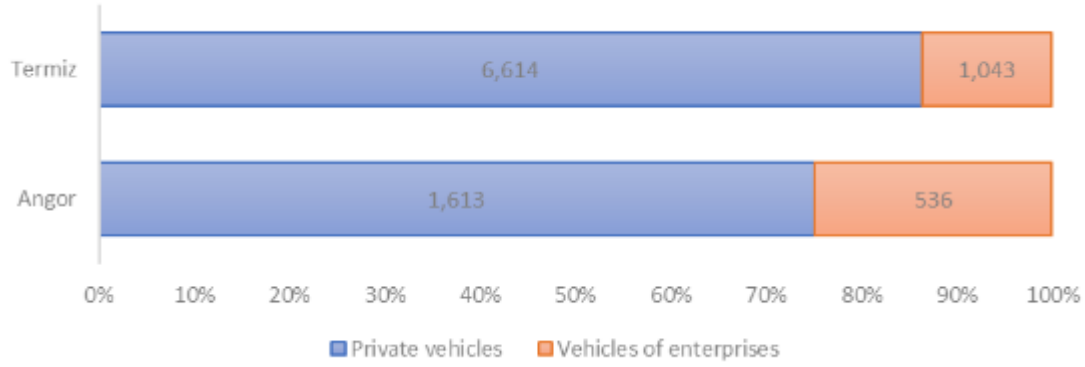


Figure 216: Private Vehicles and Vehicles of Enterprises Distribution in Termez and Angor Districts [89] [90]

Another interesting indicator is the number of people per vehicle which is used as a public transport (taxi, bus, minibus). Public transport system in both Termez and Angor districts is operated by private organizations. According to the data of the Khokimiyat of Angor region, there are 11 working enterprises with a total of 368 vehicles to serve the local population. Most of them are light vehicles (taxi services with maximum capacity of 7 passengers) in the amount of 348 units. Also, there are 6 buses and 2 minibuses. Overall, there are 366 people per unit of transport, with the calculation of the total population of the district being 134,700 people.

In Termez district, there are only 2 engaged enterprises with a total of 48 transport vehicles to serve the local population. Most of them are automobiles (taxi services) in the amount of 40 units. The number of buses is 8 units of minibuses. This complicates the maintenance of transport by most of

the population, since there are 1,650 people per unit of transport, with the calculation of the total population of the district being 79,200 thousand people.

However, number of people per private car could explain the significant difference between the ratios of public transport. In Angor per 1,000 people own 11 private cars, while in Termez, it is 83. Therefore, people in Termez depend less on public transports in their daily needs, while Angor population mostly depend on public vehicles.

Another important public asset to know about the social condition is road infrastructure. A society relies on a good road system as the basis to access jobs, health care, education and social connections. The total length of internal roads in Angor district is 604.3 km of which only 28 km of the road was repaired in 2020 and 379.6 km of the road requires further repair. In Termez district, the total length of internal roads is 716.2 km, of which only 9.5 km of the road were repaired in 2020 and 274 km of the road requires further repair. It can be concluded that in Angor 30% while in Termez 60% of internal roads require repair (see Figure 217).

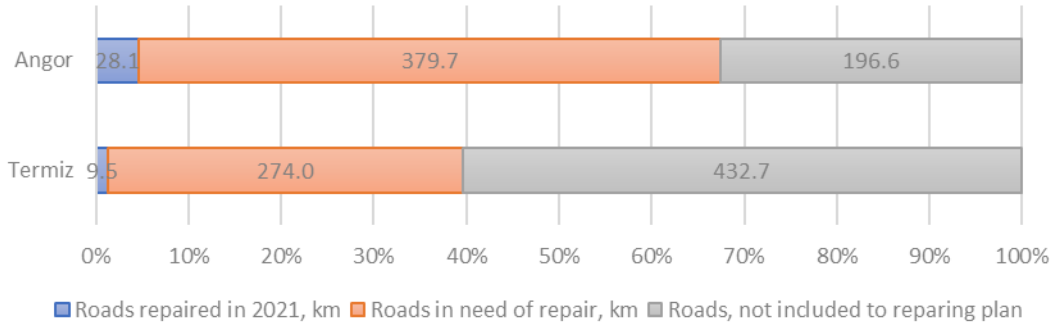


Figure 217: Total Condition of Roads In Termez and Angor Districts in 2020 [89][90]

As a conclusion, the roads which need repair prevails the roads with good conditions. Public transport is more used by Angor population than Termez. Understandably, population in Angor owns fewer private car (11: 1,000) comparing to Termez (83 : 1,000) even though its population is more than Termez for 60%.

16.2.7.5 Electricity and Energy

Electricity

Uzbekistan is capable of meeting its energy needs from its own energy resources. The total installed capacity of power plants in Uzbekistan is more than 14,000 MW.

Uzbekistan's plans for energy are aimed at increasing the share of renewable energy sources by 2030. Within 10 years, the government plans to the implement the major investment projects to increase electricity generating capacity. It includes the construction of new power units with total capacity of about 27 GW for a total of about 35 billion U.S.

In accordance with a Resolution of the President of the Republic of Uzbekistan PP-4477 of 4 October 2019 on the strategy for further development and reform of the electricity sector of the Republic of Uzbekistan, the Ministry is developing a programme for the development of generating facilities for the period up to 2030 (see Table 264). Uzbekistan generated 61.6 terawatt hours (TWh) of electricity in 2019, mostly from natural gas (>85%).

Table 264: Uzbekistan Generating Capacity Targets to 2030 [109]

Indicator	Forecast generating capacity increase (MW)					Share of electricity generation (%)	
	2019	2020	2021	2022	2023-30	2018	2030
Traditional energy	1,050	1,807	1,777	2,259.4	10,910.2	90	75
Including capacity withdrawal	-	1,060	320	740	4,280	-	-
Total renewable energy sources	24.1	119.8	504.5	542.2	7,387.6	10	25
Total	1,074.1	886.8	1,961.5	2,061.6	14,017.8	100	100
- hydropower	24.1	119.8	204.5	42.2	1,487.6	10	11.2
- solar power	-	-	300	400	4,300	-	8.8
- wind power	-	-	-	100	1,600	-	5

Energy

Uzbekistan is one of the world's largest natural gas producers, annually producing around 60 billion cubic meters (bcm) (see Figure 218). In 2019, production totaled 60.4 billion cubic meters (bcm) [78].

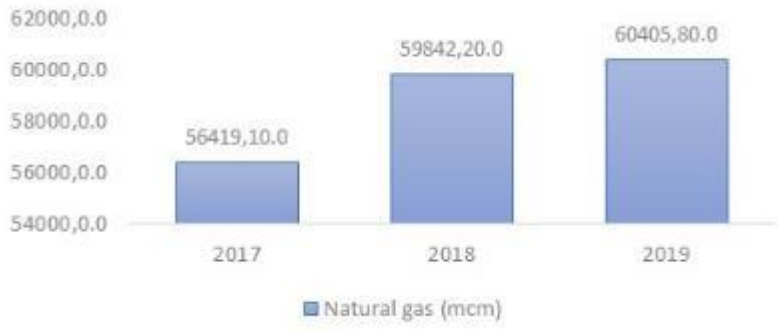


Figure 218: Natural Gas Production in Million Cubic Meter in Uzbekistan, 2017-2019 [78]

In 2019, gas condensate production amounted to 2.1 million tones (Mt) – equal to three times the conventional oil production in the same year. Conventional oil production peaked in the early 2000s and has since declined steadily [78].

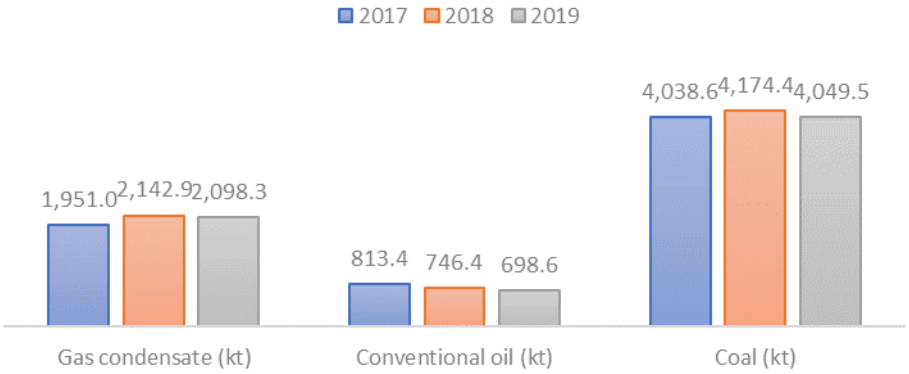


Figure 219: Uzbekistan energy production in kiloton, 2017-2019 [110]

Uzbekistan's most important export destinations for energy commodities are China, Russia and Kazakhstan. Since the early 2000s, Uzbekistan has been exporting 10-15 bcm of natural gas annually. The relevant values are as follows:15 bcm in 2018: 8 bcm to China; 4.5 bcm to Russia; 2.5 bcm to Kazakhstan; and 500-550 mcm to other Central Asian countries [110].

The following table describes supply rate of Termez and Angor districts in electricity, gas, drinking water and sewage system, in district level.

Table 265: Level of Provision of The Population With Electricity, Natural Gas And Drinking Water Supply [89][90]

	Termez	Angor
With electricity (%)	100	100
per capita electricity consumption (1 kW per day)		3-4
With natural gas (%)	100%	100%
per capita natural gas consumption (m³ per day)	1.5 m³	1.45 m³
- in summer (normally)	1 m³	0.05/0.04
- in winter (normally)	4 m³	1.6/0.9
With drinking water supply (%)	71%	11%

According to the data provided by hokimiyats, both districts are entirely supplied with electricity. However, in Angor 48% of the electric power transformers and 42% of power lines require repair. In Termez, the situation is better requiring repair of 25% and 20% of transformer and power lines respectively (see Table 266).

Table 266: Power Supply Condition in Termez and Angor [89][90]

	Termez		Angor	
	Total	**Requires repair**	**Total**	**Requires repair**
Electric Power Transformer	244	63	263	126
Power line length, km	735.2	150.1	992.92	424.3

Having 29 mahallas with total 27,062 households of Termez District, 11 of them or 6,490 households has been supplied with gas supply system [90]. However, 20,572 households of all mahallas where gas has not been supplied (72% of total households), limited number of liquefied gas cylinders have been provided. In Angor district, there are 37 mahallas with 23,344 households, out of which 2 mahallas with 1,255 households were entirely, 2 others with 1,021 were partly supplied with gas [89]. Overall, 35 mahallas or 21,068 households (90% of total households) use liquefied gas cylinders for their everyday chores including cooking, to warm the water for washing dishes or having a bath.

Table 265 has been provided by Angor and Termez Hokimiyats, and it shows that provision with gas is 100% in both Angor and Termez. Knowing the fact that has been provided in above paragraph which is also taken from the khokimats' passports, Districts with 100% meant provision with gas no matter if it is from gas supply system or liquefied gas cylinders.

Access to the drinking water, 71% of the population or 56,300 people have drinking water supply for daily use. While in Angor it is only 11% with 15,466 people while rest of the population consume water from springs, boreholes (except wells), rivers, streams and canals. Neither of the districts have sewerage supply system [89][90]

16.2.8 Income sources

According to data of State statistics in 2020, the gross domestic product (hereinafter - GDP) of the Republic of Uzbekistan amounted to 580,203.2 billion SOM [13]. When calculated in US dollars at the average exchange rate for the reporting period (average exchange rate for 2020 – 10,055.8 SOM), nominal GDP amounted to 57,698.5 million US dollars. In 2020, GDP per capita amounted to 16,949.1 thousand SOM (in the equivalent – 1,685.5 USD).

The gross value added of the Uzbek economy is fairly evenly divided among (a) agriculture, (b) industry, and (c) services (see Figure 220). Agriculture was dominant in the GDP since the independence of the country (see Figure 220).

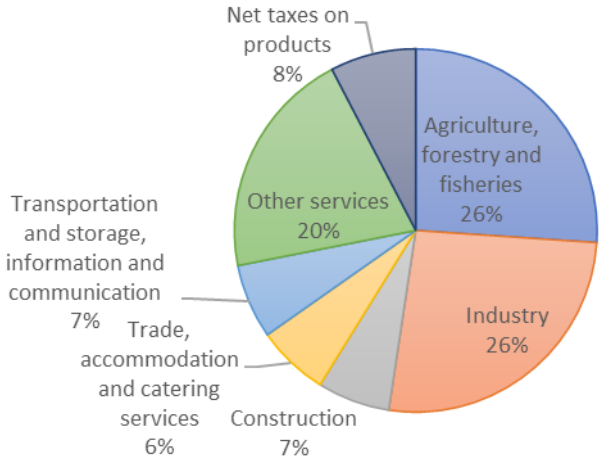


Figure 220: GDP by Sectors of Uzbekistan in 2020 [78]

There has been a structural shift in non-agricultural production, whose share of GDP was 32.4% in 2018 versus 50.0% in 1993–1995. The share of services increased from 28.1% in 1993 to 35.6% in 2018, while that of manufacturing grew from 17.1% to 26.3% over the same period (see Figure 221).

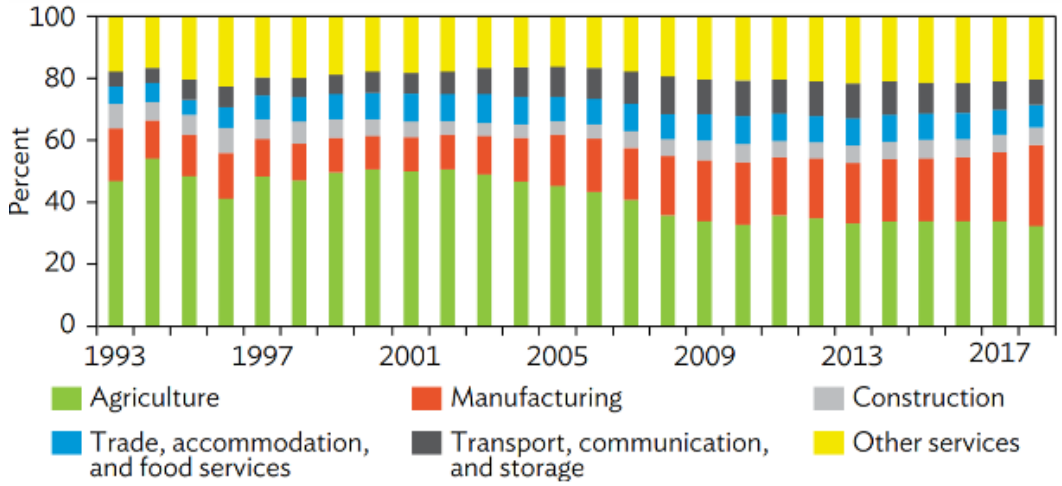


Figure 221: Asian Development Bank (ADB) Statistical Data Base System

In terms of income levels, Uzbekistan has remained in the lower-middle income group since 2001 (having briefly been classified as a low-income country during 1998–2000).

Poverty in country level in 2012 was 20% in average country level. However, it was higher than the national average in several Uzbekistan's provinces, especially in the remote and sparsely populated rural provinces including Surkhandarya, where most households are employed in agriculture, and few receive remittances.

In the province level, the gross regional product (hereinafter - GRP) of Surkhandarya amounted to 16 949.1 billion SOM in 2021 [78]. In US dollars at the average exchange rate for the reporting period (average exchange rate for 2020 – 10,055.8 SOM), nominal GDP amounted to 1,685 million US dollars. In 2020, GDP per capita amounted to 9 040,6 thousand SOM (in the equivalent – 899 USD).

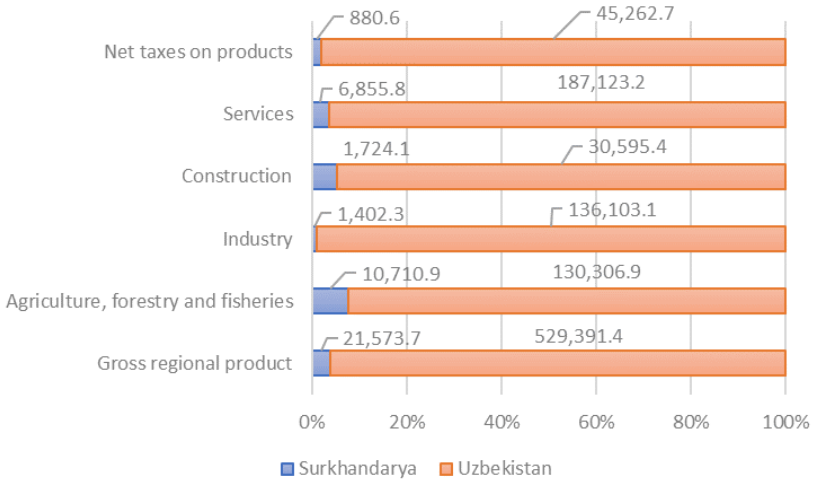


Figure 222: Share of GRP of Surkhandarya by Sectors in GDP of Uzbekistan in 2019, in billion UZS [78]

From the comparison of Figure 222 and Table 267, it can be roughly concluded that Angor and Termez together contribute to 15% of its economy. In Termez, foreign trade turnover in 2020 was 44 million US dollars, of which exports – 19.5 million US dollars, imports – 24.5 million US dollars. In Angor, foreign trade turnover in 2020 was 19.5 million US dollars, of which exports - 14.2 million US dollars, import - 5.3 million US dollars.

Table 267: Key Macroeconomic Indicators In Termez and Angor districts in 2021 [89][90]

	Angor 2020 (billion UZS)	Termez 2020 (billion UZS)
Industrial products	123.6	112.0
Consumer goods	71.5	39.1
Gross agricultural output	1,105.7	478.5
Investments in fixed assets	255.6	381.3
Construction works	187.1	258.6
Retail turnover	533	137.9
Services	257.9	198.1
Foreign trade turnover (million USD)	19.5	44
Export (million USD)	14.2	19.5
Import (million USD)	5.3	24.5

Uzbekistan's economic growth has been supported by the expansion of private sector businesses, and accelerated by government efforts to transition to a market-based economy. Such private sector development is critical for a smooth shift from state-driven to private-sector-led economic growth in which small business entities play a key role. In Termez, small business entities – 1,901 (including: 686 farms). In Angor, number of small businesses – 1,317 (including: 288 farms). Specifically, these SMEs importance in the economy of the districts could be explained in the numbers, for example, 92% of all industry products and 85% of agriculture products were produced by them in 2020 [89][90].

Table 268: SMEs Operating in Angor and Termez districts in 2020 [89][90]

Type of SME	Angor	Termez
in agriculture	393	376
in the forestry	9	
in the industry	213	265
in construction	143	228
in trade	334	398
in the service of transportation and storage	21	67
in the service of living and eating	73	126
information and communication	8	
provision of health and social services	18	
in others	281	116
Total SMEs	1,493	1,576

According to Table 268 one can draw a conclusion about the sources of income of the districts. 'Agriculture' is the dominant income sector in both districts, which is followed by sector 'services'. Summing up, Angor region is more focused on agriculture compared to Termez, while the former is less industrialized than the latter.

16.2.9 Labor Force

16.2.9.1 Labor Force Indicators

Generally, there are three key indicators of market activities. The first indicator is unemployment rate which is probably the best-known labor market measure. Moreover, this rate is useful for the underutilization of the labor market. It usually indicates the inability of economy to create the new job opportunities for those people who want to work but are not doing so, even though they are available for employment and actively seeking work. The second indicator is labor force participation which represents the relative amount of the labor resource available for the production of goods and services [111]. Another key indicator is the employment-to-population ratio. According to the International Labor Organization (ILO) the employment – to – Population ratio as proportion of a country's working-age population that is employed. A high ratio means that a large proportion of a country's population is employed, while a low ratio means that a large share of the population is not involved directly in market-related activities, because they are either unemployed or (more likely) out of the labor force altogether [112].

16.2.9.2 Unemployment rate

Uzbekistan was one of only three economies in the Europe and Central Asia (ECA) region that had a positive economic growth in 2020. Despite the global impact of the COVID-19 crisis, reforms implemented in the economy supported growth in 2020. According to the data retrieved from Ministry of Employment and Labor relations the unemployment rate in Uzbekistan remained unchanged at 10.50 percent in the first quarter of 2021 from 10.50 percent in the fourth quarter of 2020 [113]. For the same period in 2019, the unemployment rate was 9.1 percent. The total number of people who is seeking for job is 1.9 million (the unemployment rate for ages 16-30 is 20.1%, and the unemployment rate for women is 17.4%). The positive trend in unemployment during the last year occurred due to spread of COVID -19 infection and measures that the GoU took against virus.

In regard to Surkhandarya province unemployment rate was 11.1 percent in the fourth quarter of 2020 [49]. Moreover, the total number of unemployed people in the region estimated to 3,100 individuals. But this figure is slightly better in Termez district with 10.6 percent while this this rate in Angor district was 11.2 percent accordingly (see Figure 223).

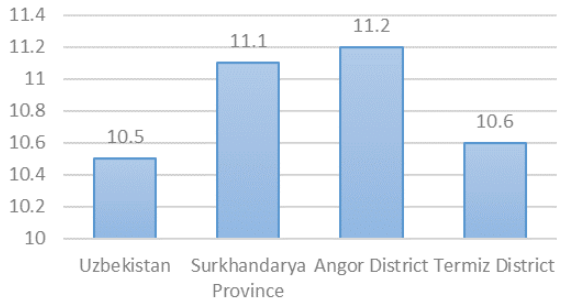


Figure 223: Unemployment Rate in Uzbekistan, Surkhandarya province and Angor, Termez districts [114][115]

16.2.9.3 Labor force participation rate

As labor force participation rate measures the number of people who actively seeking for job or those who already employed, it omits the part of population that 16 or older. For example, the employment to population ratio is depend on working age population which according to international standards all person aged 15 or older but this value differs in Uzbekistan where working age population starts from 16 aged population. This rate especially interesting to the government and investors to analyze and anticipate the potential labor force to the planned programs and projects in the field of industry, service and business. Therefore, industrialization projects tend to increase participation by creating employment opportunities in labor markets that attract people to leave household production roles or employment in the informal economy. This is particularly important to the developing countries as Uzbekistan to increase its labor participation rate.

Based on statistics from 2020, labor force participation rate in Uzbekistan was 85.5 percent. For comparison, this value for Kazakhstan was 69.2 percent while Kyrgyzstan has 53 percent [116]. However, the world average in 2020 based on 181 countries is 60.32 percent. When it comes to the province level, Surkhandarya had 70 percent while Angor and Termez districts 86 and 82 percent respectively (see Figure 224) [114] [115]. The high labor participation rate in Uzbekistan can be as a result of reform in education sector because more educated population most likely remain employed.

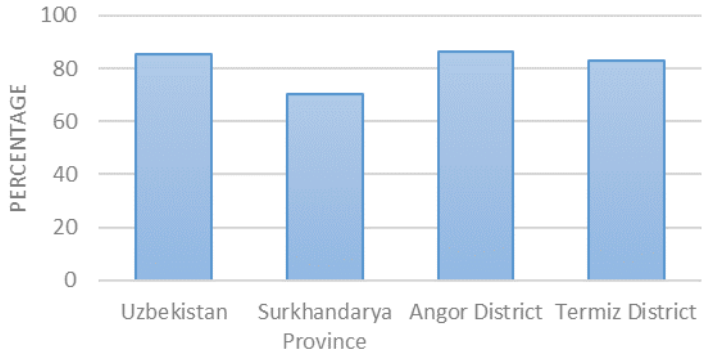


Figure 224: Labor Force Participation Rate in 2020 in Surkhandarya Province and Angor, Termez Districts [114] [115]

16.2.9.4 Employment to population ratio

The employment to population ratio or in other words the percent of population which is currently employed in Uzbekistan is accounted around 77.1 percent. Since employment to population ratio is depend on working age population which according to international standards all person aged 15 or older. However, this value differs in Uzbekistan where working age population starts from 16 aged population. Based on available statistical data, about 77 percent of working aged population is employed or 14,926,300 individuals out of 19,277,600 have a job (see Figure 225). For comparison, Iceland's country employment rate was at 83.8 percent in 2020 the highest of any OECD country [117]. Despite high employment to population ratio within country the value for Surkhandarya province was at 64.4 percent. Relatively high unemployment rate within the province has affected to the province population ratio with 1,104,100-person total and from them 122,000 individuals unemployed.

In regard to district level, the percentage of employment in Angor and in Termez in 2020 was 74.9 and 77.5, respectively. Again, the unemployment rate in relation to the working-age population is about 11 percent in Angor district and same relation for Termez is 10.5 percent.

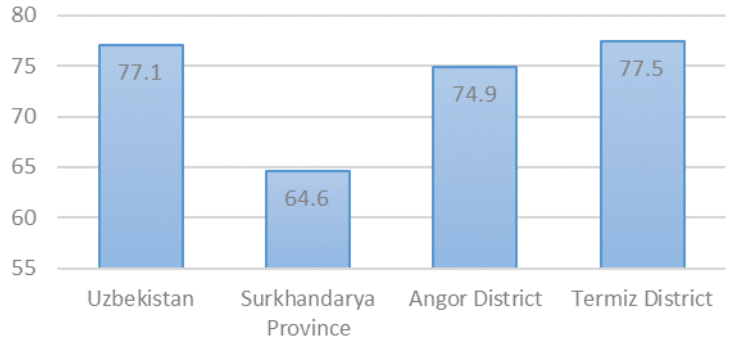


Figure 225: Employment to Population Ratio In 2020 In Surkhandarya Province and Angor, Termez Districts [114] [115]

Although, the given above figures and numbers seem positive in employment point of view but it should be noted that the reliability for those numbers and figures is the subject to the scrutiny review.

In the project districts, the unemployment rate is quite high, on average 11% of the workable population, for Angor district this figure is 11.2%. And in Termez district, the unemployment rate is 10.6%. Moreover, unemployment among women is 13.2%. It is worth to noting that an acute shortage of jobs, informal employment, low wages from one hand and bad working and labor conditions on the other hand forces rural area forces to become migrant worker in other countries.

The level of official employment is especially low among women, in Surkhandarya province only 7% of women have jobs in enterprises and organizations of the non-agricultural sector. There are also very few entrepreneurs among the employed population. The problems of high unemployment are relevant for both regions. In all areas, female unemployment prevails. Another negative feature of the labor market of these areas is the high level of the economically inactive population, especially among women. In Surkhandarya province, every fifth woman did not work and did not look for a job. Perhaps some of these women stopped looking for a job, because they lost hope of finding a job.

16.3 SITE-SPECIFIC SOCIAL BASELINE DATA

16.3.1 General Social Aspect

This chapter of the study describes the methodology of the baseline socio-economic study, including the methods of sampling, data collection, data types, research approaches used, and data collection time period.

Based on the goals and objectives of the study, the social baseline survey focused on:

- Data acquisition to assess socio-economic characteristics of the project located area and households affected by the project;
- Establishment of baseline indicators for the project of construction of the Project;
- Data acquisition to identify community's thoughts and attitudes about the Project;
- Assessment of the stakeholder engagement and information disclosure of the stakeholders about the project organization in the area;

- Analysis of the data for identification of adverse social impacts and risks for various social groups, including vulnerable groups;
- Analysis of the data to propose mitigation measures for adverse impacts and risks for various social groups, including vulnerable groups in order to avoid or reduce the impact;
- Development of grievance redress mechanism.

The study tools (questionnaires) have been developed based on the selected methods of collecting information:

- For quantitative survey technique, two questionnaires were developed: for households and for local authorities (in mahalla level). Consequently, the questionnaires were tested as a pilot study.
- For qualitative survey technique, list of questions for focus group discussions (FGD) has been developed.

16.3.1.1 Data Type and Sources

In order to conduct socio-economic assessment of the project, the primary and secondary data are used. Primary data is the data that is acquired by experts straight from sources by using different data collection methods while secondary data is the data that has already been collected by other parties that are readily available for consultants to utilize in the study. In this study, secondary data was obtained from various sources. Such data include official state statistics, district and province passports prepared by khokimyats and local authority management organizations, including mahallas. The list of secondary data collected and used included the following data:

- Size of population, households and gender distribution in three levels: province, district and mahalla (State statistics, local authorities);
- Social and public utilities infrastructure (State statistics, data from Ministries of Health, local authorities);
- Labor resources, employment rate, labor migration (State statistics).

Along with state statistical data, existing literature including journal articles, web-articles and legislative databases (lex.uz; norm.uz) were used.

Primary data is the outcome of questionnaires, stakeholder meetings and focus group discussions. There 3 questionnaires are developed to primary data collection: household questionnaire, local authority questionnaire, focus group meeting questionnaire.

Household and local authority questionnaires inquire mostly quantitative information about demography, economic conditions, educational levels, health, agriculture and stockbreeding, transportation, infrastructure and communication at the regional (districts) and local level (impact area: 0 – 10 km).

Particularly, baseline conditions of the impact area and region covers information about:

- Population structure (Population numbers, distribution, changes in years, religion, ethnicity, etc.)
- Economic structure (Economic indicators, activities, etc.)

Focus group meeting questionnaire inquire the answers to the questions about:

- Stakeholder engagement in the project;
- Disclosure of information;
- Revealing the positive/negative impacts of the project;
- Stakeholders' grievances related to the project;
- Benefits and problems of the area and the project;
- Expectations of the stakeholders from the project and their suggestions.

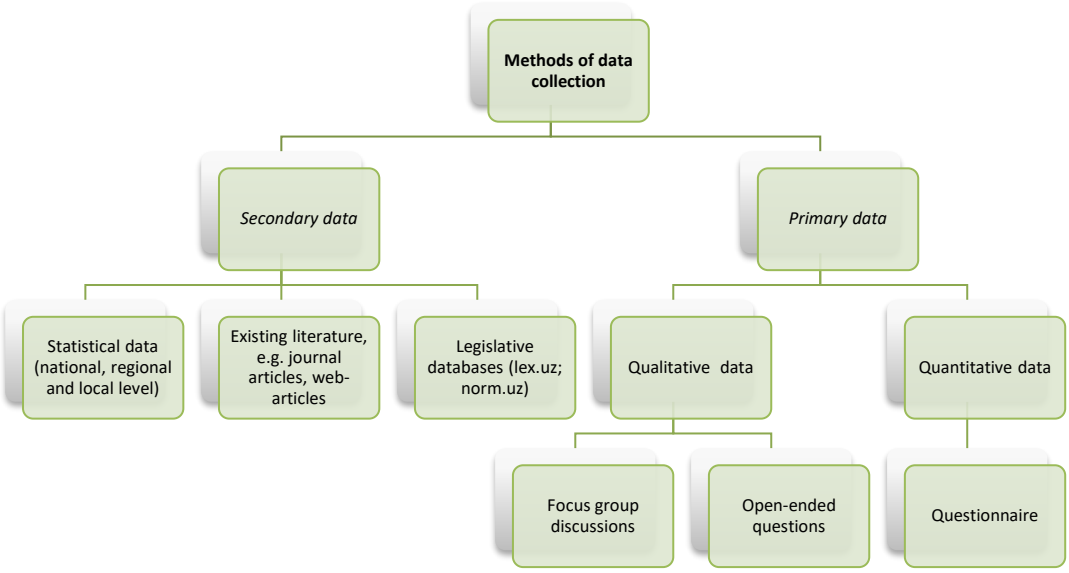


Figure 226: Data Collection Methodology of The Social Impact Assessment of The Project

16.3.1.2 Sampling

One of the methods used to create a statistically significance level Alpha (α) sample to study the socio-economic structure of large population groups is the use of the "Table of Sample Size for α=0.05" presented in the following tables and the statistical formula developed depending on this table (see Table 269, Table 270 and Equation 1).

Table 269: Table of Sample Size for α=0.05

Population	±0.03 Sampling Error (d)			±0.05 Sampling Error (d)			±0.10 Sampling Error (d)		
	p=0.5 q=0.5	p=0.8 q= 0.2	p=0.3 q=0.7	p=0.5 q=0.5	p=0.8 q= 0.2	p=0.3 q=0.7	p=0.5 q=0.5	p=0.8 q= 0.2	p=0.3 q=0.7
100	92	87	90	80	71	77	49	38	45
500	341	289	321	217	165	196	81	55	70
750	441	358	409	254	185	226	85	57	73
1,000	516	406	473	278	198	244	88	58	75
2,500	748	537	660	333	224	286	93	60	78
5,000	880	601	760	357	234	303	94	61	79
10,000	964	639	823	370	240	313	95	61	80
25,000	1,023	665	865	378	244	319	96	61	80

Population	±0.03 Sampling Error (d)			±0.05 Sampling Error (d)			±0.10 Sampling Error (d)		
	p=0.5 q=0.5	p=0.8 q= 0.2	p=0.3 q=0.7	p=0.5 q=0.5	p=0.8 q= 0.2	p=0.3 q=0.7	p=0.5 q=0.5	p=0.8 q= 0.2	p=0.3 q=0.7
50,000	1,045	674	881	381	245	321	96	61	81
100,000	1,056	678	888	383	245	322	96	61	81
1,000,000	1,066	682	896	384	246	323	96	61	81
100,000,000	1,067	683	896	384	245	323	96	61	81

Table 270: Definition of the Units in the Formula

Abbreviation	Definition
N	Number of individuals in the population
n	Number of individuals to be selected for sampling
p	Probability of frequency of occurrence of the case (0.5)
q	Frequency of absence of the case (1-p)
t	the theoretical value in the t table at a certain degree of freedom and the error level detected (1.96)
d	Standard error value (0.05)

Equation 1: The Formula

$$n = \frac{\mathrm{N.p.q.t^2}}{(\mathrm{N}-1).\mathrm{d^2} + \mathrm{t^2}.\mathrm{p.q}}$$

Implementation of the formula according to total population number

Equation 2: Implementation of the Formula (Total Population)

$$n = \frac{59{,}875.0.5.0.5.3.8416}{(59{,}874).0.0025 + 3.8416.0.5.0.5} = \frac{57{,}504}{145} = 397$$

According to Equation 2, questionnaire form will be applied with 397 separate people. Survey's representative ability will be 397 people. It is 0.7% of total population.

Table 271: Distribution Questionnaires in the Sampling by settlement population

	Settlements (Mahalla)	Population	% in Total Population	Results
1	Bahor	4,120	6.88	27.32
2	Dehqonbirlashuv	2,594	4.33	17.20
3	Ilgor	3,100	5.18	20.55
4	Karvon	3,708	6.19	24.59
5	Kattaqum	5,334	8.91	35.37
6	Kayran	4,712	7.87	31.24
7	Khalqobod	4,545	7.59	30.14
8	Madaniyat	2,650	4.43	17.57
9	Markaz	3,100	5.18	20.55
10	Namuna	3,414	5.70	22.64
11	Orol	4,178	6.98	27.70
12	Qoshtegirmon	3,631	6.06	24.08
13	Tallashqon	3,574	5.97	23.70

	Settlements (Mahalla)	Population	% in Total Population	Results
14	Uchkizil	4,582	7.65	30.38
15	Zang Gilambop	2,173	3.63	14.41
16	Zartepa	4,460	7.45	29.57
	TOTAL	**59,875**	**100.00**	**397.00**

Implementation according to total household number

Equation 3: Implementation of the Formula (Household Number)

$$n = \frac{10{,}477.0.5.0.5.3.8416}{(10{,}476).\,0.0025 + 3.8416.0.5.0.5} = \frac{10{,}062}{26} = 385$$

According to Equation 3, household questionnaire form should be applied **385** separate household. Survey's representative ability will be approximately 2,223 people, which is 3.71% of the total population due to the average household size is 5.77.

Table 272: Distribution Household Questionnaires in the Sampling by settlement Household Number

	Settlements (Mahalla)	Household	% in Total Household	Results	Average Representative Ability
1	Bahor	680	6.49	24.99	144.18
2	Dehqonbirlashuv	478	4.56	17.57	101.35
3	Ilgor	645	6.16	23.70	136.76
4	Karvon	623	5.95	22.89	132.09
5	Kattaqum	1,004	9.58	36.89	212.88
6	Kayran	792	7.56	29.10	167.93
7	Khalqobod	804	7.67	29.54	170.47
8	Madaniyat	510	4.87	18.74	108.13
9	Markaz	485	4.63	17.82	102.83
10	Namuna	556	5.31	20.43	117.89
11	Orol	725	6.92	26.64	153.72
12	Qoshtegirmon	631	6.02	23.19	133.79
13	Tallashqon	538	5.14	19.77	114.07
14	Uchkizil	894	8.53	32.85	189.55
15	Zang Gilambop	342	3.26	12.57	72.51
16	Zartepa	770	7.35	28.30	163.26
	TOTAL	**10,477**	**100.00**	**385.00**	**2,221.41**

During the social baseline study, the total number of household survey is realized is 410.

16.3.2 Household survey

The household survey was conducted on mahalla level which was located within 0-10 km Project impact area. The residents of the area are the stakeholders of the Project as Project Affected Persons (PAPs). There were 16 mahallas and 4 of them were affiliated to Termez and the remaining parts were in Angor District.

For effective implementation of the household questionnaire, 1 interviewer training and 1 pilot study were conducted before starting the household survey. In accordance with the general condition of the interviewers and pilot survey results, a household questionnaire was revised, once more.

The Household survey started on the 29th of July and ended on the 1th of August, 2022. During the household survey, 7 interviewers and 1 field coordinator worked in the field. The average age of the household survey team is 29.5 and the gender distribution is equal between males and females. The total number of completed household questionnaires is 410 whereas 115 of them have been completed within 4 mahallas of Termez district.

One of the main limitations of the household survey was taking photographs. Most of the respondents gave permission to take neither themselves nor their homes photographs.

The data which have been collected via qualitative and quantitative research techniques, are used to describe current socio economic conditions of the project impact area. Besides, additional statistical data provided by the interviewed governmental institutions are also presented to establish a local aspect for the Project Social Impact Area (PSIA). Nevertheless, core analysis, comparations and assessments are strictly dependent to the household survey results. Following significant terms are explained for the evaluation.

Survey: It covers quantitative and qualitative researches of the study. Main tool of the Social Impact Assessment.

PSIA: Represents the universe which cover mahallas in 10km radius area in which 2,073 people are represented via 410 households.

Household: Core aspect of the survey.

Household head: The key informant of the household. He/she can be also identified as "respondent" who submits both quantitative and qualitative data of the households.

Household member: Individuals whose quantitative information have been submitted by household head and/or respondent. Total number of the members constitute total population of PSIA.

Population: There are 410 completed Household Questionnaires. According to the result of the survey, total population, is 2,073. Therefore, universe of the PSIA is constituted 2,073 people who live within 410 households.

Region: Surkhandarya

District: Angor and Termiz.

Mahalla: The smallest unit of the PSIA. Number of the mahallas surveyed is 16 and 12 of them are located in Angor and (Bahor, Dehqonbirlashuv, Ilgor, Karvon, Kattakum, Kayran, Madaniyat, Markaz, Qoshtegirmon, Tallashqon, Zang Gilambop and Zartepa) and whereas 4 of them are located in Termiz (Khalqobod, Namuna, Orol and Uchkizil).

Mahalla Reis / Reis: Formal representative of the mahallas.

Angor District: The part of the Angor District which are located within PSIA. The area is represented by households of 12 mahallas. Population of Angor District is 1,577 people who live within 295 households.

Termiz District: The part of the Termiz District which are located within PSIA. The area is represented by household of 4 mahallas. Population of Termiz District is 496 people who live within 115 households.

Population of the Mahalla: People who live within the PSIA in Bahor, Dehqonbirlashuv, Ilgor, Karvon, Kattakum, Kayran, Madaniyat, Markaz, Qoshtegirmon, Tallashqon, Zang Gilambop, Zartepa, Khalqobod, Namuna, Orol and Uchkizil.

Age: Age groups. 0-14 years (children), 15-24 years (early working age), 25-54 years (prime working age), 55-64 years (mature working age), 65 years and over (elderly), which is dedicated by OECD approach.

Gender: The generic name of the biologic sex of people identified as male and female.

16.3.2.1 Population

The population is 2,073 and the most populated mahallas are Uchkizil, Kayran and Kattakum, respectively. In addition, Uchkizil and Kattakum are the nearest settlements to the Project Area (see Table 273).

Table 273: Distribution of Population by Mahallas

No	Mahallas	Angor	Termiz
1	Bahor	112	
2	Dehqonbirlashuv	128	
3	Ilgor	124	
4	Karvon	109	
5	Kattakum	177	
6	Kayran	185	
7	Madaniyat	109	
8	Markaz	83	
9	Qoshtegirmon	143	
10	Tallashqon	99	
11	Zang Gilambop	75	
12	Zartepa	120	
13	Khalqobod		155
14	Namuna		113
15	Orol		153
16	Uchkizil		188
Total		**1,577**	**496**

Most of the households are in 4 and 5 member-sizes which is similar in both districts and mahallas (see Table 274).

Table 274: Distribution of Household Size by Mahallas

		Household Size													
	Mahallas	1	2	3	4	5	6	7	8	9	10	12	13	15	Total
1	Bahor	0	0	7	7	5	4	2	0	0	0	0	0	0	25
2	Dehqonbirlashuv	0	0	0	5	5	7	3	0	0	2	0	0	0	22
3	Ilgor	0	1	3	7	7	2	4	0	0	1	0	0	0	25
4	Karvon	0	1	4	7	4	5	1	0	0	1	0	0	0	23

		Household Size													
5	Kattakum	3	2	4	10	4	7	8	0	0	0	0	0	0	38
6	Kayran	0	2	4	5	8	3	1	2	2	4	0	0	1	32
7	Madaniyat	0	2	2	2	8	3	1	2	0	1	0	0	0	21
8	Markaz	0	0	3	9	5	1	1	0	0	0	0	0	0	19
9	Qoshtegirmon	1	0	3	7	6	3	4	0	1	0	1	0	1	27
10	Tallashqon	0	2	4	2	8	2	1	2	0	0	0	0	0	21
11	Zang Gilambop	0	1	1	2	7	1	3	0	0	0	0	0	0	15
12	Zartepa	1	2	2	11	5	5	0	0	0	0	0	1	0	27
Angor district sub total		5	13	37	74	72	43	29	6	3	9	1	1	2	295
13	Khalqobod	0	0	5	8	4	7	3	2	1	0	0	0	0	30
14	Namuna	0	0	5	2	4	6	1	1	1	1	0	0	0	21
15	Orol	0	1	3	8	9	2	3	4	0	0	0	0	0	30
16	Uchkizil	1	2	5	3	8	2	5	5	1	1	0	1	0	34
Termiz district sub total		1	3	18	21	25	17	12	12	3	2	0	1	0	115
	Total	6	16	55	95	97	60	41	18	6	11	1	2	2	410

Average household sizes in PSIA, Angor and Termiz are 5.06, 4.96 and 5.30, respectively (see Table 275).

Table 275: Distribution of Average Household Sizes by Mahallas

	Mahallas	Number of household	Number of household members	Average Household Size
1	Bahor	25	112	4.48
2	Dehqonbirlashuv	22	128	5.82
3	Ilgor	25	124	4.96
4	Karvon	23	109	4.74
5	Kattakum	38	177	4.66
6	Kayran	32	185	5.78
7	Madaniyat	21	109	5.19
8	Markaz	19	83	4.37
9	Qoshtegirmon	27	143	5.30
10	Tallashqon	21	99	4.71
11	Zang Gilambop	15	75	5.00
12	Zartepa	27	120	4.44
Angor district sub total		295	1,464	4.96
13	Khalqobod	30	155	5.17
14	Namuna	21	113	5.38
15	Orol	30	153	5.10
16	Uchkizil	34	188	5.53
Termiz district sub total		115	609	5.30
	Total	410	2,073	5.06

According to the distribution of gender data, female and male population is kindly similar between each other. This condition is nearly valid in each of mahalla. Moreover, in some mahallas gender distribution is equal to one another (e.g., Dehqonbirlashuv). It can be easily said that the population number is shared by female and male by half and half. Therefore, the differences (or inequalities) that

can be seen between female and male (e.g. participation, representation, etc.), can be interpreted as gender roles (see Table 276).

Table 276: Gender Distribution by Mahallas

		Gender					
	Mahallas	Male	%	Female	%	Missing value	Total
1	Bahor	61	54.46	51	45.54		112
2	Dehqonbirlashuv	64	50.00	64	50.00		128
3	Ilgor	63	50.81	61	49.19		124
4	Karvon	55	50.46	54	49.54		109
5	Kattakum	84	47.46	93	52.54		177
6	Kayran	97	52.43	88	47.57		185
7	Madaniyat	54	49.54	55	50.46		109
8	Markaz	43	51.81	37	44.58	3	83
9	Qoshtegirmon	72	50.35	70	48.95	1	143
10	Tallashqon	50	50.51	49	49.49		99
11	Zang Gilambop	40	53.33	35	46.67		75
12	Zartepa	65	54.17	55	45.83		120
Angor district sub total		748	51.09	712	48.63	4	1,464
13	Khalqobod	78	50.32	77	49.68		155
14	Namuna	62	54.87	51	45.13		113
15	Orol	76	49.67	76	49.67	1	153
16	Uchkizil	92	48.94	96	51.06		188
Termiz district sub total		308	50.57	300	49.26	1	609
	Total	1,056	50.94	1,012	48.82	5	2,073

* The Missing Values in gender data were shared only once in this table. In subsequent analyzes, the Missing Values in gender data will not be processed.

For instance, "gender of household head" data has a capacity to illustrate this kind of gender roles. In a sense, demographical profile of the household head (or respondent) is important to understand how the household have been represented. 92.68% of 410 the respondents are males. This finding is similar both in Angor and Termiz. In addition, there is no significant differences between mahallas. According to these comparison, it can be assessed that PSIA is almost completely representing by males (see Table 277).

Another example on this issue, nearly half of the respondents are in 25-54 age groups. The majority of the female respondents (40%) are in 55-64 age group. On the contrast, over-half of the male respondents are in 25-54 age group. In short, age and gender distribution of respondents is not similar between gender. Consequently, the share of prime working age female is petite in PSIA in comparison with males in the same condition (see Table 280).

Table 277: Gender Distribution of the Household Heads

		Gender		
	Mahallas	**Male**	**Female**	**Total**
1	Bahor	24	1	25
2	Dehqonbirlashuv	19	3	22
3	Ilgor	23	2	25

		Gender		
	Mahallas	**Male**	**Female**	**Total**
4	Karvon	21	2	23
5	Kattakum	37	1	38
6	Kayran	32	0	32
7	Madaniyat	19	2	21
8	Markaz	18	1	19
9	Qoshtegirmon	26	1	27
10	Tallashqon	19	2	21
11	Zang Gilambop	14	1	15
12	Zartepa	24	3	27
Angor district sub total		276	19	295
% in District		93.56	6.44	100.00
13	Khalqobod	27	3	30
14	Namuna	19	2	21
15	Orol	28	2	30
16	Uchkizil	30	4	34
Termiz district sub total		104	11	115
% in District		90.43	9.57	100.00
Total		380	30	410
% in Total		92.68	7.32	100.00

Age distribution, as one of the main topics of socio economic analysis has significant importance to analyse age-relevant issues such as employment or unemployment. Therefore, age group classification methodology has been selected on the basis of employment. In accordance with this, OECD's approach on age grouping is quoted in the next paragraph.

"Employed people are defined as those aged 15 and over who report that they have worked in gainful employment for at least one hour in the previous week or who had a job but were absent from work during the reference week while having a formal job attachment. Employment rates are shown for four age groups: people aged 15-64 (the working age population): people aged 15 to 24 (those just entering the labour market following education); people aged 25 to 54 (those in their prime working lives); people aged 55 to 64 (those passing the peak of their career and approaching retirement)"

Although the Project will provide employment for over 18 age, the OECD approach can be used to analyse PSIA. Survey has already focused on these age groups and the findings will be presented in Table 278 and in Figure 227. According to the results, as the most populated age group 25-54 has similar proportion for each of mahalla.

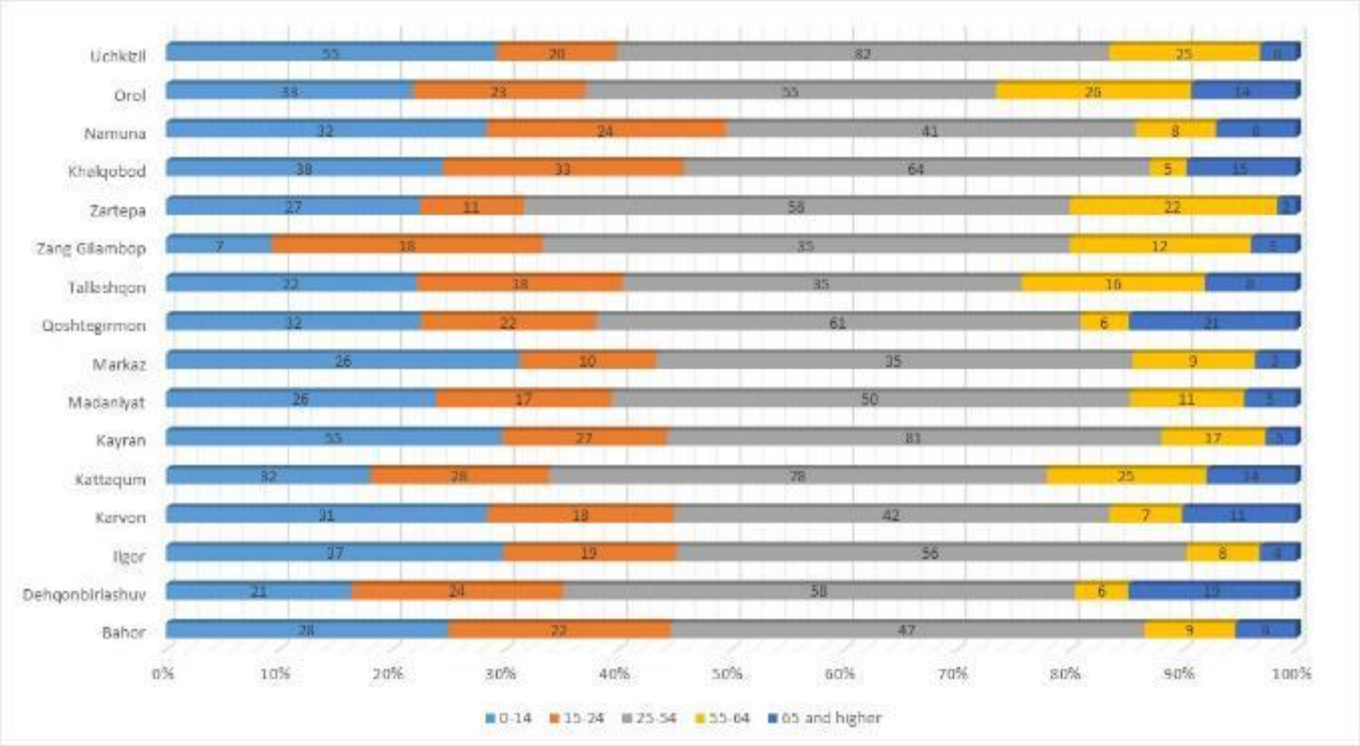


Figure 227: Age Distribution by Mahallas

Table 278: Age Distribution by Mahallas

		Age Groups											
	Mahallas	0-14	%	15-24	%	25-54	%	55-64	%	65 and higher	%	Missing Value	Total
1	Bahor	28	25.00	22	19.64	47	41.96	9	8.04	6	5.36		112
2	Dehqonbirlashuv	21	16.41	24	18.75	58	45.31	6	4.69	19	14.84		128
3	Ilgor	37	29.84	19	15.32	56	45.16	8	6.45	4	3.23		124
4	Karvon	31	28.44	18	16.51	42	38.53	7	6.42	11	10.09		109
5	Kattakum	32	18.08	28	15.82	78	44.07	25	14.12	14	7.91		177
6	Kayran	55	29.73	27	14.59	81	43.78	17	9.19	5	2.70		185
7	Madaniyat	26	23.85	17	15.60	50	45.87	11	10.09	5	4.59		109
8	Markaz	26	31.33	10	12.05	35	42.17	9	10.84	3	3.61		83
9	Qoshtegirmon	32	22.38	22	15.38	61	42.66	6	4.20	21	14.69	1	143
10	Tallashqon	22	22.22	18	18.18	35	35.35	16	16.16	8	8.08		99
11	Zang Gilambop	7	9.33	18	24.00	35	46.67	12	16.00	3	4.00		75
12	Zartepa	27	22.50	11	9.17	58	48.33	22	18.33	2	1.67		120
Angor district subtotal		344	23.50	234	15.98	636	43.44	148	10.11	101	6.90	1	1,464
13	Khalqobod	38	24.52	33	21.29	64	41.29	5	3.23	15	9.68		155
14	Namuna	32	28.32	24	21.24	41	36.28	8	7.08	8	7.08		113
15	Orol	33	21.57	23	15.03	55	35.95	26	16.99	14	9.15	2	153
16	Uchkizil	55	29.26	20	10.64	82	43.62	25	13.30	6	3.19		188
Termiz district subtotal		158	25.94	100	16.42	242	39.74	64	10.51	43	7.06	2	609
Total		502	24.22	334	16.11	878	42.35	212	10.23	144	6.95	3	2,073

**The missing Values in age group data were shared only once in this table. In subsequent analyzes, the Missing Values in age group data will not be processed.*

Table 279: Gender and Age Distribution by Mahallas

		Male						Female						Total
	Mahallas	0-14	15-24	25-54	55-64	65andhigher	Total	0-14	15-24	25-54	55-64	65andhigher	Total	
1	Bahor	17	13	23	4	4	61	11	9	24	5	2	51	112
2	Dehqonbirlashuv	9	9	31	4	11	64	12	15	27	2	8	64	128
3	Ilgor	18	9	29	4	3	63	19	10	27	4	1	61	124
4	Karvon	21	4	20	3	7	55	10	14	22	4	4	54	109
5	Kattakum	7	11	40	18	8	84	25	17	38	7	6	93	177
6	Kayran	29	13	41	11	3	97	26	14	40	6	2	88	185
7	Madaniyat	11	8	25	7	3	54	15	9	25	4	2	55	109
8	Markaz	16	3	15	7	2	43	7	7	20	2	1	37	80
9	Qoshtegirmon	10	11	32	3	16	72	21	11	29	3	5	69	141
10	Tallashqon	9	11	17	9	4	50	13	7	18	7	4	49	99
11	Zang Gilambop	5	9	14	9	3	40	2	9	21	3		35	75
12	Zartepa	12	5	33	14	1	65	15	6	25	8	1	55	120
Angor district subtotal		164	106	320	93	65	748	176	128	316	55	36	711	1,459
13	Khalqobod	19	16	33	2	8	78	19	17	31	3	7	77	155
14	Namuna	19	17	18	4	4	62	13	7	23	4	4	51	113
15	Orol	11	7	32	16	9	75	21	16	23	10	5	75	150
16	Uchkizil	20	11	42	14	5	92	35	9	40	11	1	96	188
Termiz district subtotal		69	51	125	36	26	307	88	49	117	28	17	299	606
Total		233	157	445	129	91	1,055	264	177	433	83	53	1,010	2,065

**The missing Values in age group data were shared only once in this table. In subsequent analyzes, the Missing Values in age group data will not be processed.*

Table 280: Gender and Age Distribution of the Household Heads

	Male						Female				Total
	0-14	15-24	25-54	55-64	65 and higher	Total	25-54	55-64	65 and higher	Total	
Bahor	0	0	16	4	4	24	0	1	0	1	25
Dehqonbirlashuv	0	0	9	1	9	19	1	1	1	3	22
Ilgor	0	0	17	4	2	23	0	1	1	2	25
Karvon	1	0	11	2	7	21	1	1	0	2	23
Kattakum	0	2	13	15	7	37	0	1	0	1	38
Kayran	0	0	18	11	3	32	0	0	0	0	32
Madaniyat	0	0	9	7	3	19	1	0	1	2	21
Markaz	0	0	11	5	2	18	0	1	0	1	19
Qoshtegirmon	1	0	11	2	12	26	1	0	0	1	27
Tallashqon	0	2	7	7	3	19	0	1	1	2	21
Zang Gilambop	0	0	5	7	2	14	1	0	0	1	15
Zartepa	0	0	14	9	1	24	2	1	0	3	27
Angor district	2	4	141	74	55	276	7	8	4	19	295
% in District	0.72	1.45	51.09	26.81	19.93	100.00	36.84	42.11	21.05	100.00	71.95
Khalqobod	0	0	18	1	8	27	0	1	2	3	30
Namuna	0	0	12	3	4	19	0	1	1	2	21
Orol	0	0	11	9	8	28	0	0	2	2	30
Uchkizil	0	0	16	10	4	30	1	2	1	4	34
Termiz district	0	0	57	23	24	104	1	4	6	11	115
% in District	0.00	0.00	54.81	22.12	23.08	100.00	9.09	36.36	54.55	100.00	28.05
Total	2	4	198	97	79	380	8	12	10	30	410
% in Total	0.53	1.05	52.11	25.53	20.79	100.00	26.67	40.00	33.33	100.00	100.00
% in Total	0.49	0.98	48.29	23.66	19.27	92.68	1.95	2.93	2.44	7.32	

16.3.2.2 Economy

In total, there are 1,023 people with income source, who are the nearly half of population. This condition is nearly similar both in each mahalla and each district (see Figure 228 and Table 281).

Table 281: Distribution of Having Income by mahallas

		Income owner				
	Mahallas	Yes	%	No	%	Total
1	Bahor	48	42.86	64	57.14	112
2	Dehqonbirlashuv	81	63.28	47	36.72	128
3	Ilgor	53	42.74	71	57.26	124
4	Karvon	46	42.20	63	57.80	109
5	Kattakum	115	64.97	62	35.03	177
6	Kayran	76	41.08	109	58.92	185
7	Madaniyat	48	44.04	61	55.96	109
8	Markaz	39	46.99	44	53.01	83
9	Qoshtegirmon	84	58.74	59	41.26	143
10	Tallashqon	50	50.51	49	49.49	99
11	Zang Gilambop	35	46.67	40	53.33	75
12	Zartepa	68	56.67	52	43.33	120
Angor district sub total		743	50.75	721	49.25	1,464
% in District		50.75		49.25		100.00
13	Khalqobod	70	45.16	85	54.84	155
14	Namuna	49	43.36	64	56.64	113
15	Orol	82	53.59	71	46.41	153
16	Uchkizil	79	42.02	109	57.98	188
Termiz district sub total		280	45.98	329	54.02	609
% in District		45.98		54.02		100.00
Total		1,023	49.35	1,050	50.65	2,073
% in Total		49.35		50.65		100.00

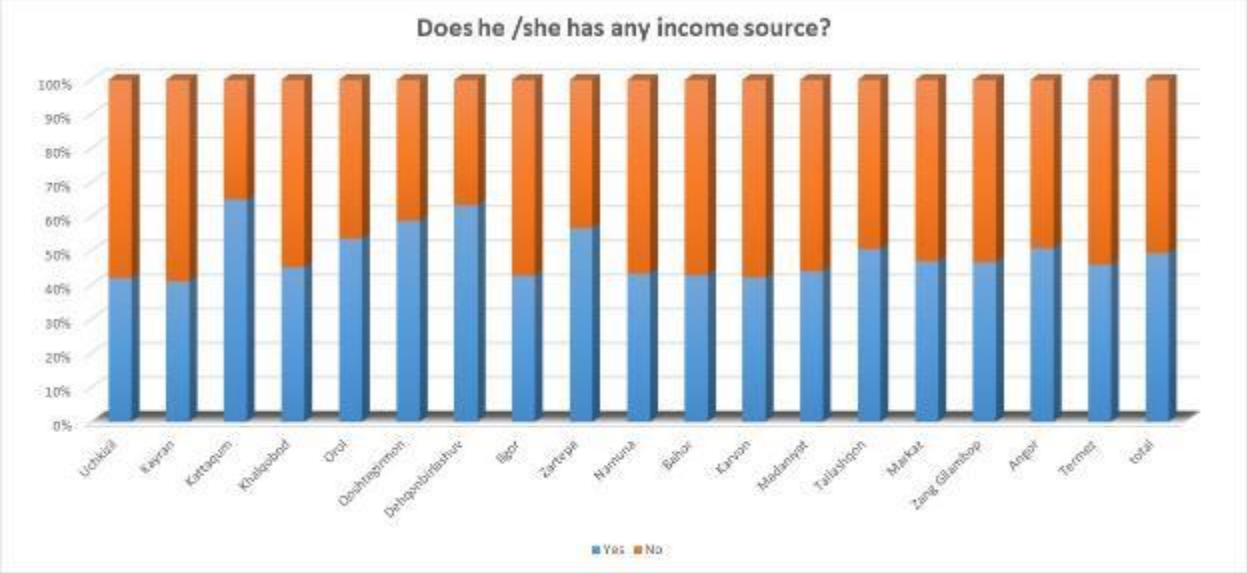


Figure 228: Having Income or Not

Percentage of income owner-males is approximately 30% of population, while the females' ratio is nearly 30%. According to these result, nearly equal distribution of population by gender is broken on having income source issue (see Table 282).

Table 282: Distribution of Having Income by Gender

Mahallas		Male			Female			Total
		Yes	No	Total	Yes	No	Total	
1	Bahor	28	33	61	20	31	51	112
2	Dehqonbirlashuv	49	15	64	32	32	64	128
3	Ilgor	28	35	63	25	36	61	124
4	Karvon	25	30	55	21	33	54	109
5	Kattakum	72	12	84	43	50	93	177
6	Kayran	46	51	97	30	58	88	185
7	Madaniyat	29	25	54	19	36	55	109
8	Markaz	25	18	43	14	23	37	80
9	Qoshtegirmon	56	16	72	28	42	70	142
10	Tallashqon	27	23	50	23	26	49	99
11	Zang Gilambop	22	18	40	13	22	35	75
12	Zartepa	42	23	65	26	29	55	120
Angor district sub total		449	299	748	294	418	712	1,460
% in District		30.75	20.48	51.23	20.14	28.63	48.77	100.00
13	Khalqobod	41	37	78	29	48	77	155
14	Namuna	25	37	62	24	27	51	113
15	Orol	53	23	76	29	47	76	152
16	Uchkizil	48	44	92	31	65	96	188
Termiz district sub total		167	141	308	113	187	300	608

Mahallas	Male			Female			Total
	Yes	No	Total	Yes	No	Total	
% in District	27.47	23.19	50.66	18.59	30.76	49.34	100.00
Total	616	440	1,056	407	605	1,012	2,068
% in Total	29.79	21.28	51.06	19.68	29.26	48.94	100.00

**Missing values have been extracted*

The relation between age groups and having income source are parallel for each mahalla and district. Alike, gender and having income source is also comparable. Members in 0-14 age group mainly have no income source except a small group with 11 people (0.5%). Similarly, a few of 15-24 age group have income sources (3%). As the age group gets older, the number of people with income increases. For instance, most of the member in 55-64 age and 65 and elderly group have income source. This condition could be related to governmental implementation for elderly's salary system for over-aged people (see Table 283 and Figure 229).

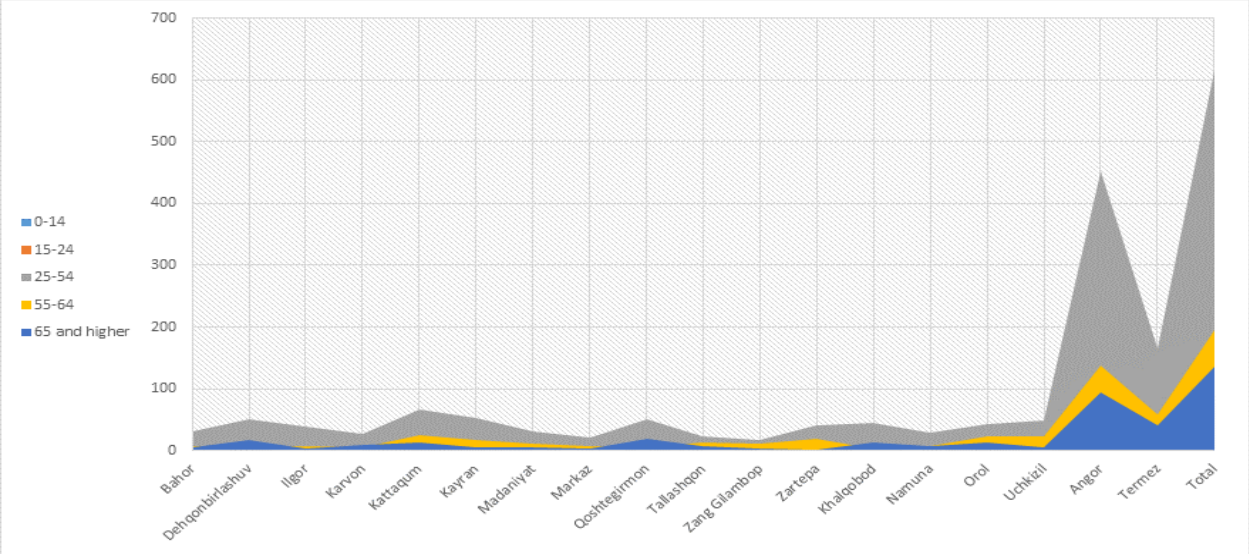


Figure 229: Income owners by Age Groups

Table 283: Distribution of Having Income by Age Groups

		0-14			15-24			25-54			55-64			65 and higher			
	Mahallas	Yes	No	Total	Yes	No	Total	Yes	No	Total	Yes	No	Total	Yes	No	Total	**Total**
1	Bahor	0	28	28	2	20	22	32	15	47	8	1	9	6	0	6	112
2	Dehqonbirlashuv	0	21	21	7	17	24	51	7	58	5	1	6	18	1	19	128
3	Ilgor	0	37	37	3	16	19	39	17	56	8	0	8	3	1	4	124
4	Karvon	1	30	31	2	16	18	27	15	42	6	1	7	10	1	11	109
5	Kattakum	0	32	32	10	18	28	66	12	78	25	0	25	14	0	14	177
6	Kayran	0	55	55	2	25	27	52	29	81	17	0	17	5	0	5	185
7	Madaniyat	0	26	26	0	17	17	32	18	50	11	0	11	5	0	5	109
8	Markaz	2	24	26	5	5	10	21	14	35	8	1	9	3	0	3	83
9	Qoshtegirmon	4	28	32	5	17	22	51	10	61	5	1	6	19	2	21	142
10	Tallashqon	0	22	22	6	12	18	23	12	35	14	2	16	7	1	8	99
11	Zang Gilambop	0	7	7	3	15	18	18	17	35	11	1	12	3	0	3	75
12	Zartepa	2	25	27	4	7	11	40	18	58	20	2	22	2	0	2	120
Angor district sub total		9	335	344	49	185	234	452	184	636	138	10	148	95	6	101	1,463
% in District		2.62	97.38	100.00	20.94	79.06	100.00	71.07	28.93	100.00	93.24	6.76	100.00	94.06	5.94	100.00	
13	Khalqobod	0	38	38	7	26	33	45	19	64	4	1	5	14	1	15	155
14	Namuna	0	32	32	4	20	24	30	11	41	7	1	8	8	0	8	113
15	Orol	2	31	33	1	22	23	42	13	55	24	2	26	13	1	14	151
16	Uchkizil	0	55	55	2	18	20	49	33	82	23	2	25	5	1	6	188
Termiz district sub total		2	156	158	14	86	100	166	76	242	58	6	64	40	3	43	607
% in District		1.27	98.73	100.00	14.00	86.00	100.00	68.60	31.40	100.00	90.63	9.38	100.00	93.02	6.98	100.00	
Total		11	491	502	63	271	334	616	260	876	196	16	212	135	9	144	2,068
% in Total		2.19	97.81	100.00	18.86	81.14	100.00	70.32	29.68	100.00	92.45	7.55	100.00	93.75	6.25	100.00	

Table 284: Distribution of Income Source

		Income Source															
	Mahallas	**Agriculture**	**%**	**Fishery**	**%**	**Livestock**	**%**	**Regular salary**	**%**	**Rental income**	**%**	**Retirement**	**%**	**Trading / Trader**	**%**	**Missing value**	**Total**
1	Bahor	21	16.15	0	0	4	14.29	12	4.10	0	0.00	8	4.60	2	3.57	1	48
2	Dehqonbirlashuv	17	13.08	0	0	3	10.71	33	11.26	7	12.28	17	9.77	4	7.14	0	81
3	Ilgor	11	8.46	0	0	2	7.14	34	11.60	0	0.00	6	3.45	0	0.00	0	53
4	Karvon	1	0.77	0	0	1	3.57	25	8.53	1	1.75	15	8.62	3	5.36	0	46
5	Kattakum	28	21.54	0	0	8	28.57	17	5.80	10	17.54	33	18.97	19	33.93	0	115
6	Kayran	8	6.15	1	100.00	0	0.00	26	8.87	8	14.04	22	12.64	11	19.64	0	76
7	Madaniyat	8	6.15	0	0	1	3.57	13	4.44	7	12.28	13	7.47	5	8.93	1	48
8	Markaz	6	4.62	0	0	1	3.57	15	5.12	6	10.53	4	2.30	6	10.71	1	39
9	Qoshtegirmon	19	14.62	0	0	6	21.43	33	11.26	6	10.53	16	9.20	4	7.14	0	84
10	Tallashqon	0	0.00	0	0	0	0.00	25	8.53	4	7.02	19	10.92	2	3.57	0	50
11	Zang Gilambop	2	1.54	0	0	0	0.00	18	6.14	7	12.28	7	4.02	0	0.00	1	35
12	Zartepa	9	6.92	0	0	2	7.14	42	14.33	1	1.75	14	8.05	0	0.00	0	68
Angor district sub total		130		1		28		293		57		174		56		4	743
% in District		17.50		0.13		3.77		39.43		7.67		23.42		7.54		0.54	
13	Khalqobod	2	11.76	0	0.00	3	27.27	37	25.87	11	73.33	13	18.57	3	14.29	1	70
14	Namuna	7	41.18	0	0.00	0	0.00	29	20.28	1	6.67	12	17.14	0	0.00	0	49
15	Orol	4	23.53	1	100.00	4	36.36	40	27.97	0	0.00	24	34.29	8	38.10	1	82
16	Uchkizil	4	23.53	0	0.00	4	36.36	37	25.87	3	20.00	21	30.00	10	47.62	0	79

		Income Source																		
	Mahallas	Agriculture	%	Fishery	%	Livestock	%	Regular salary	%	Rental income	%	Retirement	%	Trading / Trader	%	Missing value		Total		
Termiz district sub total		17		1		11		143		15		70		21		2		280		
% in District		6.07		0.36		3.93		51.07		5.36		25.00		7.50		0.71				
Total		147		2		39		436		72		244		77		6		1,023		
% in Total		14.37		0.20		3.81		42.62		7.04		23.85		7.53		0.59				

**The missing Values in income source data were shared only once in this table. In subsequent analyzes, the Missing Values in income source data will not be processed.*

Table 285: Distribution of Income Sources by Gender

		Male								Female								Total
	Mahallas	Agriculture	Fishery	Livestock	Regular salary	Rental income	Retirement	Trading / Trader	Total	Agriculture	Fishery	Livestock	Regular salary	Rental income	Retirement	Trading / Trader	Total	
1	Bahor	11	0	2	9	0	4	2	28	10	0	2	3	0	4	0	19	47
2	Dehqon birlashuv	10	0	2	20	6	9	2	49	7	0	1	13	1	8	2	32	81
3	Ilgor	6	0	1	19	0		0	28	5	0	1	15	0	4	0	25	53
4	Karvon	0	0	0	16	1	8	0	25	1	0	1	9	0	7	3	21	46
5	Kattakum	17	0	3	9	8	20	15	72	11	0	5	8	2	13	4	43	115
6	Kayran	3	0	0	15	6	14	8	46	5	1	0	11	2	8	3	30	76
7	Madaniyat	7	0	1	7	4	8	2	29	1	0	0	6	3	5	3	18	47
8	Markaz	4	0	0	11	6	2	2	25	2	0	1	4	0	2	4	13	38
9	Qoshtegirmon	12	0	2	19	5	14	4	56	7	0	4	14	1	2	0	28	84
10	Tallashqon	0	0	0	14	3	9	1	27	0	0	0	11	1	10	1	23	50

		Male								Female								Total
	Mahallas	Agriculture	Fishery	Livestock	Regular salary	Rental income	Retirement	Trading / Trader	Total	Agriculture	Fishery	Livestock	Regular salary	Rental income	Retirement	Trading / Trader	Total	
11	Zang Gilambop	1	0	0	10	5	5	0	21	1	0	0	8	2	2	0	13	34
12	Zartepa	4	0	2	24	1	11	0	42	5	0	0	18	0	3	0	26	68
Angor district sub total		75	0	13	173	45	106	36	448	55	1	15	120	12	68	20	291	739
% in District		16.74	0.00	2.90	38.62	10.04	23.66	8.04	72.96	18.90	0.34	5.15	41.24	4.12	23.37	6.87	72.21	72.66
13	Khalqobod	1	0	2	18	10	7	3	41	1	0	1	19	1	6	0	28	69
14	Namuna	4	0	0	16	0	5	0	25	3	0	0	13	1	7	0	24	49
15	Orol	3	1	1	24	0	16	7	52	1	0	3	16	0	8	1	29	81
16	Uchkizil	3	0	3	22	2	13	5	48	1	0	1	15	1	8	5	31	79
Termiz district sub total		11	1	6	80	12	41	15	166	6	0	5	63	3	29	6	112	278
% in District		6.63	0.60	3.61	48.19	7.23	24.70	9.04	27.04	5.36	0.00	4.46	56.25	2.68	25.89	5.36	27.79	27.34
Total		86	1	19	253	57	147	51	614	61	1	20	183	15	97	26	403	1,017
% in Total		14.01	0.16	3.09	41.21	9.28	23.94	8.31		15.14	0.25	4.96	45.41	3.72	24.07	6.45		

**Missing values have been extracted*

Primary income sources and their distribution through mahalla have no significant differences For the income owners (1,023 people), main primary income sources are regular salaries (43%), retirement (24%) and agriculture (15%). The reason for the prevalence of regular salary and retirement can be related to governmental implementation for elderlies, too (see Table 284). This distribution is also convenient through gender. For instance, distribution of most common primary income sources through male and female almost same (see Table 285).

The other primary income sources are limited with trading (8%), rental incomes (7%), livestock (4%) and fishery (0.2%). Actually, income sources have no diversity. For example, only 2 people (1 male in Orol and 1 female in Kayran) engaged in fishery for gathering income (see Table 284 and Table 285).

In addition to the primary income sources, some members have also additional or secondary income source. As an example, most common secondary income sources are agriculture, livestock and trading. Commonly, agriculture is most preferred secondary income source by the owners of regular salary, retirement and rental income. As a result, agriculture has a clear importance as both primary and secondary income source. Such that some people engaged in agriculture for primary income source, they prefer additional agricultural activities for secondary income source (see Table 286).

Table 286: Distribution of Secondary Income Sources by Primary Income Sources

	Yes, He / She has an additional income source							No		Total
	Agriculture	Fishery	Livestock	Rental income	Trading / Trader	Total	%	Total	%	
Agriculture	37	0	19	0	1	57	16.15	90	13.55	147
Fishery	0	0	0	0	0	0	0.00	2	0.30	2
Livestock	6	0	5	0	0	11	3.12	28	4.22	39
Regular salary	91	2	39	0	3	135	38.24	301	45.33	436
Rental income	22	0	3	0	0	25	7.08	47	7.08	72
Retirement	80	0	23	1	1	105	29.75	139	20.93	244
Trading / Trader	13	1	6	0	0	20	5.67	57	8.58	77
Total	249	3	95	1	5	353	34.71	664	65.29	1,017

** Missing values have been extracted.*

353 secondary income owners are mainly males and they mostly engaged in agriculture. Likewise, females prefer agricultural activities as secondary income source. In addition, females have tendency to get additional income through livestock activities (see Table 287).

Table 287: Distribution of Secondary Income Sources by Gender

Additional Income Source	Female	%	Male	%	Total	%
Agriculture	56	50.5	193	79.8	249	70.54
Fishery	0	0.0	3	1.2	3	0.85
Livestock	53	47.7	42	17.4	95	26.91
Rental income	1	0.9	0	0.0	1	0.28
Trading / Trader	1	0.9	4	1.7	5	1.42
Total	111	31.44	242	68.56	353	

16.3.2.3 Education

General education level is mostly in secondary and secondary special education areas. Almost half of the population situate only in one are as secondary education (see Table 288 and Figure 230)

Table 288: General Educational Level

Mahallas	Illiterate	Not in school age	Preschool education	Primary education	Secondary education	Secondary special education	Basic higher education	Academic higher education (Master's, Postgraduate, Doctoral)	Total
Bahor			10	9	25	61	7		112
Dehqonbirlashuv		4	11	8	20	73	12		128
Ilgor		5	13	15	14	48	29		124
Karvon		8	8	11	18	45	19		109
Kattakum	1	8	19	12	33	90	14		177
Kayran		10	26	14	24	94	17		185
Madaniyat		2	9	10	22	51	12	3	109
Markaz		7	15	6	10	33	12		83
Qoshtegirmon		1	20	16	19	72	14	1	143
Tallashqon		5	9	11	16	49	8	1	99
Zang Gilambop	2	2	3	6	2	52	8		75
Zartepa		6	11	8	5	63	27		120
Angor district	3	58	154	126	208	731	179	5	1,464
Khalqobod		12	13	14	29	77	10		155
Namuna		9	14	12	13	36	29		113
Orol	2	8	9	18	20	68	28		153
Uchkizil	1	9	31	12	21	90	22	2	188
Termiz district	3	38	67	56	83	271	89	2	609
Total	6	96	221	182	291	1002	268	7	2,073
%	0.29	4.63	10.66	8.78	14.04	48.34	12.93	0.34	100.00

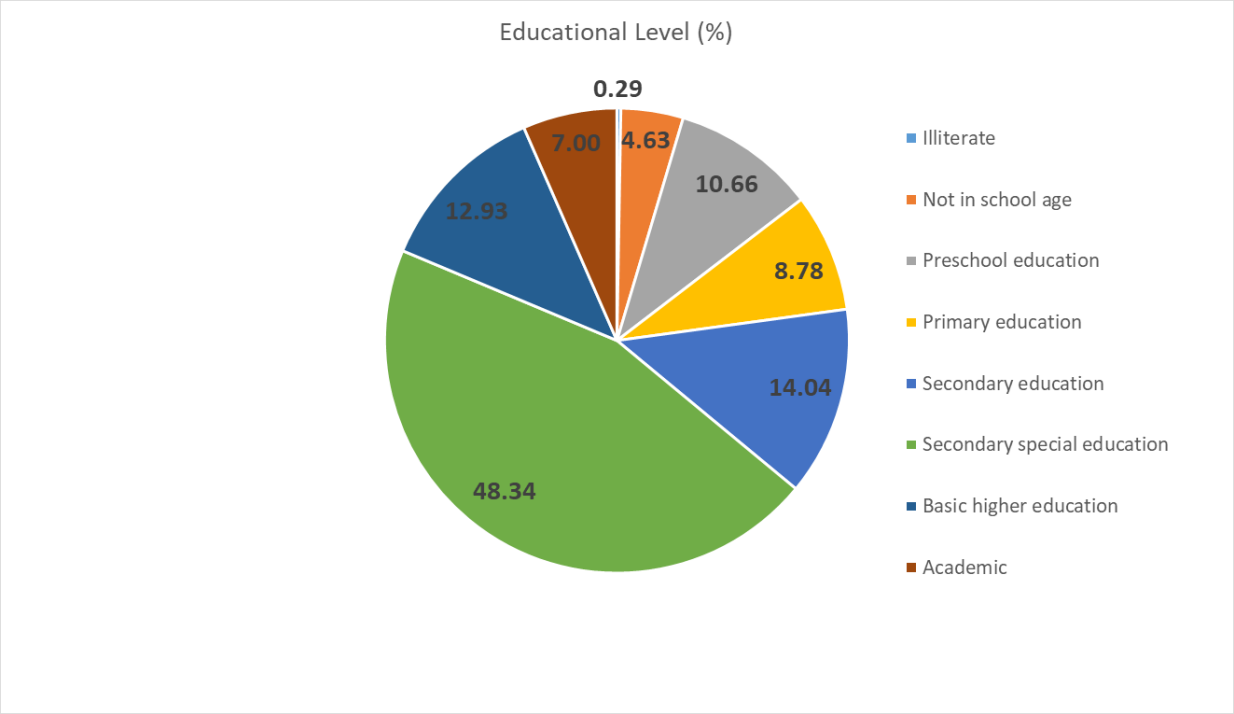


Figure 230: General Educational Level

In current condition 29% of population is student in different educational level such as preschool to basic higher education. Most of the students are enrolled in preschool and primary education. This can be related to mandatory condition of primer education (see Table 289).

Table 289: Current Educational Level of the Students

	Not student	%	Students						%	Grand Total
			Preschool education	Primary education	Secondary education	Secondary special education	Basic higher education	Total number of students		
Bahor	71	63	10	9	15	5	2	41	37	112
Dehqonbirlashuv	97	76	10	5	12	4		31	24	128
Ilgor	80	65	13	15	12	1	3	44	35	124
Karvon	77	71	8	11	12	1		32	29	109
Kattakum	135	76	18	12	9	3		42	24	177
Kayran	122	66	23	17	18	5		63	34	185
Madaniyat	71	65	8	10	15	4	1	38	35	109
Markaz	54	65	14	6	5	2	2	29	35	83
Qoshtegirmon	94	66	20	15	10	3	1	49	34	143
Tallashqon	79	80	9	7	1		3	20	20	99
Zang Gilambop	69	92	3	2		1		6	8	75
Zartepa	93	78	11	8	5	1	2	27	23	120
Angor district	1,042	71	147	117	114	30	14	422	29	1,464

	Not student	%	Students						%	Grand Total
			Preschool education	Primary education	Secondary education	Secondary special education	Basic higher education	Total number of students		
Khalqobod	106	68	13	13	18	2	3	49	32	155
Namuna	74	65	14	10	6	3	6	39	35	113
Orol	112	73	8	18	9	6		41	27	153
Uchkizil	129	69	30	11	16	2		59	31	188
Termiz district	421	69	65	52	49	13	9	188	31	609
Grand Total	1,463	71	212	169	163	43	23	610	29	2,073
			34.75	27.70	26.72	7.05	3.77	100.00		

16.3.2.4 Health

In current condition, 8% of population have chronic diseases. General distribution of chronic disease owner is similar to each other in mahallas (see Table 290).

Table 290: Distribution of Chronic Disease Owner

		Chronic Disease				
	Mahallas	Yes	%	No	%	Grand Total
1	Bahor	2	1.79	110	98.21	112
2	Dehqonbirlashuv	8	6.25	120	93.75	128
3	Ilgor	10	8.06	114	91.94	124
4	Karvon	15	13.76	94	86.24	109
5	Kattakum	36	20.34	141	79.66	177
6	Kayran	5	2.70	180	97.30	185
7	Madaniyat	4	3.67	105	96.33	109
8	Markaz	2	2.41	81	97.59	83
9	Qoshtegirmon	9	6.29	134	93.71	143
10	Tallashqon	28	28.28	71	71.72	99
11	Zang Gilambop	3	4.00	72	96.00	75
12	Zartepa	1	0.83	119	99.17	120
Angor district sub total		123	72.78	1,341	70.43	1,464
13	Khalqobod	19	12.26	136	87.74	155
14	Namuna	21	18.58	92	81.42	113
15	Orol	5	3.27	148	96.73	153
16	Uchkizil	1	0.53	187	99.47	188
Termiz district sub total		46	27.22	563	29.57	609
Grand Total		169	8.15	1,904	91.85	2,073

Most common seen chronic disease is blood pressure. Some member has more than one chronic disease and blood pressure emphasized as also secondary, even tertiary chronic disease by chronic disease owners (see Table 291 and Table 292).

Table 291: Distribution of Chronic Disease by Mahalla

Mahallas	Age-related diseases	Allergic diseases	Blood pressure	Bone diseases	Cancer	Diabetes	Diabetes	Gallbladder diseases	Heart diseases	Hormonal disorders	Kidney disease	Lung diseases	Neurological diseases	Stomach diseases	Grand Total
Bahor			1	1											2
Dehqonbirlashuv			5			1					1	1			8
Ilgor			5			1		1			2			1	10
Karvon			11			1					3				15
Kattakum	1	2	8	2	1	4	1		5	3	2	6	1		36
Kayran			1		1	2					1				5
Madaniyat			4												4
Markaz			1									1			2
Qoshtegirmon	1		3			3			2						9
Tallashqon			21	1					2		1	2		1	28
Zang Gilambop		1	2												3
Zartepa												1			1
Angor district sub total	2	3	62	4	2	12	1	1	9	3	10	11	1	2	123
% in District	2	2	50	3	2	10	1	1	7	2	8	9	1	2	100
Khalqobod			10	2					2	1	1	1	1	1	19
Namuna	3	3	10	1		3			1						21
Orol			3	1					1						5
Uchkizil											1				1
Termiz district sub total	3	3	23	4		3			4	1	2	1	1	1	46
% in District	6.5	6.5	50.0	8.7	0.0	6.5	0.0	0.0	8.7	2.2	4.3	2.2	2.2	2.2	100.0
Grand Total	5	6	85	8	2	15	1	1	13	4	12	12	2	3	169
% in Total	3.0	3.6	50.3	4.7	1.2	8.9	0.6	0.6	7.7	2.4	7.1	7.1	1.2	1.8	100.0

Table 292: Distribution of Secondary and Tertiary Chronic Disease

	Secondary Chronic Disease						Tertiary Chronic Disease	
Primary Chronic Disease	Blood pressure	Diabetes	Gallbladder diseases	Hormonal disorders	Kidney disease	Lung diseases	Blood pressure	Total
Age-related diseases	2	1						3
Allergic diseases	1	1						2
Blood pressure		3	1					4
Bone diseases	1	1						2
Cancer								0
Diabetes			1					1
Gallbladder diseases								0
Heart diseases	4			1	1	1	2	9

	Secondary Chronic Disease						Tertiary Chronic Disease	
Primary Chronic Disease	**Blood pressure**	**Diabetes**	**Gallbladder diseases**	**Hormonal disorders**	**Kidney disease**	**Lung diseases**	**Blood pressure**	**Total**
Hormonal disorders								0
Kidney disease	1							1
Lung diseases	1	1						2
Neurological diseases		1						1
Stomach diseases	1							1
Grand Total	11	8	2	1	1	1	2	26

Disability status of population is one of the most significant indicator to determine vulnerability condition. In accordance with this approach disability of people will be examined by mahalla and disability types. According to finding of survey 1.8% of population (38 people within 2,073 persons) have disabilities. In this case some mahallas in Angor (e.g. Kattakum and Qoshtegirmon) with some mahallas in Termiz (e.g. Khalqobod and Orol) can be sensitive in future (see Table 293).

Table 293: General Disability Status

	Mahallas	**Yes**	**%**	**No**	**%**	**Grand Total**	**%**
1	Bahor	0	0.0	112	7.8	112	7.7
2	Dehqonbirlashuv	1	4.2	127	8.8	128	8.7
3	Ilgor	1	4.2	123	8.5	124	8.5
4	Karvon	3	12.5	106	7.4	109	7.4
5	Kattakum	5	20.8	172	11.9	177	12.1
6	Kayran	3	12.5	182	12.6	185	12.6
7	Madaniyat	1	4.2	108	7.5	109	7.4
8	Markaz	0	0.0	83	5.8	83	5.7
9	Qoshtegirmon	4	16.7	139	9.7	143	9.8
10	Tallashqon	4	16.7	95	6.6	99	6.8
11	Zang Gilambop	1	4.2	74	5.1	75	5.1
12	Zartepa	1	4.2	119	8.3	120	8.2
Angor district sub total		24	1.6	1,440	98.4	1,464	100.0
13	Khalqobod	4	28.6	151	25.4	155	25.5
14	Namuna	3	21.4	110	18.5	113	18.6
15	Orol	4	28.6	149	25.0	153	25.1
16	Uchkizil	3	21.4	185	31.1	188	30.9
Termiz district sub total		14	2.3	595	97.7	609	
Grand Total		38	1.8	2,035	98.2	2,073	

Most common disability types are physical disabilities and hearing handicaps. In total, for 38 people disability conditions expressed as "Yes". However, 2 of them have more than one disability. Therefore, total number of disabilities seen on member is 41. According to the proportion of disabilities in own

mahalla has the highest values in Khalqobod and Tallashqon. Therefore, these mahalla should be considered under heading of disability based vulnerabilities (see Table 294).

Table 294: Distribution of Disabilities by Type

Disability Type	Mental	Speech	Hearing	Vision	Physical	Total	Population of Mahalla	% in Mahalla
Dehqonbirlashuv	0	0	0	0	1	1	128	0.78
Ilgor	0	0	0	0	1	1	124	0.81
Karvon	0	1	1	0	1	3	109	2.75
Kattakum	0	0	1	2	2	5	177	2.82
Kayran	0	0	0	0	3	3	185	1.62
Khalqobod	0	0	0	2	3	5	155	3.23
Madaniyat	0	0	0	0	1	1	109	0.92
Namuna	0	0	0	1	2	3	113	2.65
Orol	1	0	2	0	1	4	153	2.61
Qoshtegirmon	0	0	2	0	2	4	143	2.80
Tallashqon	0	0	1	0	3	4	99	4.04
Uchkizil	0	0	0	2	2	4	188	2.13
Zang Gilambop	0	0	1	0	0	1	75	1.33
Zartepa	0	0	0	2	0	2	120	1.67
Grand Total	1	1	8	9	22	41	2073	1.98

16.3.2.5 Identities

Under the heading of identities can be described as culture, religion and ethnicity social belongings. In PSIA, most crowded ethnic group is Uzbek, they are in Islamic religion system and mainly speak Turkish. According to survey findings, there are more than 4 nationality, more than 3 mother language and more than 2 religionial beliefs (see Table 295, Table 296, and Table 297).

Table 295: Distribution of Nationalities

		Nationality						
	Mahallas	Afghan	Russian	Tajik	Turkmen	Uzbek	Missing value	Grand Total
1	Bahor	0	0	0	0	112	0	112
2	Dehqonbirlashuv	0	0	0	0	128	0	128
3	Ilgor	0	0	0	0	124	0	124
4	Karvon	0	0	0	0	109	0	109
5	Kattakum	3	5	25	2	142	0	177
6	Kayran	0	0	5	0	179	1	185
7	Madaniyat	0	0	2	0	107	0	109
8	Markaz	0	0	0	0	83	0	83
9	Qoshtegirmon	0	1	0	0	142	0	143
10	Tallashqon	0	0	2	1	95	1	99
11	Zang Gilambop	0	0	0	0	75	0	75
12	Zartepa	0	1	0	0	119	0	120
Angor district sub total		3	7	34	3	1,415	2	1,464
% in District		0.20	0.48	2.32	0.20	96.65	0.14	100.00

		Nationality						
	Mahallas	Afghan	Russian	Tajik	Turkmen	Uzbek	Missing value	Grand Total
13	Khalqobod	0	0	2	24	129	0	155
14	Namuna	0	0	0	6	107	0	113
15	Orol	0	2	9	97	45	0	153
16	Uchkizil	2	2	0	6	178	0	188
Termiz district sub total		2	4	11	133	459	0	609
% in District		0.33	0.66	1.81	21.84	75.37	0.00	100.00
	Grand Total	5	11	45	136	1,874	2	2,073
% in Total		0.24	0.53	2.17	6.56	90.40	0.10	100.00

Table 296: Distribution of Mother Languages

		Mother language				
	Mahallas	Russian	Tajik	Uzbek	Missing value	Grand Total
1	Bahor	5	0	107	0	112
2	Dehqonbirlashuv	0	0	128	0	128
3	Ilgor	0	0	124	0	124
4	Karvon	0	0	108	1	109
5	Kattakum	5	15	157	0	177
6	Kayran	0	5	180	0	185
7	Madaniyat	3	2	104	0	109
8	Markaz	0	0	83	0	83
9	Qoshtegirmon	1	0	142	0	143
10	Tallashqon	0	0	99	0	99
11	Zang Gilambop	1	0	74	0	75
12	Zartepa	3	0	117	0	120
Angor district sub total		18	22	1,423	1	1,464
% in District		1.23	1.50	97.20	0.07	100.00
13	Khalqobod	0	0	155	0	155
14	Namuna	0	0	113	0	113
15	Orol	0	2	151	0	153
16	Uchkizil	8	0	180	0	188
Termiz district sub total		8	2	599	0	609
% in District		1.31	0.33	98.36	0.00	100.00
	Grand Total	26	24	2,022	1	2,073
% in Total		1.25	1.16	97.54	0.05	100.00

Table 297: Distribution of Religious Belief

		Religious Belief				
	Mahallas	Christianity	Islam	Jewish	No Response	Grand Total
1	Bahor	0	112	0	0	112
2	Dehqonbirlashuv	0	128	0	0	128
3	Ilgor	0	124	0	0	124
4	Karvon	0	109	0	0	109
5	Kattakum	5	172	0	0	177

		Religious Belief				
	Mahallas	**Christianity**	**Islam**	**Jewish**	**No Response**	**Grand Total**
6	Kayran	0	185	0	0	185
7	Madaniyat	0	109	0	0	109
8	Markaz	0	83	0	0	83
9	Qoshtegirmon	1	142	0	0	143
10	Tallashqon	0	99	0	0	99
11	Zang Gilambop	0	75	0	0	75
12	Zartepa	1	119	0	0	120
Angor district sub total		7	1,457	0	0	1,464
% in District		0.48	99.52	0.00	0.00	100.00
13	Khalqobod	0	155	0	0	155
14	Namuna	0	113	0	0	113
15	Orol	1	149	1	2	153
16	Uchkizil	1	187	0	0	188
Termiz district sub total		2	604	1	2	609
% in District		0.33	99.18	0.16	0.33	100.00
	Grand Total	9	2,061	1	2	2,073
% in Total		0.43	99.42	0.05	0.10	100.00

Photos taken during the household surveys are presented in Figure 231.

Figure 231: Selected Photos from Household Survey

16.3.3 Local Administrator survey

The local administrator survey (which can be also said as the mahalla reis survey) was conducted on the mahalla level with mahalla reis. Mahalla reis are Project's stakeholders as in the interest group.

The mahalla reis survey started on the 29th of July and ended on the 4th of August, 2022. The survey was conducted only by the team leader.

The total number of completed mahalla reis questionnaires is 16. 4 of them were in Termiz and the remaining 12 were in Angor district.

One of the main limitations of the survey was related to getting appointments for interviews. Because mahalla reis had more than one responsibility at the same time and most of the mahalla reis had to be joined zoom meetings with khokimiyat's staff. The other was related to taking photographs after completion of the interview. None of the mahalla reis did accept taking photographs.

According to the general evaluation of the mahalla reis survey results, they have intensive expectations about the employment of unemployed young people who were living adjacent to the Project area. similarly, they demanded also the installation of small ateliers within the boundaries of their mahallas. As a result, none of them had a negative opinion about the Project and they support to kick-off of the Project as soon as possible.

According to gathered data through survey, general socio economic conditions of mahallas are presented as in the following Table 298. According to these data most populated mahalla is Kattakum and the least populated one is Zang Gilambop. However, household number are higher than Kattakum in Kayran. The biggest average household size is with 6.6 in Tallashqon, while Kayran has the smallest one with 3.8 (see Table 298).

Table 298: Population and Household Size

Mahalla	Population	Number of HH	Average Household Size
Uchkizil	5,303	1,094	4.85
Kattakum	5,589	1,076	5.19
Zartepa	4,585	800	5.73
Markaz	3,288	822	4.00
Orol	4,281	753	5.69
Madaniyat	2,984	570	5.24
Kayran	4,965	1,305	3.80
Karvon	3,864	623	6.20
Khalqobod	4,545	810	5.61
Dehqonbirlashuv	2,687	521	5.16
Bahor	4,264	784	5.44
Ilgor	4,055	645	6.29
Tallashqon	3,678	558	6.59
Qoshtegirmon	3,710	653	5.68
Zang Gilambop	2,197	345	6.37
Namuna	3,584	667	5.37

16.3.3.1 Gender

Distribution of population by gender is shown in Table 299. According to this table proportion of the gender are similar nearly in each mahalla.

Table 299: Gender Distribution

Mahalla	Male (%)	Female (%)
Uchkizil	41.49	58.51
Kattakum	50.77	49.23
Zartepa	49.38	50.62
Markaz	49.36	50.64
Orol	47.98	52.02
Madaniyat	59.62	40.38
Kayran	55.19	44.81
Karvon	49.02	50.98
Khalqobod	44.95	55.05
Dehqonbirlashuv	50.09	49.91
Bahor	50.42	49.58
Ilgor	47.15	52.85
Tallashqon	48.50	51.50
Qoshtegirmon	52.32	47.68
Zang Gilambop	48.34	51.66
Namuna	47.21	52.79

16.3.3.2 Age

According to age distribution data the age groups are defined as children (0-14 age group) young (15-64 age group) and elderly (65 and over age). In this sense most populated group is constituted by young people (see Table 300 and Figure 232).

Table 300: Age Group Distribution

Mahalla	0-14 Age	15-64 Age	65 and over	Male	Female
Uchkizil	750	4,093	460	2,200	3,103
Kattakum	371	4,544	674	2,868	2,781
Zartepa	1,003	2,820	762	2,264	2,321
Markaz	578	2,515	195	1,623	1,665
Orol	811	3,158	370	2,054	2,227
Madaniyat	510	2,042	1,572	1,949	1,320
Kayran	975	3,576	414	2,740	2,225
Karvon	870	2,518	435	1,894	1,970
Khalqobod	1,622	2,485	438	2,043	2,502
Dehqonbirlashuv	578	1,852	257	1,346	1,341
Bahor	614	3,336	314	2,150	2,114
Ilgor	775	2,888	392	1,912	2,143
Tallashqon	1,064	2,261	353	1,784	1,894
Qoshtegirmon	938	2,412	360	1,941	1,769
Zang Gilambop	1,069	967	161	1,062	1,135
Namuna	991	2,205	388	1,692	1,892

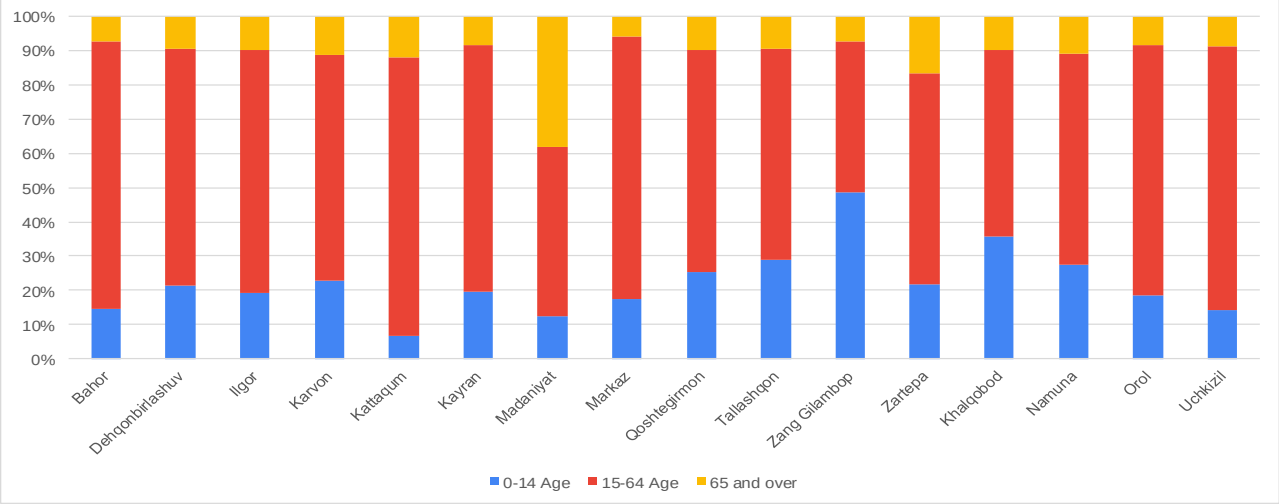


Figure 232: Age Distribution of Mahalla

16.3.3.3 Economy

Most common economic sources are agriculture. Livestock has been only given as an income source for Markaz mahalla by the reis. According to the expression of mahalla reis, most common produced products in agriculture, livestock and fishery are given in Table 301. Nevertheless, neither livestock nor fishery is income source. These are subsistence activities for local people.

Table 301: Products

Mahalla	Most common agricultural products	Most common animal products	Most common caught fish
Uchkizil	Melon, crops	Meat	No
Kattakum	Vegetables	Meat, dairy products	White amur
Zartepa	Potatoes, carrots, apples, pomegranate	Meat, dairy products	No
Markaz	Pomegranate, carrots, cabbage	Meat, dairy products	No
Orol	Tomatoes, cucumbers, pomegranate	Meat	No
Madaniyat	Cabbage	Meat	No
Kayran	Garlic, corn	Dairy products	White amur, carp
Karvon	Potatoes, greens, cabbage	Meat	No
Khalqobod	Vegetables	Meat, dairy products	No
Dehqonbirlashuv	Cabbage, carrots, onions, garlic, walnuts	Meat	No
Bahor	Cabbage, ground Clover, beets	Meat	No
Ilgor	Cabbage, ground Clover	Meat	Carp, White amur
Tallashqon	Potatoes, greens, garlic	Meat	No
Qoshtegirmon	Cabbage, oats, red beets	Meat	White amur
Zang Gilambop	Potatoes, tomatoes	Meat	No
Namuna	Tomatoes, cucumbers, bell peppers	Meat	No

People who has not any income source are living in Uchkizil, Kattakum and Dehqonbirlashuv mahalla. Total number of them is 1,614. Total number of unemployed people is 1,008 and their ratio is mainly high in Uchkizil. Distribution of job seekers clustered also in Uchkizil (see Table 302).

Table 302: Unemployment

Mahalla	What is the average number of people who do not have a source of income?	%	What is the average number of unemployed?	%	What is the average number of young people looking for job?	%	Population
Uchkizil	1,500	28	250	5	150	2.83	5,303
Kattakum	104	2	104	2	23	0.41	5,589
Zartepa	No	N/A	60	1	30	0.65	4,585
Markaz	No	N/A	96	3	50	1.52	3,288
Orol	No	N/A	87	2	95	2.22	4,281
Madaniyat	No	N/A	46	2	36	1.21	2,984
Kayran	No	N/A	65	1	24	0.48	4,965
Karvon	No	N/A	No	N/A	23	0.60	3,864
Khalqobod	No	N/A	25	1	60	1.32	4,545
Dehqonbirlashuv	10	0	89	3	34	1.27	2,687
Bahor	No	N/A	26	1	34	0.80	4,264
Ilgor	No	N/A	24	1	10	0.25	4,055
Tallashqon	No	N/A	58	2	30	0.82	3,678
Qoshtegirmon	No	N/A	40	1	40	1.08	3,710
Zang Gilambop	No	N/A	32	1	25	1.14	2,197
Namuna	No	N/A	6	0	6	0.17	3,584
Total	1,614	3	1,008	2	670	1.05	63,579

Average household income level is mostly in 2,000,001 – 4,000,000 group. These numbers can be accepted as the average income level of the PSIA (see Table 303).

Table 303: Average Income Level

Mahalla	What is the average household income level? (SOM)
Uchkizil	0 – 2,000,000
Kattakum	2,000,001 – 4,000,000
Zartepa	0 – 2,000 000
Markaz	2,000,001 – 4,000,000
Orol	2,000,001 – 4,000,000
Madaniyat	2,000,001 – 4,000,000
Kayran	0 – 2,000,000
Karvon	2,000,001 – 4,000,000
Khalqobod	2,000,001 – 4,000,000
Dehqonbirlashuv	0 – 2,000,000
Bahor	2,000,001 – 4,000,000
Ilgor	2,000,001 – 4,000,000
Tallashqon	2,000,001 – 4,000,000
Qoshtegirmon	2,000,001 – 4,000,000
Zang Gilambop	2,000,001 – 4,000,000
Namuna	2,000,001 – 4,000,000

16.3.3.4 Education

All of mahalla reis expressed that mahallas' have educational institutions. Except Zartepa mahalla, eneral education level is described as mainly in secondary and secondary special education level. In Zartepa educational level is in basic higher education (see Table 304).

Table 304: Education Level

Mahalla	Average educational level
Uchkizil	Secondary special education
Kattakum	Secondary special education
Zartepa	Basic higher education
Markaz	Secondary special education
Orol	Secondary special education
Madaniyat	Secondary special education
Kayran	Secondary education
Karvon	Secondary special education
Khalqobod	Secondary special education
Dehqonbirlashuv	Secondary special education
Bahor	Secondary special education
Ilgor	Secondary special education
Tallashqon	Secondary special education
Qoshtegirmon	Secondary special education
Zang Gilambop	Secondary special education
Namuna	Secondary special education

Within Uchkizil and Kayran mahallas there are 318 illiterate people. There is a big amount about the number of universities graduated people. In addition, the student who enrol to school in current days, total number of them are 12,273 (see Table 305).

Table 305: Education Data

Mahalla	# of Student	# of Illiterates	#of university graduates
Uchkizil	460	311	170
Kattakum	1,196	No	64
Zartepa	670	No	76
Markaz	728	No	95
Orol	1,456	No	25
Madaniyat	36	No	29
Kayran	1,068	7	17
Karvon	621	No	15
Khalqobod	697	No	15
Dehqonbirlashuv	498	No	15
Bahor	1,124	No	24
Ilgor	845	No	21
Tallashqon	715	No	28
Qoshtegirmon	860	No	20
Zang Gilambop	545	No	22

Mahalla	# of Student	# of Illiterates	#of university graduates
Namuna	754	No	105
Total	12,273	318	741

16.3.3.5 Health

According to results of mahalla reis survey (or local administrator survey) except Karvan and Namuna, all mahallas have a health institution.

Most common chronic diseases are listed as diabetic, neurological diseases, tension, kidney diseases, heart and cardiological diseases, intestinal diseases, gynecological diseases etc. according to expression of mahalla reis most common diseases are presented in below table (see Table 306).

Table 306: Chronic Diseases

Mahalla	Most Common Chronic Diseases In Mahalla
Uchkizil	Diabetes
Kattakum	Neurological Diseases, Tension, Heart Disease
Zartepa	Neurological Diseases, Tension
Markaz	Neurological Diseases, Tension, Diabetes
Orol	Tension, Diabetes
Madaniyat	Kidney Disease, Tension, Diabetes
Kayran	Kidney Disease, Neurological Diseases, Tension, Diabetes
Karvon	Kidney Disease, Neurological Diseases, Tension
Khalqobod	Neurological Diseases, Gynaecological Diseases, Tension, Cardiological Disease
Dehqonbirlashuv	Tension
Bahor	Intestinal Diseases, Tension, Diabetes
Ilgor	Tension
Tallashqon	Tension
Qoshtegirmon	Kidney Disease, Tension, Hepatitis
Zang Gilambop	Intestinal Diseases, Kidney Disease, Tension, Diabetes
Namuna	Tension, Diabetes

As a tragic issue that all mahallas cover disabled people. Their disability types are given with the ratios in Table 307.

Table 307: Disability

Mahalla	Disability Type	Number of disabled	Population	Ratio in Population
Uchkizil	2nd group disability	117	5,303	8.34
Kattakum	Mental	68	5,589	8.79
Zartepa	Physical	25	4,585	7.21
Markaz	Physical	48	3,288	5.17
Orol	Physical	70	4,281	6.73
Madaniyat	2nd group disability	86	2,984	4.69
Kayran	2nd group disability	26	4,965	7.81
Karvon	Physical	29	3,864	6.08
Khalqobod	2nd group disability	72	4,545	7.15

Mahalla	Disability Type	Number of disabled	Population	Ratio in Population
Dehqonbirlashuv	2nd group disability	57	2,687	4.23
Bahor	2nd group disability	13	4,264	6.71
Ilgor	2nd group disability	24	4,055	6.38
Tallashqon	Physical	35	3,678	5.78
Qoshtegirmon	Harelip	23	3,710	5.84
Zang Gilambop	2nd group disability	35	2,197	3.46
Namuna	Mental	202	3,584	5.64
Total		930	63,579	100.00
%		1.46		

16.3.3.6 Culture and Tourism

In mahalla level nationalities other than Uzbek, mother language other than Uzbek and religion other than İslam have been examined, due to the majorities are Uzbeks who mostly speak Uzbek and their beliefs are in İslam (see Table 308).

Table 308: Identities

Mahalla	Other than Uzbek	Other than Islam	Other than Uzbek
	Nationality	Religion	Language
Uchkizil	Russians	Christianity	Russian language
Kattakum	Turkmen	No	No
Zartepa	Tajiks, Turkmen	No	Tajik
Markaz	Tatar	No	No
Orol	Turkmen	No	No
Madaniyat	No	No	No
Kayran	No	No	No
Karvon	No	No	No
Khalqobod	Turkmen	No	No
Dehqonbirlashuv	Tajiks, Turkmen	No	Turkish
Bahor	No	No	No
Ilgor	Russians	Christianity	Russian language
Tallashqon	No	No	No
Qoshtegirmon	Turkmen	No	No
Zang Gilambop	No	No	No
Namuna	Turkmen	No	No

In the line with cultural heritage assets within the mahallas two reis (Zartepa and Namuna) expressed a cultural heritage areas, which are located in 10-15 km and more than 20 km to the Project area.

One of the mentioned cultural heritage areas is named as Ancient Settlement of Zartepa. According to gathered data by Surkhandarya Regional Tourism department, exact location of these area is on ”37°24'37.69°N” and 67°9'13.27°E”. This area is out of the Project Area’s vicinity.

The other Sulton-Saodat mausoleum complex located near of Namuna on 37°15'46.55"N 67°18'40.10”E, in Termiz city. This area is out of the Project Area’s vicinity.

There are none intangible cultural heritage assets.

Responses of reis about the cultural activity areas, touristic facilities and accommodation area are given in Table 309.

Table 309: Properties

Mahalla	Are there areas of cultural activity in the village?	Is there any hotel in the village?	Are there tourist zones and facilities in the village?	Is there any accommodation for tourists in the village?
Uchkizil	Yes	Yes	Yes	Yes
Kattakum	No	No	No	No
Zartepa	No	No	Yes	No
Markaz	No	No	No	No
Orol	Yes	No	No	No
Madaniyat	Yes	No	No	No
Kayran	No	No	No	No
Karvon	No	No	No	No
Khalqobod	No	Yes	No	No
Dehqonbirlashuv	No	No	No	No
Bahor	No	No	No	No
Ilgor	No	No	No	No
Tallashqon	No	No	No	No
Qoshtegirmon	No	No	No	No
Zang Gilambop	No	No	No	No
Namuna	No	No	No	No

16.3.3.7 Land Use

Although land use is mentioned, the project land has been allocated to the project by the decision of the chairmanship. There is no land use on the project area other than recreational uses. The uses expressed by the chiefs are also for recreational purposes (see Table 310).

Table 310: Land Use

Mahalla	Does any resident use the Project Area for any purpose?	Purpose of use	How many people use this area near the project area?
Uchkizil	No	No	No
Kattakum	Yes	Amateur Fishery	21
Zartepa	No	No	No
Markaz	No	No	No
Orol	No	No	No
Madaniyat	No	No	No
Kayran	Yes	Amateur Fishery	1
Karvon	No	No	No
Khalqobod	No	No	No
Dehqonbirlashuv	No	No	No

Mahalla	Does any resident use the Project Area for any purpose?	Purpose of use	How many people use this area near the project area?
Bahor	No	No	No
Ilgor	No	No	No
Tallashqon	No	No	No
Qoshtegirmon	No	No	No
Zang Gilambop	No	No	No
Namuna	No	No	No

16.3.4 Interviews with Governmental Institutions

Between 27th of July and 3rd of August, 2022 a total of 25 interviews were realized. During the survey, interviews with other interest group such as local administrators and businesses were met. For instance, 2 additional interviews were conducted with mahalla reis of Kattakum and Uchkizil, which are the nearest settlements to the Project area border. The in-depth interviews with mahalla reis were conducted by unstructured questions. The main aim of the in-depth interviews was to collect detail information about general socio-economic conditions, vulnerable groups and opinions about the Project.

In addition, 3 in-depth interviews were also conducted with a farm owner, an owner of fishery area and the owner of a facility which is the nearest facility to the Project area. As an in-depth interview was conducted with an archaeologist who was the staff of Termiz Archaeological Museum.

The remaining interviews were conducted with responsible departments of the governmental institutions such as education, health, labour, agriculture, irrigation, municipal affairs, cadastre, cultural heritage etc. Distribution of the realized interviews by stakeholder categorization, number and interview techniques are listed in below;

- Interest Group/ Governmental Institutions_ 17 semi-structured interviews with governmental institutions
- Interest group / Local Administrators_ 2 in-depth interviews with mahalla reis,
- Interest Group/ Governmental Institutions_3 in-depth interviews with responsible staff of governmental institutions,
- Interest group /Business Owners_3 in-depth interviews with business owners

List of institutional meetings are presented in Table 311. Minutes of institutional meetings are presented in Annex-H.

Table 311: List of Institutional Meetings

No	District	Name of Institution	Stakeholder type	Interview technique	Date
1	Termiz	Termiz Khokimiyat	Interest group / Governmental Institutions	Semi Structured Interview	27/Jul/22
2	Termiz	Department of Cultural Heritage of Surkhandarya Region	Interest group / Governmental Institutions	Semi Structured Interview	27/Jul/22
3	Termiz	Department of Cultural Heritage of Surkhandarya Region	Interest group / Governmental Institutions	Semi Structured Interview	27/Jul/22
4	Termiz	Termiz Archaeological Museum	Interest group / Governmental Institutions	In Depth Interview	27/Jul/22
5	Termiz	Uchkizil Mahalla	Interest group / Local Administrators	In Depth Interview	29/Jul/22
6	Termiz	Termiz District Education Department	Interest group / Governmental Institutions	Semi Structured Interview	29/Jul/22
7	Termiz	Termiz District Health Department	Interest group / Governmental Institutions	Semi Structured Interview	29/Jul/22
8	Angor	Angor Khokimiyat	Interest group / Governmental Institutions	Semi Structured Interview	29/Jul/22
9	Angor	Angor District Health Department	Interest group / Governmental Institutions	Semi Structured Interview	30/Jul/22
10	Angor	Angor District Agriculture Department	Interest group / Governmental Institutions	Semi Structured Interview	30/Jul/22
11	Angor	Angor District Educational Department	Interest group / Governmental Institutions	Semi Structured Interview	30/Jul/22

No	District	Name of Institution	Stakeholder type	Interview technique	Date
12	Angor	Angor District Cadastre Department	Interest group / Governmental Institutions	Semi Structured Interview	01/Aug/22
13	Angor	Amu Surkhan Regional Inspection Department	Interest group / Governmental Institutions	Semi Structured Interview	01/Aug/22
14	Angor	Angor District Labour Department	Interest group / Governmental Institutions	Semi Structured Interview	01/Aug/22
15	Angor	*Individual - Farmer*	Interest group /Business Owners	In Depth Interview	01/Aug/22
16	Angor	Angor District Road Construction and Transportation	Interest group / Governmental Institutions	Semi Structured Interview	01/Aug/22
17	Angor	Angor MonoCentre Official Training Centre (Ministry of Labour)	Interest group / Governmental Institutions	In Depth Interview	01/Aug/22
18	Angor	Angor District Youth Department	Interest group / Governmental Institutions	In Depth Interview	02/Aug/22
19	Angor	Kattakum Mahalla	Interest group / Local Administrators	In Depth Interview	02/Aug/22
20	Angor	*Individual - Fishermen in Kattakum*	Interest group /Business Owners	In Depth Interview	02/Aug/22
21	Termiz	Termiz District Agriculture Department	Interest group / Governmental Institutions	Semi Structured Group Interview	03/Aug/22
22	Termiz	Termiz District Labour Department	Interest group / Governmental Institutions	Semi Structured Group Interview	03/Aug/22
23	Termiz	Termiz District Municipal Department	Interest group / Governmental Institutions	Semi Structured Group Interview	03/Aug/22

No	District	Name of Institution	Stakeholder type	Interview technique	Date
24	Termiz	Termiz District Cadastre Department	Interest group / Governmental Institutions	Semi Structured Group Interview	03/Aug/22
25	Termiz	The nearest facility to the Project Area	Interest group /Business Owners	In Depth Interview	03/Aug/22
26	Termiz	Termiz Department of Tourism of Surkhandarya Region	Interest group /Business Owners	Semi Structured Interview	09/Aug/22
27	Termiz	Termiz Crude Oil Mining Facility	Interest group /Business Owners	Semi Structured Interview	09/Aug/22
28	Angor	*Individual - Fishermen in Angor*	Project Affected Persons (PAPs) / Vulnerable Groups	In Depth Interview	09/Aug/22

Furthermore, there is no non-governmental organization (NGO) within Angor.

There is only one limitation of the survey was related to getting appointments for interviews, similar to mahalla reis survey. All of the interest group have positive opinion about the Project due to the need of the region both to additional power supply and employment opportunities. They also wanted to get support to Project owner, if they will demand. As a summary, basic socio-economic problems are caused by unemployment of people who are in working age separation. Therefore, their expectations were clustered on local employment demand for both unskilled and semi-skilled workers.

16.3.5 Focus Group Discussion

Focus group discussion are targeted to access to Project's stakeholders as in vulnerable group. The identification of vulnerable groups can be varied and differentiated in accordance with socio economic conditions of the region. In this case, identification of vulnerable groups revised according to the preliminary results of the other surveys including household, mahalla reis and governmental institutions. Consequently, the vulnerable groups and the meeting details are given in Table 312.

Table 312: Focus Group Discussions

No	Name of FGD	Stakeholder Type	Meeting Place	Date	Number of Participants
1	Women who live in Angor's mahallas	Project Affected Persons (PAPs) / Vulnerable Groups	Angor District Angor Khokimiyat Meeting Room	02-Aug-22	13
2	People engaged in Agriculture and/or in Husbandry in Angor	Project Affected Persons (PAPs) / Vulnerable Groups	Termiz district governor	09-Aug-22	5
3	Angor Young /Unemployed people	Project Affected Persons (PAPs) / Vulnerable Groups	Angor district governor	10-Aug-22	13
4	People engaged in Agriculture and/or in Husbandry in Termiz	Project Affected Persons (PAPs) / Vulnerable Groups	Termiz district governor	10-Aug-22	7
5	Women who live in Termiz's mahallas	Project Affected Persons (PAPs) / Vulnerable Groups	Uchkizil Mahalla Committee	13-Aug-22	7
6	Termiz Young /Unemployed people	Project Affected Persons (PAPs) / Vulnerable Groups	Uchkizil Mahalla Committee	13-Aug-22	6

16.3.5.1 Woman FGD / Angor District

Demographic profile of the women group in Angor District is given in Table 313.

Table 313: Demographic Profile of the Attendances to FGD

No	Age	Mahalla	Occupation	Gender
1	49	Angor /District Centre	Deputy Khokim of Women Issue in Angor Khokimiyat	Female
2	42	Angor /Ozbekistan	Responsible of Mahalla Women Issue	Female
3	33	Angor / Zang Gilombo	Housekeeping	Female
4	28	Angor / Zartepa	Farmer at household level/ Unemployed	Female
5	43	Angor /Ozbekistan	Farmer at household level/ Unemployed	Female
6	38	Angor /Navroz	Temporarily Cooker	Female
7	34	Angor / Dehqonittifoq	Temporarily Cooker (3days in a week)	Female
8	30	Angor /Ozbekistan	Farmer at household level/ Unemployed	Female
9	45	Angor /Navroz	Farmer at household level/ Unemployed	Female
10	39	Angor /Zartepa	Deputy Khokim of Women Issue in Zartepa	Female

No	Age	Mahalla	Occupation	Gender
11	33	Angor /Zang Gilambop	Deputy Khokim of Women Issue in Zang Gilambop	Female
12	39	Angor /Kattaqum	Farmer at household level/ Unemployed	Female
13	38	Angor /Kattaqum	Deputy Khokim of Women Issue in Kattaqum	Female

16.3.5.2 Youth / Unemployed FGD / Angor District

Demographic profile of the youth/unemployed group in Angor District is given in Table 319.

Table 314: Demographic Profile of the Attendances to FGD

No	Age	Mahalla	Occupation	Gender
1	27	Angor / Zang gilambop	Finance	Male
2	25	Angor / Zartepa	Director	Male
3	22	Angor / Madaniyat	Accounter	Male
4	23	Angor / Zartepa	Daily income owner	Male
5	26	Angor / Markaz	Student	Female
6	21	Angor / Talashqon	Programmer	Male
7	17	Angor / Qo'shtegirmon	Programmer	Male
8	17	Angor / Qoraqum	Temporarily unemployed	Male
9	19	Angor / Bahor	Temporarily unemployed	Male
10	24	Angor / Bahor	Temporarily unemployed	Male
11	18	Angor / Dehqonbirlashuv	Athlete	Male
12	23	Angor /Ilgor	Daily income owner	Male
13	22	Angor / Ilgor	Study	Male

16.3.5.3 Agriculture/ Husbandry FGD / Angor District

Demographic profile of the farmer group in Angor District is given in Table 315.

Table 315: Demographic Profile of the Attendances to FGD

#	Age	Mahalla	Occupation	Gender
1	42	Kattakum	Gardening	Male
2	33	Bahor	Fishing	Male
3	50	Kattakum	Vegetable growing	Male
4	36	Kattakum	Vegetable growing	Male
5	39	Dexqonbirlashuv	Gardening	Male

16.3.5.4 Woman FGD / Termiz District

Demographic profile of the women group in Termiz District is given in Table 316.

Table 316: Demographic Profile of the Attendances to FGD

No	Age	Mahalla	Occupation	Gender
1	23	Uchqizil	Housewife	Female
2	28	Uchqizil	Unemployed	Female
3	34	Uchqizil	Unemployed	Female
4	31	Uchqizil	Unemployed	Female

No	Age	Mahalla	Occupation	Gender
5	30	Namuna	Accountant	Female
6	33	Namuna	Simple worker	Female
7	21	Namuna	Housewife	Female

16.3.6 Youth / Unemployed FGD / Termiz District

Demographic profile of the youth/unemployed group in Termiz District is given in Table 317.

Table 317: Demographic Profile of the Attendances to FGD

No	Age	Mahalla	Occupation	Gender
1	18	Uchqizil	Unemployed	Male
2	19	Uchqizil	Unemployed	Male
3	24	Uchqizil	Student	Male
4	21	Uchqizil	Sewing	Female
5	22	Uchqizil	Unemployed	Male
6	20	Namuna	Student	Male
7	18	Namuna	Housewife	Male

16.3.7 Agriculture/ Husbandry FGD / Termiz District

Demographic profile of the farmer group in Termiz District is given in Table 324.

Table 318: Demographic Profile of the Attendances to FGD

No	Age	Mahalla	Occupation	Gender
1	23	Surhon yashnar	Gardening	Male
2	40	Qoraqum	Growing fruits and vegetables	Male
3	46	Guliston	Fruit and gardening	Male
4	34	Yangi hayot	Fruit cultivation	Male
5	38	Uchqizil	Greenhouse Fruiting	Male
6	41	Xalqobod	Gardening	Male
7	39	Orol	Gardening	Male

The main discussions during the FGDs were focused on the job opportunities that can arise due to the implementation of the project. Majority of the participants raised that rather than part-time basis job opportunities, full time daily shifts are crucial for them to sustain their economic independency. The main economic income of the women group is seasonal working in the agricultural activities and/or part-time working for house cleaning. During the FGDs, participants raised their awareness on the importance of electricity generation since they are already facing electricity cuts in their daily routines. In conclusion, FGDs focused on having full-time salary jobs both during construction and operation of the proposed power plant.

16.4 POTENTIAL IMPACTS, MITIGATION, MANAGEMENT & RESIDUAL IMPACT MEASURES

16.4.1 Construction Phase

The research team identified several positive and negative impacts likely to arise during the construction of the Project. These included the following, respectively.

16.4.1.1 Employment and Economics

Employment Generation

The primary economic impact during construction is likely to result from employment creation during this phase. This Project is expected to create employment opportunities during the construction phase for unskilled and applicably skilled workers. HR Policy including company positive approach for the promotion of local employment has been developed by the Project Company and will be implemented before/during the Project construction activities. To prevent social conflicts between local employee and expats, should be paid attention to the balance between in the employment shares.

The inhabitants of the communities closest to the project area are of mixed ethnic origin and are predominantly Muslims with their own traditions and beliefs. The influx of workers and immigrants to the Project site may introduce new habits or practices that are inconsistent with the local culture. This can lead to potential conflicts with new workers or a decline in social cohesion among local communities.

Therefore, in order to have an idea about the employment opportunities in the local area, it is necessary to keep in touch with the local authorities, local employers and employment-related institutions. Long-term consultations with the aforementioned stakeholders may be required, especially for a qualified and unskilled workforce.

The Project has the potential to encourage the spread of construction and construction support skills from expatriate workers to the local workforce. This will open up job opportunities for the unemployed in the Region and increase their chances of securing similar jobs after the completion of the Project construction phase.

It is expected that the majority of workers' contracts (especially for temporary/contract staff) will expire with the completion of the construction phase of the project.

Local Economic Development

In addition to the direct monetary increase to the families of the employed, the money paid to the workers will also stimulate the local economy with a multiplier effect, so that the money earned from the locally spent Project will recirculate within the local economy.

Additional secondary impact on the local economy is likely to arise from spending on domestic and foreign goods and services during the construction process. The nature of the development and the specialized nature of the materials required, their construction materials will be sourced locally. There is also the potential to buy food products locally to stimulate the local economy, where local people can sell vegetables and daily products to workers.

Besides, the training of employers and employees will equip potential graduates with the tools and knowledge to support the local supply chain for the utilities and chemicals sectors in Uzbekistan.

Labour Influx

The Project construction will require involvement of significant workforce (direct and contracted) Approximately 30% of the workforce is estimated to be non-qualified and 70% of will be qualified. The Contractor prioritise localisation of workforce (including subcontractors through contractual requirements) and it is anticipated that 50 % of the workforce will be national people. This policy will maximise the use of local workers and reduce the influx of non-local workers to the area.

Non-local workers will accommodate at the off-site accommodation facilities in naearby cities. Non-local workers will be transferred to the project site via shuttle buses. Therefore, no adverse impacts are foreseen in the existing public transportation system.

The workers to be employed from the local will lodge in their local houses and transported to the Project site by means of shuttle buses to be arranged by the Project. It is anticipated that subcontractor will be engaged in the Project activities over approximately 24 months construction period. Duration of involvement of each subcontractor will vary depending on their work scopes, such that, part of the subcontractors will work for longer durations, whilst part of them will work for very limited durations - weeks.

The adverse risks or impacts of off-site accommodation on the nearby district centres, such as increased demands on infrastructure, services and utilities, development of illicit trade activities, inflation in local rent and other subsistence items or risk of gender-based violence (GBV), as well as the potential benefits on the economies of the nearby settlements and district centres (e.g. rental incomes, supply of goods and materials, etc.), are anticipated to be temporary. The Contractor will arrange service busses for the personnel to be transported to the work sites from local houses including rental houses in the nearby district or neighbourhoods/villages.

16.4.1.2 Social Services

There is a poor condition on social services facilities such as educational institutions and healthcare institutions. As a result of the increasing population due to the employment opportunities provided by the construction phase, the demand for these services will increase. The growing demand for services can also put pressure on local authorities to improve existing facilities. As a result, the development of facilities and services will be a positive impact both for the local population and for immigrants from outside.

. The medical personnel and facilities to be provided on-site will meet the requirements of the applicable national legislation. Mobile schooling times will be taken into account for planning the transportation of construction materials.

Damage caused by the Project (by contractor or subcontractor) on electrical infrastructure, local water supply/irrigation infrastructure, etc. will be reinstated/repaired immediately after the completion of construction activities at respective work sites in collaboration with the related authorities. Where necessary, the Contractor will enforce and monitor the corrective actions to be taken by the subcontractors.

Work sites and access routes to be used by the contractors and subcontractors will be clearly identified to avoid potential off-site impacts on local infrastructure. Project-specific SEP, including the external grievance mechanism, will be implemented to inform the mukhtars and communities about potential

interruptions on local infrastructure services and collect relevant concerns and grievances for further management/resolution.

16.4.1.3 Emergency Preparedness and Response

The Emergency Preparedness and Response Plan (EPRP) will be developed as stand-alone documents separately for the construction and operation phases. The EPRPs will provide preventive measures and response strategies to manage potential incidents/accidents and to protect the community health, safety and environment against potential natural hazards, fires, or sabotage.

The EPRP will include:

- Roles and responsibilities for emergency management
- Identification of potential emergencies
- Identification of existing emergency response structure and capacity along the Project route (i.e. police, fire brigades, hospitals, etc.)
- List and location of emergency response equipment (fire extinguishers, spill response, first aid kits, etc.)
- Use of the emergency equipment and facilities
- Clear identification of evacuation routes
- Procedures to respond to the identified emergencies (preventive/preparatory measures, rescue, evacuation and response measures)
- Procedures to follow an emergency situation (recovery and assessment measures)
- Framework for the schedule for periodic inspection, testing and maintenance of emergency equipment (e.g. rescue equipment)
- Framework for the schedule of trainings and drills
- Emergency contacts and communication protocols, including with communities when necessary, and procedures for interaction with the government authorities
- Procedures for periodic review and update of emergency response plans.

Measures/systems for collaboration with the local communities and other external parties including local governmental agencies, media, etc. will be developed, where necessary. Emergency preparedness and response information will be disseminated to the potentially affected communities (e.g. emergency notification systems and evacuation procedures).

Local communities will be notified by using appropriate tools (e.g. telephone call lists, vehicle mounted speakers) in case of emergencies arising from the Project work/construction sites may pose risk on them. Where necessary, the details of the nature of the emergency, protection options, etc. will be communicated through trained community liaison officers (CLOs).

The related authorities will be cooperated both for prevention of and responding to emergencies and during emergency situations, where necessary. For fire emergencies, the procedures to be applied, including the trainings to be given to Project personnel and the measures to be taken, will be planned in coordination with the fire response units of the provinces.

In the event of a fire, wall-mounted, hand-held, suitable type fire extinguishers and special extinguishing systems in places where the fire response units cannot enter or reach quickly will be provided, and kept ready for use.

16.4.1.4 Indirect Impacts of Environmental Components

The construction works of the Project is most likely to be a noisy operation due to the moving construction machines and vehicles. This could be a potential source of disturbance in Termez and Angor districts. Therefore, noise could be negatively impact the vulnerable groups with hearing handicapped. To minimize this negative impact, the movement of heavy vehicles during the night will be avoided wherever practical.

Dust is likely to occur excavation and spreading of the topsoil during construction of the Project. There is a small possibility that may affecting the site workers and even neighbors' health. Furthermore, dust emission can negatively affect on vegetation and agriculture within the impact area. The yield loss that may occur in agricultural products due to dust may indirectly affect agricultural activities. To avoid dust based negative impact, where sand and other dusty materials are transported to the site, trucks will not be overloaded and will be appropriately covered/sheeted to avoid loses.

During construction of the Project, solid wastes such as packaging materials, plastics, scrap metal and timber could be generated. Dumping areas with the non-aesthetic condition, they can have a negative visual impact. Therefore, all wastes generated during the construction phase has to be transported off the site.

In addition, there are places for recreation on the shore of Uchkizil reservoir, including the Termez Marvaridi Recreation Area. Industrial design of the Project will interfere with the aesthetic status and landscape of the area.

Uchkizil reservoir may be sensitive to aquaculture stock when used in different ways within the Project construction. This sensitivity is related with fishery activities. Therefore, fishery as an income source of the adjacent settlements could be negatively impacted. So, domestic solid wastes must be segregated from the other waste streams into separate waste containers/bins clearly to facilitate recycling.

The plan of mitigation measures provided in Table 320, describes mitigation measures to minimizing or avoiding the negative impacts associated with the Project construction. The impacts are identified according to recent conducted study.

16.4.1.5 Land Users

Based on the first social site survey, there are no land users within the project area. Additional baseline survey demonstrates this situation in detail.

16.4.1.6 Local Road Users

A Traffic Safety Management Procedure will be developed and implemented by all Project personnel (direct and contracted) (details are provided in Chapter). The suggestions of the PAPs (e.g. enforcement of speed limits, placing warning signs, for the management of traffic-related impacts, collected through social surveys, will be reflected in the Procedure as relevant.

Based on the additional site surveys, baseline and impact assessment will be presented.

Table 319. The Plan of Mitigation Measures Construction Phase

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Employment generated by the Project	Local Communities and Businesses in Project Affected Settlements (potential for the working age group in all settlements)	Medium	Negligible	Negligible	In order to enhance Project benefits around employment opportunities, the Project will adopt the policy of localisation of workforce, where possible. HR Policy including company positive approach for the promotion of local employment has been developed by the Project Company and will be implemented before/during the Project construction activities. The Contractor will set localization targets for the employment of unskilled, semiskilled and skilled workers (direct and contracted) within the Labour Management Plan to be developed and implemented. Job applications will be collected from the settlements in collaboration with the local authorities. Project Contractor will develop and implement Subcontractor Management Plan (covering employment, procurement and supply chain aspects in line with IFC PS2). Project-specific SEP, including the external grievance mechanism, will be implemented. General job application forms will be collected from the settlements (The local employment potential of the settlements is presented in this report).	Negligible
Impacts of Project-related worker influx	Project Employees and Stakeholders	High	Medium	Major	Project-specific SEP, including external grievance mechanism, will be implemented. In case GBV is reported through the external grievance mechanism, this will be investigated by trained investigators and responded in accordance with current GIIPs. Through the implementation of SEP, local women will be specially informed by qualified Project personnel/representatives about the following following: - Project external grievance mechanism and privacy policy - Women's rights - Self-protection in cases of GBV and Sexual Exploitation and Abuse and Sexual Harrassment (SEA/SH) - Emergency phone numbers, and - Contact information of the institutions and organisations that can be applied to Contractor and subcontractor personnel (accommodating on-site and off-site) will be provided with training on Project's Social Policy and Contractor's Code of Conduct covering Project's approach to relations with the local communities, prevention of GBV and SEA/SH, atthe time of employment (refresher training will be provided annually and as required). Trainings will cover, inter alia, the following - Definition of violence against women in national and international documents, - Types of violence (physical, sexual, economic, emotional), and - Legal sanctions. Project CLOs and Contractor's Human Resources (HR) team will be specially trained on GBV. Project-specific Labour Management Plan, Camp Site Management Plan and Contractor Management Plan will be developed and implemented. The Contractor will develop and implement an internal audit system to check and monitor compliance of the Contractor and subcontractor implementations with the requirements of the Labour Management Plan covering the off-site accommodation aspects. The Contractor will develop and implement an internal audit system to check and monitor compliance of the Contractor and subcontractor implementations with the requirements of the following Project-specific documents; - Social Policy - HR Policy	Moderate

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
					- Subcontractor Management Plan - Labour Management Plan - Internal Grievance Mechanism as part of Project SEP. Subcontractor will be contractually required to maximise use of local workforce.	
Impacts on vulnerable groups and persons	Vulnerable groups in Project Affected Sites (PAS) The list of vulnerable persons who will be identified in additional site survey	High	Medium	Major	Special mitigation/enhancement measures will be designed tailored to the needs of vulnerable groups/persons affected from the Project (vulnerable PAPs) in PASs such needs will be identified by Project CLOs through implementation of Project-specific SEP, including but not limited to the following as necessary: - Access to legal resources with an assistance in case of a need (i.e. transportation) when relevant to management of Project-related impacts - Assistance on acknowledging and signing official documents when relevant to management of Project-related impacts - Assistance to access compensation payments if any implementation management of Project-related impacts - Assistance to obtain personal documents - Job assistance for PAPs - Priority for job opportunity during the construction phase of the Project The deterioration that has occurred or is likely to occur in seasonal workers' housing conditions will be eliminated. The SEP will be implemented, together with the specialised to be developed for the vulnerable groups, to mitigate Project's potential adverse impacts on them and enhance Project benefits. The list of vulnerable persons will be identified through the ESIA surveys is kept in the Project database, and will be updated as necessary throughout the Project. Vulnerable persons/groups will be specially informed about the Project activities and the external grievance mechanisms in collaboration with mukhtars. Vulnerable persons/households with vulnerable members will be given priority for Project's employment and procurement benefits, where possible.	Moderate

16.4.2 Operation Phase

Completion of the Project will result in an increase in electrical energy capacity for the population of the Region. As with the construction phase, an economic impact during operation can be employment generated by the Project. However, the operational phase will require significantly less staff than the construction phase. Besides management and technical operator positions, the majority of staff will be security teams and other office-based support personnel. Such non-technical personnel will likely be locally procured. While the size of the required workforce is significantly smaller, the type of work and increasing timescales present an opportunity for greater diffusion of skills. In this respect, HR Policy including company positive approach for the promotion of local employment has been developed by the Project Company and will be implemented during the Project operation activities. A targeted local recruitment system and investment in the human capital of the local workforce will improve this process and ultimately increase the benefit to the local economy. The plan of mitigation measures provided in Table 320.

Table 320:The Plan of Mitigation Measures Operation Phase

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Increase in electrical energy capacity	**Local energy demand**	**Negligible**	**Negligible**	**Negligible**	**Completion of the Project will result in an increase in electrical energy capacity for the population of the Region**	**Negligible**
Employment generated by the Project	**Management and technical operator positions**	**Negligible**	**Negligible**	**Negligible**	**The operational phase will require significantly less staff than the construction phase. Management and technical operator positions, the majority of staff will be security teams and other office-based support personnel** **HR Policy including company positive approach for the promotion of local employment has been developed by the Project Company and will be implemented during the Project operation activities.** **Based on the indicators proposed by AIIB concerning gender balanced employment, the Project should also ensure female participating in technical internship with the target value of 15% for the year 2027 and 2028.**	**Negligible**

16.4.3 Cumulative Impacts

The purpose of a cumulative impact assessment is to determine how the potential impacts of a proposed development might combine cumulatively, with the potential impacts of other projects or human activities as well as natural stressors such as droughts or extreme climatic events. Summary of Cumulative Impacts of Socio& Economic, Labour & Working Conditions and Human Rights Impacts is presented in Table 321.

Table 321: Summary of Cumulative Impacts of Socio& Economic, Labour & Working Conditions and Human Rights Impacts

Environmental and Social Aspect	Construction	Operation
Socio-Economics		
Cumulative Impacts	Development of the Projects at the same time will also lead to increase in local employment.	Positive impact in terms of increase in power generation and employment opportunities.
Labour & Working Conditions		
Cumulative Impacts	Labour and working conditions during the construction phase are expected to be Project specific and therefore cumulative impacts are not expected to be significant.	Project related impacts with regards to worker conditions and worker conditions (occupational health and safety) would mainly be those associated with operation and will depend on conditions within each Project site as well as depending on Project-specific operational activities.
Human Rights Impacts		
Cumulative Impacts	Human rights impact during construction are expected to be Project-specific and therefore cumulative impacts are not expected.	Human rights impact during operations are expected to be Project-specific and therefore cumulative impacts are not expected.

17. STAKEHOLDER ENGAGEMENT

Stakeholder engagement to be implemented in the construction and operation phase of the Project is described and the Stakeholder Engagement Plan (SEP – including the external and internal grievance mechanisms) developed as part of the ESIA process in line with the requirements of EP4 (2020) and IFC PSs (2012) as a stand-alone document and planned to be implemented throughout Project is summarized in the following sections.

17.1 Regulations and Requirements

17.1.1 National Requirements

Article 29 of the Law on Environmental Protection states ensuring stakeholder participation is crucial for improving the efficiency of environmental monitoring in the implementation of state and other environmental programs. Uzbekistan, public hearings as part of the EIA is regulated by Appendix 3 of Decree of the Cabinet of Ministers No 541 dated September 07, 2020. According to the Decree all objects divided in four categories and public hearings are mandatory for categories I and II (almost similar to World Bank A and B categories). There are no requirements for public hearing or EIA disclosure for Category III and IV projects

There are two non-mandatory mechanisms for public participation in the EIA assessment procedure which include the public hearings. The law allows for independent expert groups to organize public environmental review (PER) but the findings are non-mandatory. However, there are no provisions for public hearings.

In line with Uzbekistan National Requirements, the Project belongs to facilities of the Category-I of environmental impact.

17.1.2 International Requirements

17.1.2.1 AIIB Environmental and Social Policy

Environmental and Social Policy

The objective of this overarching policy is to facilitate achievement of these development outcomes, through a system that integrates sound environmental and social management into Projects. The overarching policy comprises Environmental and Social Policy (ESP), and Environmental and Social Standards (ESSs) and Environmental and Social Exclusion List. The ESP sets out mandatory requirements for the Bank and its Clients relating to identification, assessment and management of environmental and social risks and impacts associated with Projects supported by the Bank.

AIIB requires disclosure of environmental and social information in accordance with ESS 1. According the AIIB, the consultation covers Project design, mitigation and monitoring measures, sharing of development benefits and opportunities on a Project-specific basis, and implementation issues. The AIIB requires the Client to engage in meaningful consultation with stakeholders during the Project's preparation and implementation, in a manner commensurate with the risks to and impacts on those affected by the Project.

- Consultation is required for each Category A Project, and it is normally more elaborate than consultation for a Category B Project.

- Consultation for each Category B Project is undertaken in a manner proportional to the Project's risks and impacts.
- For each Project with (a) significant adverse environmental and social impacts, (b) Involuntary Resettlement or (c) impacts on Indigenous Peoples, the AIIB may participate in consultation activities to understand the concerns of the affected people and to require the Client to address these concerns in the Project's design and ESMP or ESMPF (as applicable) or other Bank-approved documentation.
- The AIIB requires the Client to include a record of the consultations and list of participants in the environmental and social assessment documentation.

The AIIB requires the Client to establish, in accordance with the ESP and applicable ESSs, a suitable Project-level GRM to receive and facilitate resolution of the concerns and complaints of people who believe they have been adversely affected by the Project's environmental or social impacts, and to inform Project-affected people of its availability.

According to the AIIB, the GRM is scaled to the risks and impacts of the Project. The GRM: (a) may utilize existing formal or informal complaint-handling mechanisms, provided that they are properly designed and implemented, and deemed by the Bank to be suitable for the Project (these may be supplemented, as needed, with Project-specific arrangements); (b) is developed in such a manner that it does not impede access to other judicial or administrative remedies that might be available under law or through existing arbitration or mediation procedures; (c) is designed to address affected people's concerns and complaints promptly, including gender-related concerns and complaints relating to GBV, using an understandable and transparent process that is gender sensitive, culturally appropriate and readily accessible to all affected people; (d) includes provisions: (i) to protect complainants from retaliation, grant them confidentiality and enable them to remain anonymous, if requested; and (ii) to protect those who defend the rights of complainants to make such complaints; (e) provides for maintenance of a publicly accessible case register and reports on grievance redress and outcomes, which are disclosed in accordance with the applicable ESS; and (f) is required to be operational by the time implementation of the relevant Project activities commences and for the duration of the Project.

The AIIB also requires the Client (including an FI Client) to establish or maintain a GRM for contracted Project workers under the Project to address workplace concerns, and reflect this in the tender documents for contracted Project workers. The requirements for this workplace GRM are described in ESS 1.

Environmental and Social Standard 1 (ESS 1)

The ESS 1 aims to ensure the environmental and social soundness and sustainability of Projects and to support the integration of environmental and social considerations into the Project decision-making process and implementation. ESS 1 is applicable if the Project is likely to have adverse environmental risks and impacts or social risks and impacts (or both). The scope of the environmental and social assessment and management measures are proportional to the risks and impacts of the Project. ESS 1 provides for both quality environmental and social assessment and management of risks and impacts through effective mitigation and monitoring measures during the course of Project implementation. The ESS 1 defines the detailed requirements of the environmental and social assessment to be carried out for any project to be financed by the Bank.

The AIIB ESS1 also requires;

- Carry out meaningful consultation with Project-affected people and other stakeholders and facilitate their informed participation in the consultations
- Meaningful consultation is an interactive process to provide information and facilitate informed decision-making that: (a) begins early in the preparation stage of the Project to provide accurate information on the proposed Project, minimize misinformation and unsupported expectations, and obtain initial views on the Project; (b) is carried out on an ongoing basis throughout the implementation and life cycle of the Project; (c) is designed so that all relevant parties have a voice in consultation, including national and subnational governments, the private sector, nongovernmental organizations and people affected by the Project, including, as applicable, Indigenous Peoples; (d) provides additional support as needed so that women, elderly, young, disabled, minorities and other vulnerable groups participate; (e) provides timely disclosure of relevant and adequate information, including availability of the Project's GRMs and of the PPM or other Bank-approved IAM, which is understandable and readily accessible to the people affected by the Project and other relevant stakeholders; (f) is undertaken in an atmosphere free of intimidation or coercion; (g) is gender sensitive, inclusive, accessible, responsive and tailored to the needs of vulnerable groups; and (h) enables the consideration of relevant views of people affected by the Project and other concerned stakeholders in decision-making.
- Continue consultation with Project-affected people throughout Project implementation as necessary on issues related to environmental and social performance and implementation of the Project-level GRM.

17.1.2.2 IFC Performance Standards

All of the IFC Performance Standards include requirements for an amount of stakeholder consultation/engagement (either in the ESIA, or as part of the future ESMS) and therefore the Project will require a level of engagement. In particular, IFC Performance Standard 1 on "Social and Environmental Assessment and Management Systems" describes the stakeholder engagement requirements in more depth.

IFC Performance Standard 1 requires that Clients should identify the range of stakeholders that may be interested in their actions and consider how external communications might facilitate a dialog with all stakeholders. Where projects involve specifically identified physical elements, aspects and/or facilities that are likely to generate adverse environmental and social impacts to Affected Communities the client will identify the Affected Communities and will meet the relevant requirements described below:

The client will develop and implement a Stakeholder Engagement Plan that is scaled to the project risks and impacts and development stage, and be tailored to the characteristics and interests of the Affected Communities. Where applicable, the Stakeholder Engagement Plan will include differentiated measures to allow the effective participation of those identified as disadvantaged or vulnerable. When the stakeholder engagement process depends substantially on community representatives, the client will make every reasonable effort to verify that such persons do in fact represent the views of Affected Communities and that they can be relied upon to faithfully communicate the results of consultations to their constituents.

In cases where the exact location of the project is not known, but it is reasonably expected to have significant impacts on local communities, the client will prepare a Stakeholder Engagement Framework, as part of its management program, outlining general principles and a strategy to identify Affected Communities and other relevant stakeholders and plan for an engagement process

compatible with this Performance Standard that will be implemented once the physical location of the project is known.

Disclosure of relevant project information helps Affected Communities and other stakeholders understand the risks, impacts and opportunities of the project. The client will provide Affected Communities with access to relevant information on: (i) the purpose, nature, and scale of the project; (ii) the duration of proposed project activities; (iii) any risks to and potential impacts on such communities and relevant mitigation measures; (iv) the envisaged stakeholder engagement process; and (v) the grievance mechanism.

When Affected Communities are subject to identified risks and adverse impacts from a project, the client will undertake a process of consultation in a manner that provides the Affected Communities with opportunities to express their views on project risks, impacts and mitigation measures, and allows the client to consider and respond to them. The extent and degree of engagement required by the consultation process should be commensurate with the project's risks and adverse impacts and with the concerns raised by the Affected Communities. Effective consultation is a two-way process that should: (i) begin early in the process of identification of environmental and social risks and impacts and continue on an ongoing basis as risks and impacts arise; (ii) be based on the prior disclosure and dissemination of relevant, transparent, objective, meaningful and easily accessible information which is in a culturally appropriate local language(s) and format and is understandable to Affected Communities; (iii) focus inclusive engagement on those directly affected as opposed to those not directly affected; (iv) be free of external manipulation, interference, coercion, or intimidation; (v) enable meaningful participation, where applicable; and (vi) be documented. The client will tailor its consultation process to the language preferences of the Affected Communities, their decision-making process, and the needs of disadvantaged or vulnerable groups. If clients have already engaged in such a process, they will provide adequate documented evidence of such engagement.

For projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation (ICP) process that will build upon the steps outlined above in Consultation and will result in the Affected Communities' informed participation. ICP involves a more in-depth exchange of views and information, and an organized and iterative consultation, leading to the client's incorporating into their decision-making process the views of the Affected Communities on matters that affect them directly, such as the proposed mitigation measures, the sharing of development benefits and opportunities, and implementation issues. The consultation process should (i) capture both men's and women's views, if necessary through separate forums or engagements, and (ii) reflect men's and women's different concerns and priorities about impacts, mitigation mechanisms, and benefits, where appropriate. The client will document the process, in particular the measures taken to avoid or minimize risks to and adverse impacts on the Affected Communities, and will inform those affected about how their concerns have been considered.

Clients will implement and maintain a procedure for external communications that includes methods to (i) receive and register external communications from the public; (ii) screen and assess the issues raised and determine how to address them; (iii) provide, track, and document responses, if any; and (iv) adjust the management program, as appropriate. In addition, clients are encouraged to make publicly available periodic reports on their environmental and social sustainability.

As Policy on Environmental and Social Sustainability and Access to Information Policy are directed towards Corporation itself, Performance Standards are directed towards clients, providing direction on risks and impacts identification. The standards are designed to assist in avoidance, mitigation, and management of risks and impacts of the project financed.

17.1.2.3 Equator Principles

The EPs reresent a framework for project financing, which is underpinned by the revised IFC Performance Standards (PS). EP$_4$ establishes the minimum Environmental & Social standards to be adopted by EP Financial Institution which are from IFC Performance Standards on Environmental and Social Sustainability (Performance Standards), the World Bank Group Environmental, Health and Safety Guidelines and/or the relevant host country laws, regulations and permits that pertain to environmental and social issues.

Relevant guidance notes published by the EP and applicable to the Project ESIA include the following:

- EP Guidance Note on Implementation of Human Rights Assessments Under the EP (2020)
- EP Guidance Note on Climate Change Risk Assessment (2020)
- EP Guidance Note on Biodiversity Data Sharing for EPFI Clients (2020)
- EP Guidance Note on Implementation of EP during the COVID-19 Pandemic (2020)

17.1.3 Project Stakeholders

As defined by the IFC in Stakeholder Engagement Handbook of 2007, stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project and/or the ability to influence its outcome, either positively or negatively. Stakeholders may include locally affected communities or individuals and their formal and informal representatives, national or local government authorities, politicians, religious leaders, civil society organisations and groups with special interests, the academic community, or other businesses.

Among the stakeholders, disadvantaged or vulnerable groups/persons refer to those who may be more likely to be adversely affected by the project impacts and/or more limited than others in their ability to take advantage of a project's benefits.

The detailed list of Project stakeholders, identifying specific stakeholders under the following external and internal stakeholder groups together with their interest in/relevant to the Project, is presented in the Stakeholder Engagement Plan (SEP):

Table 322: The Detailed List of Stakeholders

Stakeholder Group	Definitive Stakeholders	Specific Interest /Relevance/Influence
Project Affected People	• Residents of Uchkizil Mahalla (within 5 km radius of the project area) • Residents of Kattakum Mahalla (within 5 km radius of the project area) • Residents of Bahor Mahalla (within 10 km radius of the project area) • Residents of Dehqonbirlashuv Mahalla (within 10 km radius of the project area) • Residents of Ilgor Mahalla (within 10 km radius of the project area)	- Affected/potentially affected from Project-related E&S risks and impacts that will be managed through the Project's future ESMS - Management of E&S impacts

Stakeholder Group	Definitive Stakeholders	Specific Interest /Relevance/Influence
	• Residents of Karvon Mahalla (within 10 km radius of the project area) • Residents of Kayran Mahalla (within 10 km radius of the project area) • Residents of Khalqobod Mahalla (within 10 km radius of the project area) • Residents of Ilgor Mahalla (within 10 km radius of the project area) • Residents of Madaniyat Mahalla (within 10 km radius of the project area) • Residents of Markaz Mahalla (within 10 km radius of the project area)	- Cooperation to maximise benefits and planning for local employment and the supply of goods and services
Other interested parties	• Termiz Khokimiyat • Angor Khokimiyat • District Health Department • Department of Cultural Heritage of Surkhandarya Region • Department of Cultural Heritage of Surkhandarya Region • Termiz Archaeological Museum • Termiz District Education Department • Termiz District Health Department • Angor District Health Department • Angor District Agriculture Department • Angor District Educational Department • Angor District Cadastre Department • Amu Surkhan Regional Inspection Department • Angor District Labour Department • Angor District Road Construction and Transportation • Angor MonoCentre Official Training Centre (Ministry of Labour) • Angor District Youth Department • Termiz District Agriculture Department • Termiz District Labour Department • Termiz District Municipal Department • Termiz District Cadastre Department	- Influence on Project-related permitting processes - Coordination of Project activities and processes, and stakeholder engagement activities - Management of environmental and social impacts - Emergency preparedness and coordination - Management of cumulative impacts

Stakeholder Group	Definitive Stakeholders	Specific Interest /Relevance/Influence
	• Academic/educational institutions	
Disadvantaged and vulnerable	Women Youth Female headed households Fishermen People with disabilities People with irregular income	- Affected/potentially affected from Project-related E&S risks and impacts that will be managed through the Project's future ESMS - Ensuring that sensitive and disadvantaged Persons / Groups have access to sufficient information about the Project, ensuring that these persons / groups benefit equally from the benefits of the Project
Local businesses, suppliers, other industrial projects	Local companies	- Positively affected from potential Project benefits/opportunities - Supply of local goods and services related to the project - Coordination of infrastructure services - Management of cumulative impacts
Local media	National and local newspapers, local magazines and TV channels	Project information sharing with stakeholders

17.1.4 Stakeholder Engagement Plan

A stand-alone SEP has been prepared as part of the ESIA process based on the comprehensive social surveys conducted by the ESIA team. The purpose of the SEP is to establish and maintain constructive dialogue between the Project and the local communities, other stakeholders and interested groups.

The Project Company will assist and collaborate with the EPC Contractor to implement the SEP throughout the construction phase of the Project. The implementation of the SEP throughout the operation phase of the Project will be under the responsibility of the Project Company.

The Project SEP, inter alia:

- Identifies all stakeholders (individuals, groups or entities) directly and/or indirectly affected by the Project or have a direct or indirect influence/impact on the Project.
- Defines mechanisms and tools for appropriate engagement with each stakeholder group during the lifetime of the Project, with the ultimate aim of establishing and maintaining constructive relationship through public consultation and information disclosure.
- Establishes external and internal mechanisms that will ensure timely and appropriate implementation of actions for the management of grievances and feedback received.

17.1.5 Public Consultation Timeline

17.1.5.1 Public Hearing

In line with Uzbekistan National Requirements, the Project belongs to facilities of the I category of environmental impact, the management of the combined cycle power plant under construction together with representatives of the Angora District Khokimiyat, the Ecology and Environmental Protection Inspectorate, the Kattakum Village Community Assembly in the prescribed manner, were organized and carried out public hearings on 17th of August 2021.

During the public hearings with the participation of the population, issues of the implementation of the planned project were discussed and relevant presentations were presented on the technological process and the impact of the power plant on the environment, as well as social and economic benefits for residents of the area where the facility is located.

The main questions were about possible employment and state environmental monitoring during operation.

On the received questions satisfactory answers were given, it was explained that the state environmental monitoring will be carried out in accordance with the law, employment issues will be addressed as the start of construction.

The more public hearings were conducted as part of the socio-economic assessment of the impact area in Angor and Termez districts in Surkhandarya province, in 2021.

Both public hearings were conducted in Uzbek and lasted approximately 2 and half hours. Each focus group discussion was tape-recorded and later transcribed. Two focus group discussions were conducted at the two sides (Angor and Termez) on 28 of July, 2021. The number of participants and place of the event are given in the Table 323.

The majority of the participants stressed out that the positive sides of the project are much more than the negative consequences of the project. Following improvements were highlighted by participants as project positive effect: no more power cut in the settlements, unemployment decrease, district GDP will increase, possibility of the development innovative business models such as greenhouse development close to the power plant etc. However, there were several negative points against power plant construction and further operation in the district. The negative sides that participants spoke up

about are negative environmental consequences (micro-climate change, biodiversity change, noise from the TPP.

In general, they believe that the Project will benefit everyone. Despite listed by participants negative effects of the project, all participants supported the idea to have industry plant in the allocated place. The population of both districts believes that planned TPP would play a significant role in the development of the place they live in and in the reduction of the unemployment rate in the settlements. They hope that investors and government officials will involve local labor for the project construction and operation so that even unskilled people could get foundation training courses.

Many participants of public hearings in both districts emphasized that the drinking water, natural gas supply and unemployment are the most important issues that the local population ask pay attention to.

Participants also believe that it is important for the government and the project investor to attract population to the discussion of actions, hold a meeting in the mahalla, a discussion with the population, informing about the results of completed stages of works.

Moreover, drinking water supply in settlements and hire as many as possible local labor for the construction and operation period are the main anticipated actions from the government and project investor.

Generally, these focus groups were well received by the participants. Many participants expressed their appreciation of having the opportunity to "learn" about the project. They also were glad to be able to vocalize their opinion on this subject.

Table 323: Public Hearing Details

Date	Location	Representatives from	Number
28.07.2021 (Morning)	Small Hall of Termez hokimiyat, Uchqizil city.	Khokiyat, district statistic department, district health department, labor and social protection, mahalla etc.	24
28.07.2021 (Afternoon)	Conference Hall at Angor hokimiyat, Angor city.	Khokiyat, district statistic department, district health department, finance and investment department, labor and social protection, mahalla etc.	37

17.1.5.2 Local Authority Meetings

In 2022, within the scope of social baseline survey meetings were performed with 16 mahalla reis and local governmental authorities that can have influence on the project. Participants were informed on the project characteristics and time schedule of the project. List of governmental authories are as follow:

- Termiz Khokimiyat,
- Department of Cultural Heritage of Surkhandarya Region,
- Department of Cultural Heritage of Surkhandarya Region,
- Termiz Archaeological Museum,

- Termiz District Education Department,
- Termiz District Health Department,
- Termiz Khokimiyat,
- Angor District Health Department,
- Angor District Agriculture Department,
- Angor District Educational Department,
- Angor District Cadastre Department,
- Amu Surkhan Regional Inspection Department,
- Angor District Labour Department,
- Angor District Road Construction and Transportation,
- Angor MonoCentre Official Training Centre (Ministry of Labour),
- Angor District Youth Department,
- Uchkizil Mahalla,
- Kattakum Mahalla

that are located within 10 km radius of the project area.

Disclosures were conducted among 8 local authority representatives in Angor and Termez districts from 22 to 29 July, 2021.

Table 324: List of Settlements Located Within 10 Km of The Impact Area (Source: Local Authority Survey, July, 2021)

#	Settlements (Mahalla)
1	Bahor
2	Dehqonbirlashuv
3	Ilgor
4	Karvon
5	Kattakum
6	Kayran
7	Madaniyat
8	Markaz
9	Qoshtegirmon
10	Tallashqon
11	Zang Gilambop
12	Zartepa
13	Namuna
14	Orol
15	Uchkizil
16	Khalqobod

According to the results of the survey, none of the respondents is aware of the project, except for the district and regional Khokimiyats. Local authorities would like to know about the negative impact of the project on the life of the population, flora and fauna. Due to the high level of unemployment, the respondents were very interested to get information about the required specialist and the number of employees (see Table 325).

Table 325:Opinions of Local Authorities on Project

Questions	Answers of the respondents
Do you have any information about the Project?	*None of the respondents know about the project*
What do you want to know about the Project?	*Negative impacts of the project* *What specialists will be hired* *TPP operation year* *Job creation opportunities*
Who should give the information which do you want to know?	*Stone City, UzAssystem or Khokimiyat*
How should given the information which do you want to know?	*Via Telegram network*

17.1.6 ESIA Disclosure Process

The ESIA Disclosure Package of the Project includes this ESIA Report including the Environmental and Social Management Plan (ESMP), as well as stand-alone SEP and Non-technical Summary (NTS) documents.

During the 60-day ESIA disclosure period, the ESIA Disclosure Package will be published at the Project and the Lender's website. As per the relevant requirements of the international standards, NTS and SEP will be disclosed in national language by using appropriate disclosure methods. If any further comments are received during this disclosure period, comments will be registered and responded by means of methods described in SEP.

This section has been revised since the disclosure activities were conducted to inform the public who are likely to be affected by the planned Project and other interested stakeholders. In this respect, the disclosure activities have been documented, including the consultations conducted, feedback and comments received and what was the response or how they were reflected in the ESIA.

Specifically, the water quality and quantity of water withdrawn will be shared with the stakeholders identified in the SEP who will be affected directly/indirectly from the Project activities in this regard to monitor if there are any adverse impacts on the fishing and agricultural activities.

17.1.6.1 Meetings with Angor and Termez Hokimiyats

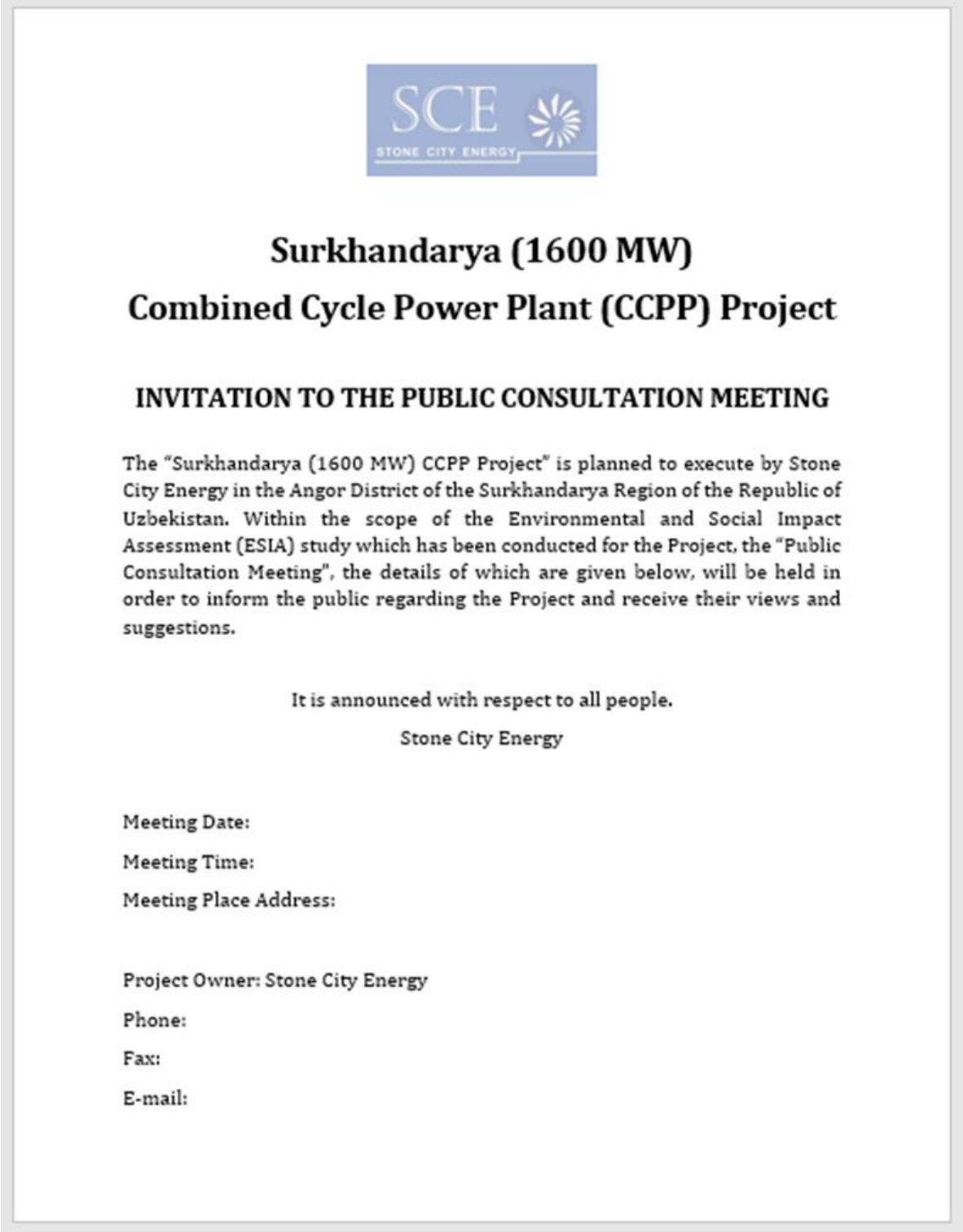
A meeting was held with the Deputy Khokim of Angor Hokimiyat on 19th December 2022 in Angor District before the public disclosure meeting to be held on 20th and 23rd December in Angor District. The Environmental Project Lead (Farrukh Sattarov) from Uzassystem and Senior Environmental Engineers (Arın Hellaç and Cevdet Kabal) from Assystem Turkey were available during the meeting. At the end of the meeting, Kattakum Mahalla Reis and his assistant also participated in the meeting.

Before the public disclosure meetings to be held on 22nd and 23rd December in Termez District, another meeting was held with the Deputy Khokim of Termez Hokimiyat on 21st December 2022 in Termez District. The Environmental Project Lead (Farrukh Sattarov) with the Translator (Aziz Mukhamedjanov) from Uzassystem and Senior Environmental Engineers (Arın Hellaç and Cevdet Kabal) from Assystem Turkey were available during the meeting. At the end of the meeting, with the participation of Uchkizil Mahalla Reis and Termez Hokimiyat Deputy Khokim of the Women/Girls Committee, Farruk Sattarov gave information on the meetings to be held in Termez District and the arrangements to be done for the meetings. He informed the authorities that the meeting to be held on 22nd December 2022 will include mixed public groups whereas the meeting to be held on 23rd December 2022 will be conducted for 2 separate focus groups consisting of women and youth only. Farrukh Sattarov shared his contact information with the Uchkizil Mahalla Reis and the Deputy Khokim and they also shared their contact information with Farrukh Sattarov.

During these meetings held with the Hokimiyats, Farrukh Sattarov made the introduction speech and gave some information regarding the Project's ESIA Report. He informed the Deputies about the Project's financers and the Project schedule. Then he mentioned the meetings to be held in Angor and Termez Districts within the scope of disclosure activities and arrangements to be needed to conduct before the meetings such as suitable locations that have a capacity of 30 people at least. The Deputies asked for information about the period of the construction phase and the number of people to be employed during the Project's construction and operation periods. Farrukh Sattarov responded that the construction period is 3 years and the planned number of workers during the construction and operation phases are 2,050 and 300, respectively. Farrukh Sattarov stated that the investor of the Project is Stone City Energy. The Deputies asked for information on the Project's investment cost for the construction phase and what type of agreement was signed between the Republic of Uzbekistan and the SCE. Farrukh Sattarov responded that the investment cost is 1.2 billion as it is indicated in Presidential Decree and the type of agreement is a public-private partnership (PPP). Farrukh Sattarov also stated that the Project is stimulated by the President's Decree and he mentioned the high technology to be selected for the Project.

17.1.6.2 Announcements and Disclosure Documents

The public disclosure meetings were held on 20th, 22nd and 23rd December 2022 in Angor and Termez Districts. The meetings were announced via advertisements in one local newspaper 20 and 23 days and another local newspaper 22 and 23 days in advances on 30th November 2022. The announcements were also carried out through the official Telegram channels of Surkhandarya Region and Termez District Khokimiyats in addition to the Mukhtars of Kattakum Neighborhood and Uchkizil Neighborhood. The announcement format for public informing about the disclosure meeting is given in Figure 233. The announcement notices are provided in Figure 234 and Figure 235.



SCE
STONE CITY ENERGY

Surkhandarya (1600 MW)
Combined Cycle Power Plant (CCPP) Project

INVITATION TO THE PUBLIC CONSULTATION MEETING

The "Surkhandarya (1600 MW) CCPP Project" is planned to execute by Stone City Energy in the Angor District of the Surkhandarya Region of the Republic of Uzbekistan. Within the scope of the Environmental and Social Impact Assessment (ESIA) study which has been conducted for the Project, the "Public Consultation Meeting", the details of which are given below, will be held in order to inform the public regarding the Project and receive their views and suggestions.

It is announced with respect to all people.

Stone City Energy

Meeting Date:

Meeting Time:

Meeting Place Address:

Project Owner: Stone City Energy

Phone:

Fax:

E-mail:

Figure 233. Announcement Format for Public Informing about the Disclosure Meeting

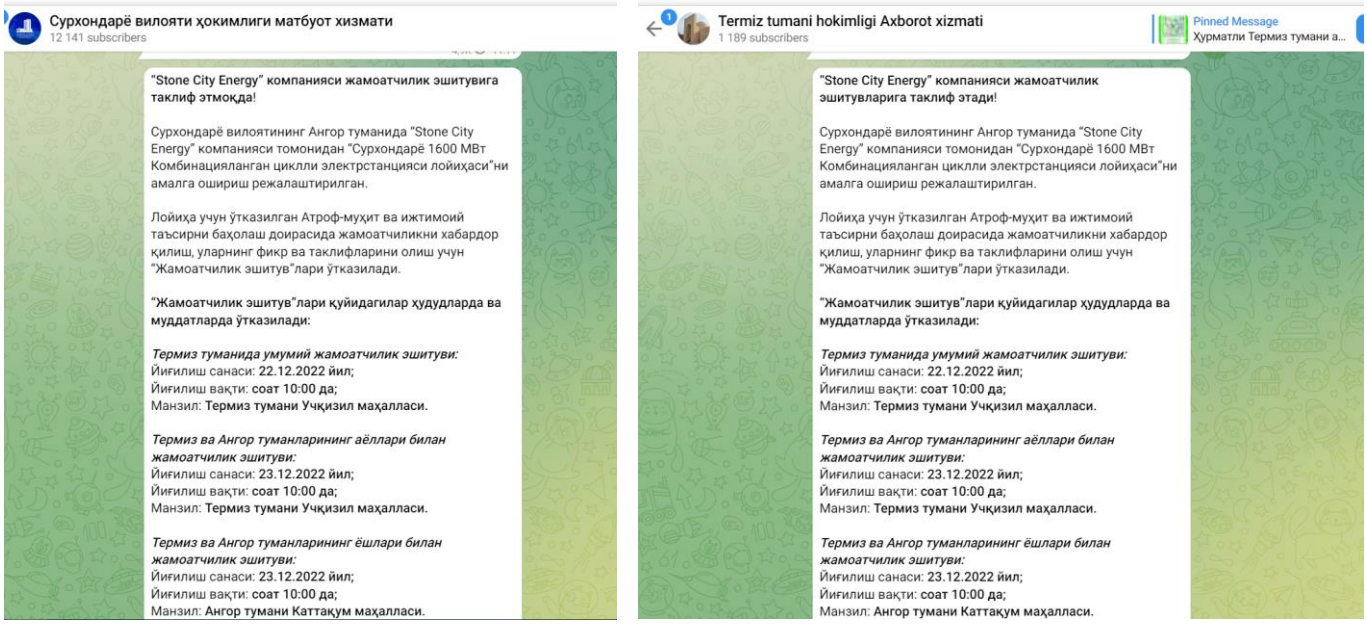


Figure 234. Official Telegram channels of Surkhandarya Region and Termez Khokimiyats

Figure 235. Newspaper Advertisements of Disclosure Meeting

As well as ESIA, NTS and SEP documents distributed, a PowerPoint presentation was presented (see Figure 236) and the Project leaflets (see Figure 237) in local languages were distributed to the participants during the meetings.

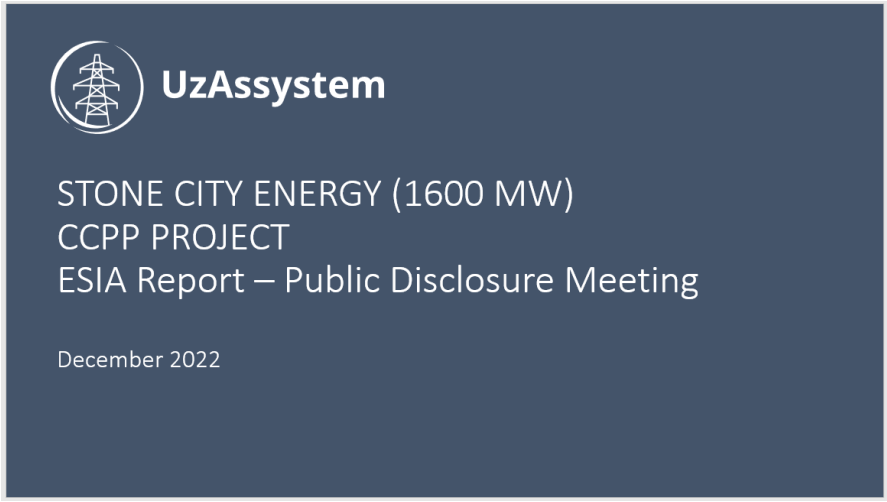


Figure 236. Presentation Given in the Disclosure Meeting

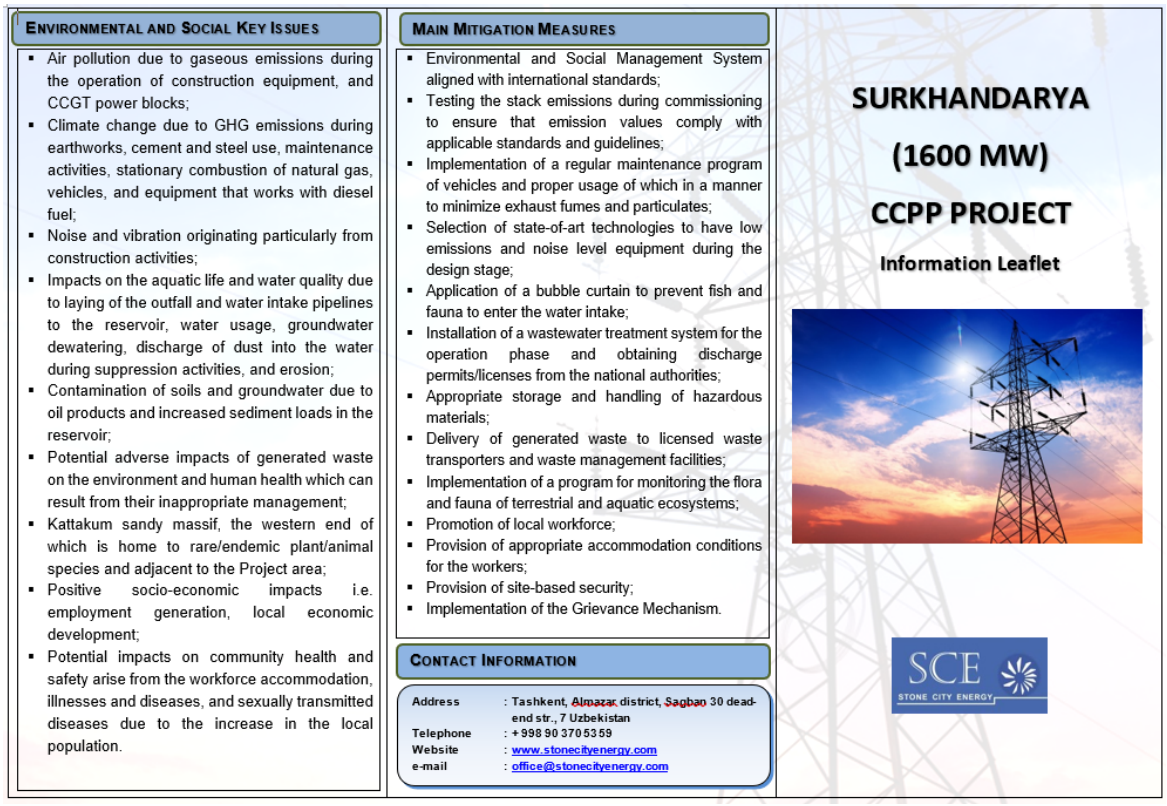


Figure 237. Brochure Distributed during the Disclosure Meeting

17.1.6.3 Disclosure Meeting in Angor District

A disclosure meeting was held on 20th December 2022 in Kattakum Neighborhood, Angor District. 27 people attended the meeting. The Environmental Project Lead (Farrukh Sattarov) from Uzassystem

and Senior Environmental Engineers (Arın Hellaç and Cevdet Kabal) from Assystem Turkey were available during the meeting.

The meeting presentation was presented by Farrukh Sattarov. The Project's GRM was also communicated with the participants. At the end of the meeting, the representative of Mono Center of Angor District which is under the Labor Ministry of the Republic of Uzbekistan presented short information about Mono Center and its capability to prepare human resources for the construction and operation period of the Power Plant. The photographs taken during the meetings and the participant lists are given in Figure 238 and Figure 239, respectively.

At the end of the meeting, there was also a question/answer session where participants raised questions and suggestions. All the questions were answered by Farrukh Sattarov kindly. The participants asked questions, and the answers given to these questions at the meeting are given below. No concern regarding the Project was received during the meeting.

The Questions raised during the Disclosure Meeting

Q1. Public (unknown): What kind of positions will be required during the construction and operation period of the Power Plant?

A1. It was noted that the construction period will mainly need professionals involved in construction such as welders, concrete workers, and specialists in metal structures, will also be required complementary professions such as cooks, drivers, and operators of machinery (excavators, graders, etc.). Mainly power engineers will be needed for the operational period.

Q2. *Public (unkown): What kind of impact is expected on the environment?*

A2. Information is given that the main source of environmental impact will be the impact on the air, as power generation will burn gas, but at the same time, it is noted that all norms and standards of air quality will be met. It is also noted that there will be an impact on water and on fauna and flora. At the same time information is given about the baseline and stakeholder engagement studies conducted as well as developed mitigation measures. It is also highlighted that a positive conclusion of the State Environmental Expertise was obtained for this Project.

Q3. Public (unknown): What kind of raw materials will be used to generate electricity?

A3. Natural gas.

Q4. Public (unknown): Will the water from the reservoir be used?

A4. Yes, water will be used, but in very small quantities, so it is planned to install an air-cooling system. It is also noted that the water discharged into the reservoir will comply with all norms and standards in force on the territory of the Republic of Uzbekistan.

Q5. The representative of Mono Center: When is the mobilization date?

A5. April 2023

Q6. What is the minimum education level to apply for construction positions during construction?

A6. As on any construction site, the level of professionalism will be evaluated based on knowledge and skills, not on the level of education only.

Q7. Where do they teach power engineers?

A7. The main base for training power engineers is the Tashkent State Technical University, and these faculties also function at many technical higher educational institutions.

Figure 238. Photographs from the Disclosure Meeting in Angor District

DISCLOSURE MEETING PARTICIPATION FORM
ЖАМОАТЧИЛИК ЙИҒИЛИШИДА ҚАТНАШИШ ВАРАҚАСИ
Location/Манзил Kattakum Mahalla/Angor District 33.maktab Data/Сана 20/12/2022

No	Name/Исми шарифингиз	Occupation/Иш жойингиз	Signature/Имзо
1	Cevdet Kabal	ESIA Expert	
2.	Рахмонкулова Гулчехра	Мактаб директори	
3	Назаров Мухиддин	Мактаб ўқит.	
4	Shomuratova Nafisa	мактаб ўқит	
5	Shodiyev Jasurbek	[illegible]	
6	Шомирзаева Нодира	мактаб ўқит.	
7	Xushboqov Mamatmurod	talaba	
8.	Orolov Tohir	talaba	

DISCLOSURE MEETING PARTICIPATION FORM
ЖАМОАТЧИЛИК ЙИҒИЛИШИДА ҚАТНАШИШ ВАРАҚАСИ
Location/Манзил Kattakum Mahalla/Angor District 33.maktab Data/Сана 20/12/2022

No	Name/Исми шарифингиз	Occupation/Иш жойингиз	Signature/Имзо
1.	Achilova Olmos Berdiyevna	uy bekasi	
2.	Rahmonqulova Gulnora	uy bekasi	
3	Tôxtaheva Diloram	hamshira	
4	Quloatova Xayitoy	uy bekasi	
5	Тўхтаева Дилафуза	уй бекаси	
6	Amirov Eldor	talaba	
7.	Бердиев Фарход	Ангор Мономарказ директор ўринбосари	
8	Олимов Зафар	Ангор Мономарказ	
9.	Анаев Хуршид	МФЙ раиси	
10.	Arin Hellas	ESIA Expert	
11.	Бекенов Жамшид	Туман ҳокимлиги	
12.	Маматқулов Фаррух	Туман ҳокимлиги	
13	Саттаров Фаррух	UzAssystem	

DISCLOSURE MEETING PARTICIPATION FORM
ЖАМОАТЧИЛИК ЙИҒИЛИШИДА ҚАТНАШИШ ВАРАҚАСИ
Location/Манзил Kattakum Mahalla/Angor District 33.maktab Data/Сана 20/12/2022

No	Name/Исми шарифингиз	Occupation/Иш жойингиз	Signature/Имзо
1	Бузрукова Замира	Ангор тумани 33-мактаб	
2.	Юсупова [illegible]	33-мактаб	
3	Rushboqova Surayyo	33-maktab	
4	Turdiqulova Xolnisa	33-maktab	
5	Nortŏrayev Sulton	Talaba	
6	Bozorov Doniyor	Talaba	

Figure 239. Participant Lists of the Disclosure Meeting in Angor District

17.1.6.4 Disclosure Meeting in Termez District

A Disclosure Meeting was held on 22nd December 2022 in Uchkizil Neighborhood, Termez District. 23 people attended the meeting. The Environmental Project Lead (Farrukh Sattarov) and the Translator (Aziz Mukhamedjanov) from Uzassystem together with the Senior Environmental Engineers (Arın Hellaç and Cevdet Kabal) from Assystem Turkey were available during the meeting.

The meeting presentation was presented by Farrukh Sattarov. The Project's GRM was also communicated with the participants. The participants asked for that during the clarification of the price of electricity, to consider the option of providing benefits and discounts on electricity prices. The photographs taken during the meetings and the participant lists are given in Figure 240 and Figure 241, respectively.

At the end of the meeting, there was also a question/answer session where participants raised questions and suggestions. All the questions were answered by Farrukh Sattarov kindly. The participants asked questions, and the answers given to these questions at the meeting are given below. No concern regarding the Project was received during the meeting.

Questions raised during the Disclosure Meeting

Q1. Public (unknown): Please answer what will be the thermal impact on the reservoir. And how will it affect the fish in the reservoir?

A1. It was noted that there were enough studies of the ichthyofauna in the lake. In order to have the least impact on water quality and ichthyofauna, the possibility of installing air cooling equipment is being considered. It was also reported that the Project received a positive conclusion from the State Environmental Expertise.

Q2. *Public (unknown): How will the consumption of gas in electricity generation affect the transmission of gas to the population?*

A2. It was stated that the decree of the President of the Republic of Uzbekistan on the organization of this Power Plant states that Uztransgaz is responsible for the gas supply for the production, which means that there will be no influence on the transfer of gas to the population.

Q3. Public (unknown): What professions will be needed during construction and operations?

A3. It was noted that the construction period will mainly need professionals involved in construction such as welders, concrete workers, and specialists in metal structures, and also require complementary professionals such as cooks, drivers, and operators of machinery (excavators, graders, etc.). Mainly power engineers will be needed for the operational period.

Q4. Public (unknown): Can you provide detailed information about the surveys you conducted?

A4. Yes, of course. You can ask your question now or contact Stone City Energy at those numbers and details, we provide. We also provide information about the surveys in the form of ESIA, non-technical summaries of booklets, and so on, to the chairman of the mahalla. Also, you can take leaflets to your neighbors.

Q5. Public (unknown): What will be the quality of the discharged water?

A5. Noted that there will be an impact on water, at the same time it is noted that all norms and standards of water quality will be met. Also, information is given about the baseline studies conducted as well as developed mitigation measures.

Figure 240. Photographs from the Disclosure Meeting in Termez District

DISCLOSURE MEETING PARTICIPATION FORM

ЖАМОАТЧИЛИК ЙИҒИЛИШИДА ҚАТНАШИШ ВАРАҚАСИ

Location/Манзил Uchkizil mahalla, Termez District ART DEPARTMENT Data/Сана 22 / 12 / 2022

No	Name/Исми шарифингиз	Occupation/Иш жойингиз	Signature/Имзо
1	Arın Hellaç	ESIA Expert	
2	Cevdet Kabal	ESIA Expert	
3	Aziz Mukhamedjanov	UzAssystem WGL	
4	Сайиторов Фаррух	UzAssystem PL	
5	Эрзаев Хасан	фуқаро	
6	Содатов Бўстон	фукоро	
7	[illegible] Р	фуқаро	
8	Раупов Б	раис МФЙ	
9	Маматкулов Ч.	раис ёрдамчи	
10	Махмудов М	фуқаро	
11	Юсупова Ойнахол	фуқаро	
12	Менглиева Норбегим	фуқаро	
13	Мардонақулова Гулноза	фуқаро	
14	Ятимишева Нигина	МФЙ хотин-қизлар фаоли	
15	Холмуродова Гулноза	Шахс ўтмишойиси	
16	Чернякова Виктория В.	фукоро	
17	Бобоев Жемрон	фуқаро	
18	Буронов [illegible]	[illegible]	
19	Тўраев Ю. Б	фуқаро	
20	Алманазаров А. Х.	фуқаро	

DISCLOSURE MEETING PARTICIPATION FORM

ЖАМОАТЧИЛИК ЙИҒИЛИШИДА ҚАТНАШИШ ВАРАҚАСИ

Location/Манзил Uchkizil Mahalla, Termez District Art Department Data/Сана 22 / 12 / 2022

No	Name/Исми шарифингиз	Occupation/Иш жойингиз	Signature/Имзо
1	Эшмуратов Нуро	нафақахўр	
2	Пиригалов Фаррух	Тадбиркор	
3	Норкулқорова Адолат	Янги - ҳаёт	

Figure 241. Participant Lists of the Disclosure Meeting in Termez District

17.1.6.5 Disclosure Meeting with the Women Group

A Disclosure Meeting for the women's group was held on 23rd December 2022 in Uchkizil Neighborhood, Termez District. 52 people attended the meeting. The Senior Environmental Engineer (Arın Hellaç) from Assystem Turkey and the Translator (Aziz Mukhamedjanov) from Uzassystem were available during the meeting.

The opening speech was made by Arın Hellaç in English. She introduced herself and gave a piece of short information regarding the ESIA Report developed for the Project. Then, she gave the floor to Aziz Mukhamedjanov. First, he translated the opening speech and then presented the meeting presentation in the Uzbek language. The Project's GRM was also communicated with the participants. A representative from the Termez Hokimiyat Women/Girls Committee also participated in the meeting. The photographs taken during the meetings and the participant lists are given in Figure 242 and Figure 243, respectively.

At the end of the meeting, there was also a question/answer session where participants raised questions and suggestions. All the questions were answered by Aziz Mukhamedjanov kindly. The participants asked questions, and the answers given to these questions at the meeting are given below. No concern regarding the Project was received during the meeting.

Questions raised during the Disclosure Meeting

Q1. Public (unknown): What positions will be provided for women? Will people of retirement age be hired?

A1. In recruiting workers, the main criterion will be professional skills, no restrictions on gender and age will be, with the exception of cases stipulated in the legislation of the Republic of Uzbekistan.

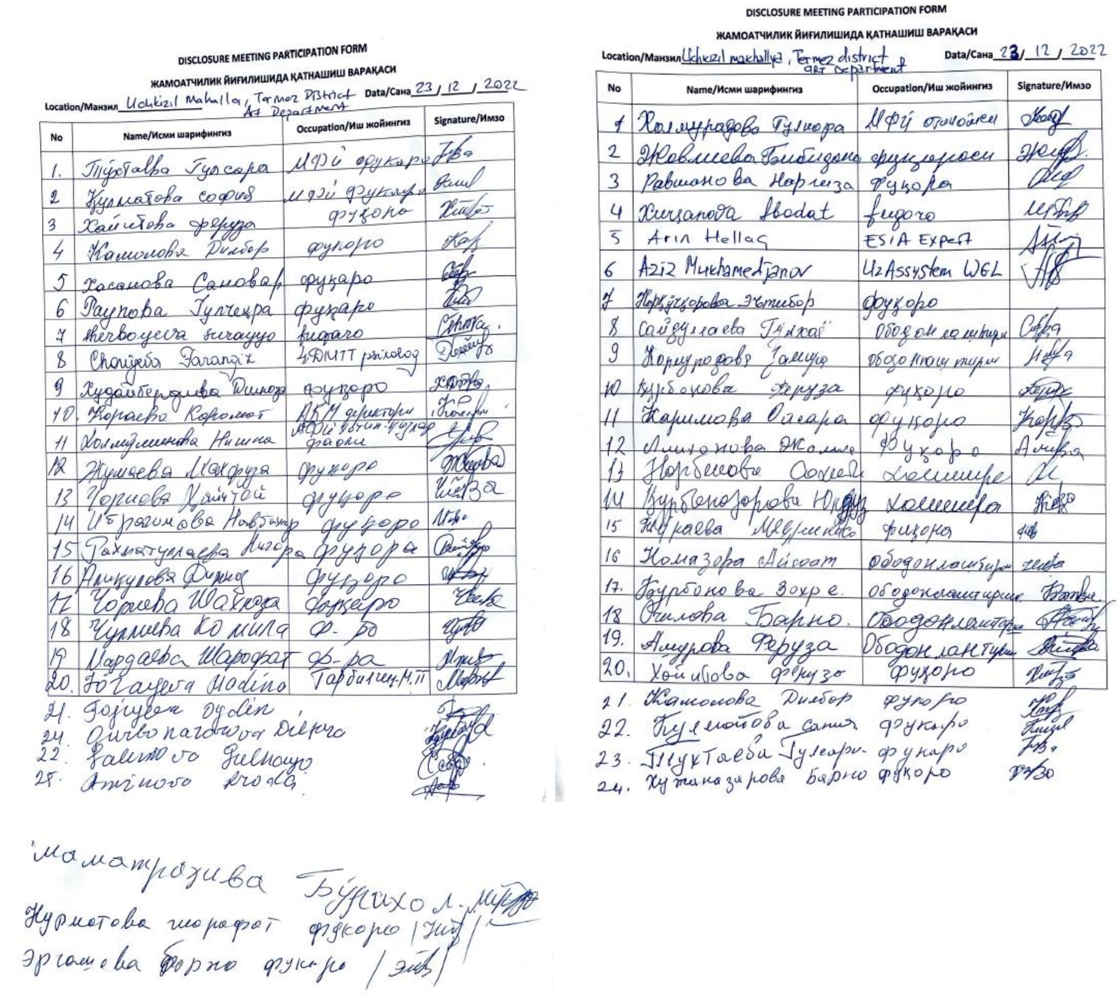
Q2. When does construction start and end?

A2. Starts – April 2023, Ends – March 2023.

Q3. Can you give information on the expected wages for workers during construction?

A3. At this stage it is too early to talk about it, at the time of hiring, wages will be negotiated individually with each applicant based on the professional level of the applicant.

Figure 242. Photographs from the Women Group's Disclosure Meeting


DISCLOSURE MEETING PARTICIPATION FORM
ЖАМОАТЧИЛИК ЙИҒИЛИШИДА ҚАТНАШИШ ВАРАҚАСИ
Location/Манзил Uchkizil Mahalla, Termez District Art Department Data/Сана 23/12/2022

No	Name/Исми шарифингиз	Occupation/Иш жойингиз	Signature/Имзо

DISCLOSURE MEETING PARTICIPATION FORM
ЖАМОАТЧИЛИК ЙИҒИЛИШИДА ҚАТНАШИШ ВАРАҚАСИ
Location/Манзил Uchkizil mahallya, Termez district Art Department Data/Сана 23/12/2022

No	Name/Исми шарифингиз	Occupation/Иш жойингиз	Signature/Имзо
5	Arin Hellag	ESIA Expert	
6	Aziz Muhamedjanov	UzAssystem WGL	

Figure 243. Participant Lists of the Women Group's Disclosure Meeting

17.1.6.6 Disclosure Meeting with the Youth Group

A Disclosure Meeting with the youth was held on 23rd December 2022 in Khokimiyat of Angor District. 23 people attended the meeting. The meeting was also announced through the Regional Branch of the Youth Affairs Agency. The Environmental Project Lead (Farrukh Sattarov) from Uzassystem and Senior Environmental Engineer (Cevdet Kabal) from Assystem Turkey were available during the meeting.

The meeting presentation was presented by Farrukh Sattarov. The Project's GRM was also communicated with the participants. The photographs taken during the meetings and the participant lists are given in Figure 242 and Figure 243, respectively.

At the end of the meeting, there was also a question/answer session where participants raised questions and suggestions. All the questions were answered by Farrukh Sattarov kindly. The participants asked questions, and the answers given to these questions at the meeting are given below. No concern regarding the Project was received during the meeting.

Questions raised during the Disclosure Meeting

Q1. *Public (unknown): Please indicate to the attending youth leaders what types of professions will be needed in the construction and operation of the Power Plant.*

A1. It was noted that the construction period will mainly need professionals involved in construction such as welders, concrete workers, and specialists in metal structures, and also require complementary professionals such as cooks, drivers, and operators of machinery (excavators, graders, etc.). Mainly power engineers will be needed for the operational period.

Q2. *Public (unknown): What is the expected impact on the environment and people?*

A2. Information is given that the main source of environmental impact will be the impact on the air, as for power generation will burn gas, but at the same time, it is noted that all norms and standards of air quality will be met. It is also noted that there will be an impact on water and flora/flora. At the same time information is given about the baseline and stakeholder engagement studies conducted as well as developed mitigation measures. It is also highlighted that a positive conclusion of the State Environmental Expertise was obtained for this Project.

Q3. Public (unknown): Please tell me how the generated electricity will be distributed.

A3. According to the Power Purchase Agreement, Stone City Energy undertook to guarantee the sale of generated electricity to a single buyer represented by the National Power Grid of Uzbekistan JSC, which is also specified in the Decree of the President of the Republic of Uzbekistan on the organization of the Power Plant. This means that the distribution of the generated electricity will be handled by the National Electric Grid of Uzbekistan JSC in the established procedure.

Q4. Public (unknown): Will the water from the reservoir be used?

A4. Yes, water will be used, but in very small quantities, so it is planned to install an air-cooling system. It is also noted that the water discharged into the reservoir will comply with all norms and standards in force on the territory of the Republic of Uzbekistan.

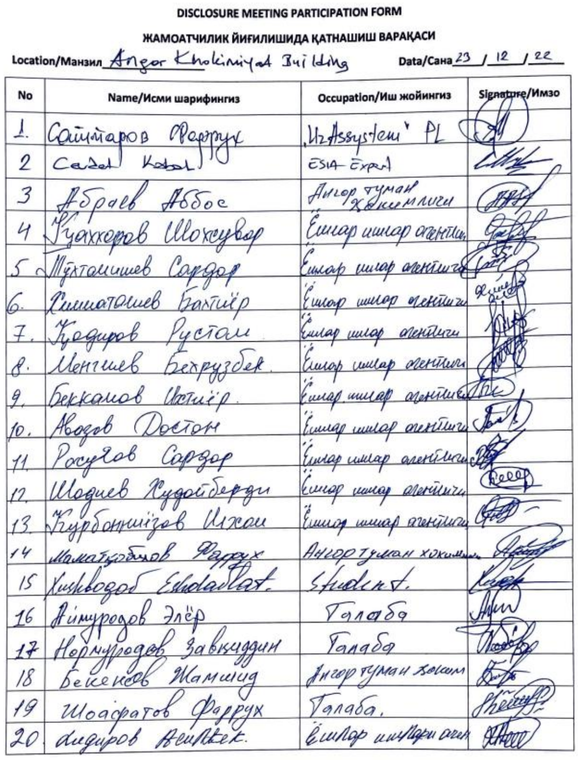
Q5. Public (unknown): When and how will local residents be recruited?

A5. Prior to the start of construction, there will be a commitment to recruit the necessary manpower, as is usually the case. All labor relations will be formalized in accordance with the labor laws of the Republic of Uzbekistan. During the construction work, all measures to ensure the safety and health of workers will be strictly observed.

Q6. Public (unknown): Can you give information on the expected wages for workers during construction?

A6. At this stage it is too early to talk about it, at the time of hiring wages will be negotiated individually with each applicant based on the professional level of the applicant.

Figure 244. Photographs from the Youth Group's Disclosure Meeting

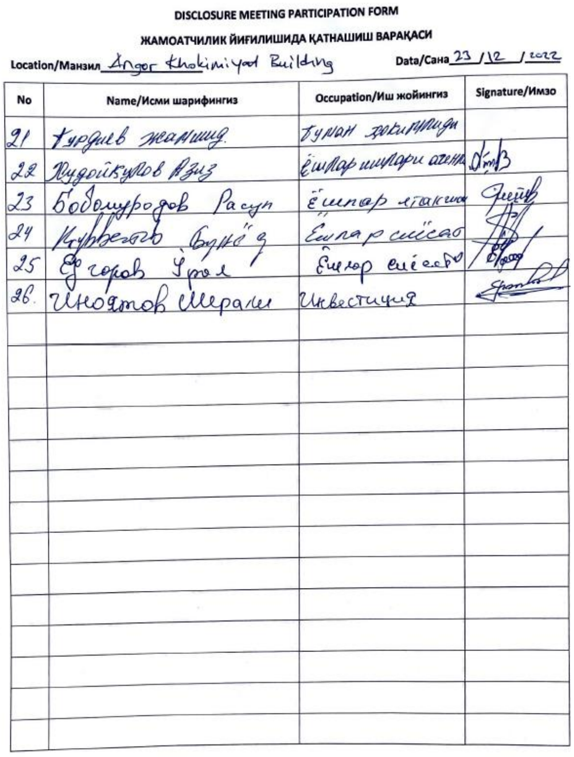


DISCLOSURE MEETING PARTICIPATION FORM

ЖАМОАТЧИЛИК ЙИҒИЛИШИДА ҚАТНАШИШ ВАРАҚАСИ

Location/Манзил Angor Khokimiyat Building Data/Сана 23 / 12 / 22

No	Name/Исми шарифингиз	Occupation/Иш жойингиз	Signature/Имзо
1.	Саттаров Фаррух	"UzAssystem" PL	
2	Cadat Kobal	ESIA Expert	
3	Абраев Аббос	Ангор туман хокимлиги	
4	Туаххоров Шохсувор	Ёшлар ишлар агентлиги	
5	Мўхтомишев Сардор	Ёшлар ишлар агентлиги	
6.	Химматошев Бахтиёр	Ёшлар ишлар агентлиги	
7.	Қодиров Рустам	Ёшлар ишлар агентлиги	
8.	Менгиев Бехрузбек	Ёшлар ишлар агентлиги	
9.	Бекканов Ихтиёр	Ёшлар ишлар агентлиги	
10.	Авазов Достон	Ёшлар ишлар агентлиги	
11.	Росулов Сардор	Ёшлар ишлар агентлиги	
12.	Шодиев Худойберди	Ёшлар ишлар агентлиги	
13.	Курбонниёзов Илхом	Ёшлар ишлар агентлиги	
14	Маматкурбонов Фаррух	Ангор туман хокимлиги	
15	Xushboqov Ekhdavlat.	Student.	
16	Ашуродов Элёр	Талаба	
17	Нормуродов Завқиддин	Талаба	
18	Бекенов Жамшид	Ангор туман хоким	
19	Шоафатов Фаррух	Талаба.	
20.	Дидиров Асилбек.	Ёшлар ишлари аген	



DISCLOSURE MEETING PARTICIPATION FORM

ЖАМОАТЧИЛИК ЙИҒИЛИШИДА ҚАТНАШИШ ВАРАҚАСИ

Location/Манзил Angor Khokimiyat Building Data/Сана 23 / 12 / 2022

No	Name/Исми шарифингиз	Occupation/Иш жойингиз	Signature/Имзо
21	Турдиев Жамшид	Туман хокимлиги	
22	Худойкулов Азиз	Ёшлар ишлари агент	
23	Бобомуродов Расул	Ёшлар етакчи	
24	Курбонов Бунёд	Ёшлар сиёсат	
25	Егоров Урол	Ёшлар сиёсат	
26.	Иноятов Шерали	Инвестиция	

Figure 245. Participant Lists of the Youth Group's Disclosure Meeting

17.1.7 Grievance Mechanism

From the national legislation prospective there is a centralized complaints mechanism (online portal) for all public utility providers that was opened in 2017 by Presidential Decree No. 728 of 15/09/2017. As this online portal is intended for wide range of issues brought to government attention, it was considered more appropriate to develop a single system/approach for receiving feedback and complains from stakeholders. The following approach was used in the establishment of the Project specific grievance mechanism.

This part of the report describes grievance redress mechanism which is going to be implemented for the project for internal (construction and commissioning personnel, workers, project staff) and external parties including supply chain system.

A Grievance Redress Mechanism (GRM) is a set of measures that enable stakeholders to raise grievances to the project and seek redress when stakeholders perceive an adverse impact arising from the project activities together with recommendations and feedback. The mechanism sets out clear systematic steps for affected individuals and communities to submit complaints and feedback and simultaneously for the Project in responding to queries, feedbacks and complaints received. The mechanism will be applied to guarantee the project is responsive to any concerns and grievances particularly from affected stakeholders and communities.

The mechanisms will seek to resolve concerns promptly, using an understandable and transparent consultative process that is culturally appropriate, and at no cost and without retribution to the external or internal party that originated the issue or concern.

The key principles of the external and internal grievance mechanism will be to:

- Ensure impartiality, confidentiality, and free of coercion or intimidation.
- Ensure resolution of concerns within the time frames specified in the Project SEP.
- Provide an understandable and transparent consultative process that is culturally appropriate and readily accessible.
- Provide the option of submitting grievances and feedback anonymously.
- Provide access at no cost and without retribution to the party that originated the issue of concern.
- Not impede access to judicial and administrative remedies

Besides the right to appeal the outcomes of the grievance process, the rights of the grievance/feedback holder includes more than only the right to appeal the outcomes of the grievance process, as indicated below:

- The grievance/feedback holder does not have to participate in the grievance and feedback mechanism and can choose to follow other remedies, including other judicial, administrative, civil, etc. remedies. The judicial or administrative remedies will be applicable as per the Government of Uzbekistan and relevant legislation.
- The grievance/feedback holder cannot be coerced to participate in the grievance management process.
- The grievance/feedback holder can choose to stop participating in the Project grievance and feedback mechanism at any time and elect to follow other remedies.

GRM will be available to construction and commissioning personnel, workers, project staff and people living or working in the areas impacted by the project activities. Any impacted or concerned person or group of people about the project activities have the right to participate in the GRM and be encouraged to use it. Moreover, the developed GRM does not replace the public mechanisms for filing complaints and resolving conflicts in the legal system of Uzbekistan, but, on the contrary, seeks to minimize its use as much as possible.

The external and internal grievance collection channels to be used during the construction and operation phase are described in Table 326. The Project Owner will review and adapt these channels, as appropriate and consistent with their internal/institutional procedures and mechanisms, within the SEP to be updated prior to start of operation phase and implemented throughout the operation phase.

The Project will enable GRM focal points: (i) local level (Project site) offices including (a) EPC contractor during the construction phase and (b) O&M office during the operation phase; and (ii) central level in Tashkent both during construction and operation phases. By this arrangement, the project will intend to address effectively and efficiently all grievances raised at the grass root level.

- The first tier will be at the Project site level. Both the EPC contractor and the O&M office have the primary responsibility for uptake grievances as well as handling them as per the adopted GRM. Unresolved grievances will be elevated to the second tier.
- The second tier will include the Grievance Redress Commission (GRC) established at the central level at the office of the Project owner. The GRC will be available for any parties to submit a grievance directly. GRC will resolve issues that could not be resolved at the local level or those that came directly. The GRC will deal with issues before referring to legal recourse.

To promote the transparent and efficient implementation of the project, the PMU will accept and investigate queries from any Project-affected parties, including anonymous queries.

Table 326. External and Internal Grievance Collection Channels for Construction and Operation Phase

Grievance Collection Channels	Explanation
Central level – Stone City Energy (Construction and Operation phases)	
Project Phone Line	+ 998 90 370 53 59
Project Web-site	www.stonecityenergy.com
Project E-mail	office@stonecityenergy.com
Official Letter Address	Tashkent, Almazar district, Sagban 30 dead-end str., 7 Uzbekistan
Plant level – O&M Office of the plant (Operation phase)	
Operation and Management office of the plant	Contact details to be confirmed
Project Owner Social Manager	Social Manager will collect grievances during stakeholder meetings, through phone calls, e-mails, etc. and manage them as per Project SEP.
Plant level – EPC Contractor (Construction phase)	
EPC Contractor CLO	Contact details to be confirmed
	CLOs will collect grievances during public and individual meetings, through phone calls, e-mails, etc. and manage them as per Project SEP. Where required, CLOs will help stakeholders on how to fill in grievance forms.
Grievance forms and boxes	Grievance forms and boxes will be placed in all mahallas affected from Project and at relevant work sites.
Country complaint handling system	
National System	Please see Section 17.1.7.3
District hokimiyat	Hokimiyat of Angor and Termez districts
Provincial hokimiyat	Hokimiyat of Surkhandarya province
National level	Virtual reception of the President of the Republic of Uzbekistan • By calling the phone number 0-800-210-00-00 or the short number 10-00; • By using the online portal and filling out a special request form on the website pm.gov.uz; • By visiting the People's Reception Office. The address of the 14 People's Reception offices in each district of the Bukhara region are provided on its site.

17.1.7.1 External Parties / Local Community Grievance Redress Mechanism

The Project Owner Social Manager will engage with the PAPs to inform and integrate their feedback and suggestions to the process. The Social Manager will undertake an awareness raising process and inform the external stakeholders, including local communities, about Project's grievance and feedback collection channels.

All complaints/suggestions evaluated under the Grievance Redress Mechanism will be recorded as in the Grievance Log Form table given in SEP. Information about the complaint, the complainant and detailed information about the action taken will be recorded in this database as detailed.

The step-by-step internal and external grievance redress process to be adopted is provided in Table 327. In addition, sample forms to be used by the Social Manager for GRM are the Grievance Form that is given in SEP.

Table 327. Grievance Redress Mechanism Flowchart

Grievance Redress Mechanism	Requirement / Action
Submission of a complaint	Receiving the grievance by any communication channel explained above.
Registration of complaint	Registering/recording through making an entry in the sample grievance log table and filling of the Grievance Form. All the complaints will be registered within two (2) working days and feedback will be given to the complainant. If the complainant requests that this complaint be treated anonymously, this complaint will be recorded anonymously and the request will be met.
Forwarding of complaint	The compliant is forwarded to relevant persons (related experts on construction/operation sites) responsible for handling the complaint in not later than three (3) working days upon receiving the complaint (except for any emergent complaint, which would be handled as appropriate).
Evaluation of a complaint	Evaluating the complaints within ten (10) working days and determining whether the complaint meets the admissibility criteria. If the complaint is not valid, providing relevant explanation to the complainant.
Response for a complaint	If the complaint is valid, identifying and taking corrective measures for resolving the complaint in not later than fifteen (15) working days upon receiving. If resolving the complaint would take longer, a partial response could be provided to the complainant. All comments and complaints will be responded to either verbally or in writing, in accordance with the preferred method of communication specified by the complainant, if contact details of the complainant are provided. At this point, it should be noted that the action taken and the result of this anonymously recorded grievance should be shared on the Project Owner's website, so that anonymous complainants is informed about their complaint and the results.
Recording the result of a complaint	Recording the result of the complaint in register log.
Right to Appeal	If the complaint cannot be resolved with the existing process, applicants can always apply to relevant legal institutions.

17.1.7.2 Internal Parties/Worker Grievance Redress Mechanism

The internal grievance mechanism will have same operational flow as External Grievance Redress Mechanism and will be made available for all construction and commissioning personnel associated with construction and commissioning activities to enable them make work related concerns. This includes all those employed by the Project Company, EPC contractor, sub-contractors, any other related contractors and project site visitors. All construction and commissioning personnel will be made aware of the grievance mechanism during their employment inductions at the project site and in employment documents.

Grievances of construction and commissioning personnel will be made in writing to the EPC Contractor via a specific grievance form. The grievance form will be made available at key locations on-site (e.g. administration block, canteen area, and office locations) as well as at any staff accommodation area. The grievance form will be available in Uzbek, Russian, English and any other languages of Project staff. Where the complainant is illiterate, the complaint can be made verbally in confidence to a manager, so that the manager will complete the grievance form on behalf of the grievant.

Grievance forms will include contact details of the complainant; however, a grievance can be raised anonymously if desired. Grievance forms will be posted in a sealed and locked 'post box', located at all key locations where grievance forms are available. The grievance box will be checked on a regular schedule several times a week. If a verbal grievance is preferred this can be specified by the complainant at the time of raising the grievance and the responsible staff will also record the grievance received and register it via the formal process.

Responses to grievances will be transparent and free of retribution. Follow-up to grievances will be completed on a grievance follow up form and signed off by the Project Owner and EPC Contractors

grievance control representative. The follow up form will state all actions taken to resolve the grievance and any further dialogue that had ensued, as well as any future monitoring of the situation or other planned actions. The completed and signed off forms will be kept in a dedicated grievance mechanism folder on site, which will be made available for review to the external independent environmental and social auditors during the periodic environmental and social audits required during the construction and commissioning phase.

17.1.7.3 Management of Sexual Exploitation and Abuse/Sexual Harassment (SEA/SH) Issues

The grievance mechanism will include handling SEA/SH complaints. The GRM that will be in place for the project workers will also be used for addressing SEA/SH related issues and will have in place mechanisms for confidential reporting, with safe and ethical documenting of SEA/SH issues.

The GRM will include a channel to receive and address confidential complaints related to SEA/SH, with special measures in place. If an employee faces SEA/SH issue s/he can either apply to a higher level superior or go directly to the national referral system of the country for dealing such cases. The content and procedures of the project's GRM will also have a reporting line on such cases in regard to SEA/SH issues and will be handled under full confidentiality and with the consent of the survivor. Project owner or contractor shall not investigate any SEA/SH cases without survivor's informed consent. If the Project owner or contractor will receive a SEA/SH related grievance, the severity of the grievance will be evaluated. The following potential sanctions will be applied depending on the severity of the grievance:

- Informal or formal warning;
- Additional training;
- Loss of up to one week's salary;
- Suspension of employment (either administrative leave as above or without payment of salary) for a minimum period of one month up to a maximum of six months;
- Termination of employment;
- Referral to the police or other authorities as warranted (wit survivor's informed consent).

All details of the complainant of the sensitive case will be kept strictly confidential.

All details of the GBV and SEA/SH survivors will be kept strictly confidential in the Grievance Register Database; and

- The GRM Officer will not ask for, or record, information on more than the following related to the GBV and SEA/SH allegation:
- The nature of the complaint (what the complainant says in her/his own words without direct questioning);
- If, to the best of the survivor's knowledge, the perpetrator was associated with the project; and if possible, the age and sex of the survivor.

17.1.7.4 Grievance Redress Mechanism: National System

If after the intervention and assistance from the GRC, no solution has been reached, and if the grievance redress system fails to satisfy the complaining parties, the case will be referred to the court for resolution in accordance with the legislation of Government of Uzbekistan.

In the meantime, it should also be emphasized that the GRM Guideline does not limit the right of the complaining party to submit the case to the court of law in the first stage of grievance process.

Moreover, in the Government of Uzbekistan Complaint Handling System functions. This is another option of filing a complaint. The Law of the Republic of Uzbekistan on the Appeals of Individuals and Legal Entities was introduced on 29 October 2014 and this law replaced the earlier law on Appeal of Citizens that was introduced on 13 December 2012. This law guarantees the right to appeal and prescribes the requirements of an appeal, its form and structure. Further, the timeline for addressing the appeal, the procedure for personal hearing, need for maintaining record of appeals and procedure for second appeal are prescribed.

According to the law, affected persons can submit their grievances through the Virtual reception of the President of the Republic of Uzbekistan, which is an online portal. From February 2018, the online version is updated and presented on this online portal. All citizens of the country can use different options for their appeals.

- By calling the phone number 0-800-210-00-00 or the short number 10-00;
- By using the online portal and filling out a special request form on the website pm.gov.uz;
- By visiting the People's Reception Office. The address of the 14 People's Reception offices in each district of the Bukhara region are provided on its site.

This mechanism assures the constitutional rights of citizens to appeal to the President of the Republic of Uzbekistan. Through this system, any persons in Angor and Termez districts can send their applications, suggestions and complaints to the portal of the President of the Republic of Uzbekistan. After receiving the complaint from a district, the responsible person from online portal will provide complainant with contact details of the responsible person from related Hokimiyat. The Hokimiyat will directly request the Project Social manager of "Stone City" LLC to resolve the grievance, with an option of sending the grievance through an email. In the new version of the Virtual Reception, the complainant can indicate the mahalla in which they live when submitting the appeal. This will speed up the solution of the problem, help determine which sector is responsible for the problem resolving.

The online portal has provisions for checking the status of the grievance and further appeal if the appellant has been harassed for raising the grievance. If someone who sends a complaint is persecuted, she/he can quickly report it by pressing a special "button" on the same site. Such messages will be considered promptly and with high priority of involving law enforcement agencies.

17.1.7.5 AIIB'S Project-affected People's Mechanism

AIIB's Project-affected People's Mechanism (PPM) applies to this Project. The PPM has been established by AIIB to provide an opportunity for an independent and impartial review of submissions from Project-affected people who believe they have been or are likely to be adversely affected by AIIB's failure to implement the ESP in situations when their concerns cannot be addressed satisfactorily through the Project-level GRM or the processes of AIIB's Management. Information on AIIB's PPM is available at: https://www.aiib.org/en/policies-strategies/operational-policies/policyon-theproject-affected-mechanism.html.

17.1.7.6 Disclosure of the Grievance Process

Information about the grievance handling process (Including PPM) will be disseminated through booklets and posted to the Khokimiyat. During informal meetings on the project site during the construction phase of the Project, grievance mechanism will also be presented. Information on the resolution of grievances will be summarized in the Project Environmental and Social progress reports.

17.1.7.7 Engagement Methods

The following methods will be used to inform stakeholders about the on-going stakeholder engagement process during construction and operations of the Project:

Letters, Phone calls and email - Suitable to engage interest-based stakeholders and to notify them of the engagement and disclosure mechanisms.

Posters or Notices - Signboards and Illustrative posters (info graphics) will be placed at the Project entrance gate, including direct access to the grievance mechanism.

Social Media – This may include use of messaging platforms such as Telegram, Zoom, Facebook, etc. to communicate general information about the Project.

Local media, weekly official newspaper of Angor Khokimiyat (Angor yog'dusi gazetasi)

Data privacy must be ensured and protected if a stakeholder database is established.

Meetings with community leaders- These can be informal meetings held with community leaders so as to maintain good relations with the community and address any concerns the community might have.

Bilateral meetings - Suitable to engage impacted and interest-based stakeholders as identified, to allow these stakeholders provide their views and opinions and to notify them of the engagement and disclosure mechanisms.

Online – Useful for Interest-based Stakeholders. The engagement and disclosure mechanisms for the ESIA package during the construction and operational phases of the project will be advertised on website with a contact point provided for comment. The same will be available on the lending institution respective websites.

18. LIVELIHOOD RESTORATION

During the social site surveys conducted in 2021 and 2022, no formal and/or informal landusers are observed within the project area. Although the project does not have any impact on livelihood of households and communities, a Livelihood Restoration Framework (LRF) is presented within this ESIA Report to ensure that the Project company will follow the minimum requirements set in this plan, in case required. The LRF sets out the Project company program for ensuring that project affected people are fully compensated for their losses, in a manner such that their livelihods are completely restored. The objectives of this LRF are to:

- Provide a framework that sets out how the Project will approach any economic displacement resulting from its operations.
- Ensure that negative impacts of future economic displacements are mitigated.
- Define the process and timeframe for the development of a detailed Livelihood Restoration Plan (LRP).

The LRP will comply with the following principles:

- avoid or, when unavoidable, minimise, involuntary resettlement by exploring alternative designs;
- ensure provision of adequate compensation for loss of income / assets at replacement cost;
- improve, or at least restore, the livelihoods and standards of living of affected communities;
- consult with, and encourage the informed participation of those affected, and disseminate all relevant information to stakeholders.

This document can be updated, as a result of consultations with stakeholders, as part of stakeholder engagement activities. The LRF will set the livelihood restoration process which should be implemented and developed as part of the LRP.

18.1 Legislation – Institutional Framework & International Standards

International lenders have for managing social, economic and environmental risks and impacts, such as World Bank (WB) has Operational Policy (OP) and Environmental and Social Standards (ESSs), Asian Infrastructure Investment Bank has Environmental and Social Policy, and International Finance Corporation (IFC) has Performance Standards (PS).

The national and local legislation of Uzbekistan and Surkanderya region, where the project will be implemented, will bring many social, environmental and economic limitations and opportunities for the management of the impacts that will occur during and after the implementation of the project.

Conducting the analysis of national and international regulations and standards interact between the impact of the project and the people of the region can answer this question is important for the beginning of the LRP study. Because laws and standards will provide new opportunities and limitations for the direct and indirect livelihoods of the people living in the region, and will function in minimizing their grievances, if any.

During these analyses, it is important to identify any gaps and contradictions, especially between the legislation of Uzbekistan and international standards.

In order to fill the gap that will arise due to these contradictions, the proposed actions and activities should be specified.

18.2 Assessment of Existing Situation

Describing the socio-economic situations – baseline data, including demographic composition of project effected people; income & expenditure; income sources; perceptions on their livelihood; fishery & agriculture & husbandry activities of affected people; education, health, poverty, gender, natural environment, etc.

If the assessment of the existing situation is divided into two parts, regional and local, the data presented in the assessment process can be used as a more effective tool.

According to, conducted social impacted assessment surveys such as household, local authority and focus group discussion can gather information about existing situation.

18.3 Impact on Livelihoods

- Potentially Affected Assets and Values (properties, building – structures, settlement lands, agricultural lands, crops, products, forested areas, pasture lands, areas for aqua product, communal lands, roads, any kind of access, historical places, natural areas, natural resources, heritage sites, intangible assets & values, businesses.)
- Potential Impact on Livelihoods:
    - Analysis of the effects on assets and values by determining their direct and indirect relationships with the below listed livelihoods.
    - Loss of agricultural lands, products, grazing lands, forest and forest products, hunting and fishery.
    - Loss of infrastructure including transformation, sanitation, community facilities, commercial buildings, etc.
    - Businesses that will lose income
    - Employment, which includes job opportunities and loss of existing jobs
    - In particular, losses of people in fisheries and aquaculture production, who will experience loss of income due to changes in water quality and quantity.
    - Determining whether there will be income losses due to possible effects on livestock and agricultural production, soil and water resources, which are an important source of livelihood for the people of the region.
    - Identifying disadvantaged and vulnerable groups and identifying possible impacts on them, determining whether there is a need for specific LRP action.
    - Preliminary investigation of whether there will be socio-economic inequality, conflict and unfair income distribution among the people of the region due to the opportunities that the power plant will create and determining the risks.
    - Potential impacts arising from changes in land use (forest, agriculture etc.) during construction activities of the OHL.

18.4 Eligibility and Entitlement

Eligibility is the preparation of a set of criteria and justifications for who can (and also who cannot) benefit from compensation or support in the LRP process.

It determines the rules regarding the compensation of immovable assets when necessary. For the implementation of a transparent and fair LRP between the parties, it is important that it is prepared in detail and in a language that stakeholders can understand.

In this section, the legal responsibilities of the parties are also noted. Relevant legal articles are used as a reference when necessary. Eligibility is an issue that stakeholders may doubt and may cause disagreements. Often the locals do not carefully read the criteria on this subject or long explanations can be tiring for them. For this reason, it is important to explain the eligibility criteria to stakeholders through face-to-face meetings describing the process.

During the development of the LRP process, a series of alternative livelihood assistance and compensation measures will be made available to the affected land owners and users (including fish farmers). The selected livelihood assistance options and compensation package (either in cash or alternative land) will be evaluated through consultation with the affected people to determine their suitability. The options will be considered based on different categories of Project Affected Persons (PAPs) and nature of impact (permanent or temporary loss of land/assets or income).

A preliminary entitlement matrix is presented below to see out the principles of compensation for the different groups of affected people depending on the assets, properties and livelihood loss as a result of the project. This matrix will need to be updated and tailored to the identified impact and affected persons as part of the LRP.

In accordance with AIIB Environmental and Social Policy, IFC Standards and Equador Principles, economic activities and livelihoods will be assessed to identify appropriate compensation and mitigation measures. The eligibility will be determined based on the census of affected households/land plots and the date of the census will serve as a cut-off data for compensation for persons with no formal claims to land/assets.

It should be noted that the livelihood restoration process for the new right of way is dependent on third-party action (National Electric Grid of Uzbekistan, NEGU). As land acquisition and resettlement are the responsibility of the RUz, the Project Company will collaborate with NEGU, to the extent permitted by the authority, to achieve outcomes addressed in the matrix (see Table 328) that are consistent with IFC PS5. The Project Company will liaise with NEGU to obtain information about the valuation process undertaken for the project following national law to:

- identify and describe the measures that NEGU plans to use to compensate any PAPs,
- to develop a proposal to complement RUz actions where necessary (likely to be in the form of non-monetary efforts to restore lost livelihoods) in case the relevant measures planned to be taken by the authority do not meet PS5 requirements for replacement value.

In addition, the Sponsor will disclose the Project GRM and provide evidence that PAPs are informed that the GRM covers the Project activities within the scope of OHTL construction as well.

Table 328 Entitlement Matrix

Category of Affected Persons	Type of Project affected right/property/loss	Entitlement
Land owners	Loss of land as consequence of land acquisition for the Project or due to adverse impact caused by the Project	Cash compensation for lost assets resulting from land acquisition at full replacement cost[28] or through replacement land equal in value and productivity to the plot lost, and at locations acceptable to the affected people where feasible. Cash compensation for actual crop loss at full market rate. If more than 20% of the productive land held by the land owners is lost, additional cash compensation equal to one year crop harvest value and agricultural subsidies. Where full replacement property cannot be offered to the affected landowners, livelihood restoration assistance will be included in the compensation package.
	Loss of crops due to construction activities	For annual crops: the right to harvest crops or if harvesting not possible, cash compensation for annual crops at replacement value. For perennial crops: the right to pick fruits, vegetables etc. and cash compensation for perennial trees/plants at replacement value.
	Temporary loss of land during construction	Cash compensation at full replacement cost for the right to use land under contract, for the land use period and reinstatement of land after use.
	Loss of crops and income due to water shortage or worsened water quality caused by the Project plant construction or operation.	For annual crops: cash compensation for annual crops at replacement value. And cash compensation of potential profit loss equal to a market value of one-year crop harvest (based on a 3-year average).

[28] Replacement value indicates market value of the property plus legal costs of acquiring other property, such as taxes and fees related to purchase of other property, registration in land registry etc.

Category of Affected Persons	Type of Project affected right/property/loss	Entitlement
		For perennial crops: cash compensation for perennial trees/plants at replacement value. And cash compensation of profit loss equal to a market value of one-year harvest (based on a 3-year average) multiplied by the restoration time of trees/plants.
		Cash compensation for cleaning contaminated soil.
Lease holders	Loss of land as a consequence of land acquisition for the Project (including associated facilities) or due to adverse impact caused by the Project.	Cash compensation of potential profit loss equal to market value of one-year crop harvest (based on 3-year average). Cash compensation for activities related to land plot development, maintenance, protective measures. Cash compensation for pre-termination of lease or renewed lease for an alternative plot. If more than 10% of productive land held by the lease holder is lost, additional cash compensation equal to one-year crop harvest value and agricultural subsidies.
	Loss of crops due to construction activities	For annual crops: the right to harvest crops, if harvesting not possible cash compensation for annual crops at replacement value. For perennial crops: the right to pick fruits, vegetables etc and cash compensation for perennial trees/plants at replacement value.
	Temporary loss of land during construction	Information about the acquisition of the land at least three month in advance of land entry. Compensation at (1) government-established rate, or (2) replacement value, whichever is higher, and predicted total annual profit from harvest, multiplied by number of seasons required to re-establish crop to productive potential to be paid in annual instalments at harvest time. This option is only permissible where harvest is not possible due to the

Category of Affected Persons	Type of Project affected right/property/loss	Entitlement
		project schedule and/or crop life cycle.
	Loss of crops and income due to water shortage or worsened water quality caused by the construction or operation under the Project.	For annual crops: cash compensation for annual crops at replacement value. And cash compensation of profit loss equal to a market value of one-year crop harvest (based on a 3-year average). For perennial crops: cash compensation for perennial trees/plants at replacement value. And cash compensation of potential profit loss equal to a market value of one-year harvest (based on a 3-year average) multiplied by the restoration time of trees/plants.
Fish farmers	Adverse impact on fish breeding pools	Cash compensation of profit loss assessed by the independent appraisal.
Any unanticipated impacts identified during the Project construction and operation phases will be compensated in full at the replacement rate, subject to independent valuation methodology.		

18.5 Census and Socio-Economic Survey

A detailed census of all affected people, households, plots, properties and other assets is necessary to identify the number of affected people and plots. The census shall be undertaken by Project Owner or a third party with experience in census and survey activities. The census will collect information on cadastre identification and coordinates of land plots, assets, category of land, size of the plot and any cultivated crops, trees and structures that will be affected by the Project. The Census shall utilise cadastral information to identify formal land owners and users. Further investigations may be needed to identify any informal owners and users of the affected land plots.

The socio-economic survey will provide detailed information on formal and informal livelihoods, assets, activities and structures. All affected people regardless of having formal title who are recorded during the census will be eligible for compensation in accordance with national legislation and AIIB Environmental and Social Policy, IFC Standards and Equador Principles.

The socio-economic survey shall identify:

- Patterns of land use, crops cultivated and use of natural resources.
- Livelihood and income levels of affected persons, especially income from temporarily lost land and income for both formal and informal land users.
- Seasonal resources users who might be affected by the project.

Vulnerable people who require additional attention in order to be equally compensated as entitled.

18.6 Livelihood Restoration and Community Development Programs

Under AIIB's ESS2 and IFC PS5, people whose livelihoods are affected by the project are entitled to livelihood restoration measures aimed at improving or at least restoring their standards of living or livelihood to pre-project levels.

Project Owner will design appropriate livelihood restoration support, based on the findings of the socio-economic surveys undertaken to measure and quantity of livelihood and income that is likely to be impacted by the project.

Various methods can be used in the application of LRP. Among these, there may be community-based LRP application for risk groups, household-based application or even support for individuals. Hybrid methods that include all of these may be functional in some cases. The method of LRP is determined during the preparatory work according to the characteristics of the target group, the size of the impact and the needs.

Community development program can be implemented as a support program other than LRP. This is an optional strategic decision. Long-term community development programs can be developed if the affected population density is high in the area and the extent of the impact is permanent. These programs may specifically target vulnerable – disadvantaged groups within the affected population. It is possible to prepare a sustainable development program for the people of the region and support it with rational development projects.

Such programs aimed at improving the living standards and livelihoods of the people of the region should include objectives that meet local needs and development and social development trends.

18.7 Consultation

A series of stakeholder engagement activities will be undertaken in order to develop the LRP and complete the process. The following consultation activities will be conducted:

Consultation with all the affected land owners and users (including any informal people and local businesses). The consultant, with the support of the relevant district council, will undertake consultations with the affected people. The consultation will be undertaken once the affected individuals and households are identified and the process for conducting a census is initiated. The census and consultation will be undertaken at the same time to avoid any confusion among the affected people. A focus group will be undertaken with women to ensure that their concerns will be incorporated into the LRP process. The consultation with the affected land owners and users will be conducted in the following manner:

- Consultation with affected people through Khokimiyat
- Meaningful and culturally appropriate in the Uzbek language
- Transparent and clear of any manipulation
- To be conducted in a public / community centre

Engagement and Consultation with the Khokims. As part of the Project meetings, engagements will be conducted with project manager and Khokim to ensure that sufficient support is available to the

third party consultant for carrying out the LRP process. The Project CLO will lead the discussions on the provision of livelihood assistance and the compensation process. All the negotiations with be conducted by the CLO and Khokim.

18.8 Establishing a cut-off date

A cut-off date will be set when the census is announced to ensure that there is a specific time period for identifying and registering the eligible land owners and users. Consultation with various stakeholder groups will be made in accordance with the processes set out in the SEP. Any land owner or user who appear after this date may not be considered for the provision of compensation and assistance. The cut-off date will need to be set at least 6 months prior to the commencement of the construction. However, the following assumptions will be used for further investigation in the LRP process:

- A 4-6 month period will be available to undertake the census and complete the LRP process;
- Land owners and users who register their details during this time will be considered as 'Eligible' if they also meet the eligibility criteria specified earlier;
- Monitoring for a full 12 months from commencing the implementation of the LRP will be undertaken to identify seasonal trends and informal people. Trends (including indications of opportunistic influx issues) and eligibility of those registering after the first 4 months of implementation of the LRP will be reviewed.

18.9 Monitoring & Evaluation

In order to monitor the whole process from the beginning, a monitoring program is established according to local conditions, time and budget. The objective of monitoring is to observe whether livelihoods are successfully restored and persistence.

A component of the monitoring program can also be established as monitoring of histories of identified individuals and families, if conditions permit, and if there is sufficient time. For this, stakeholders must trust the monitoring team, and dialogue based on sincerity must be established.

Performance indicators need to be determined beforehand for monitoring. These indicators can be updated when necessary during the LRP implementation.

Quantitative indicators (economic income, productivity, etc.) are relatively easy to detect and monitor. However, the effects on satisfaction are difficult to monitor. For this, it may be a good choice to follow the story with pre-determined stakeholders.

The water quality and quantity of water withdrawn will be shared with the stakeholders identified in the SEP who will be affected directly/indirectly from the Project activities in this regard to monitor if there are any adverse impacts on the fishing and agricultural activities.

18.10 Implementation Schedule and Budget

An implementation schedule will be created, taking into account possible risks and external factors (climate, holidays, intense work schedules of stakeholders). Preparing a flexible budget in accordance with this calendar and LRP implementation program will also allow unexpected expenses to be incurred

during implementation. The LRP should be prepared and implemented prior to any displacement and construction works.

Please refer to Section 2.1.5 for mitigation measures against potential impacts arising from changes in land use (forest, agriculture etc.) during construction activities of the OHL.

19. LABOUR & WORKING CONDITIONS

This Chapter provides baseline information on the labour and working conditions in Uzbekistan, explains the Contractor's approach to the management of labour and working conditions including occupational health and safety (OHS) aspects and accommodation conditions during the construction phase, sets out operation phase labour and working conditions risks and impacts, and presents management measures to be taken in the Project to ensure compliance with the applicable legislative requirements as well as international standards.

19.1 Standards and Regulatory Requirements

19.1.1 National Requirements

Uzbekistan pursues a purposive policy of creating a legal framework for the protection of human rights and freedoms in accordance with international standards (ILO, 2008). Having joined the world community, the Republic has constitutionally sealed the priority of universally accepted norms of international law. As a fully-fledged member of the United Nations Organization, Uzbekistan accedes to international human rights acts thus assuming an obligation to comply with them and apply them in its state and legal practice.

The universal significance of international human rights acts means that its provisions should be embodied in national legislation. The Main Law of the Republic of Uzbekistan includes all the provisions of the Universal Declaration of Human Rights.

Uzbekistan has published several laws since foundation for protection of Human and worker rights. General information about these legal can be found below.

19.1.1.1 The Constitution of the Republic of Uzbekistan (December 8 1992)

Article 37 of the Constitution of Uzbekistan says that "each has the right to work, to free choice of work, fair terms of work and protection against unemployment under the law."

19.1.1.2 Labour Code of the Republic of Uzbekistan (1995 as amended in 2017)

The code treats labour legislation with due account of the interests of the employees, employers and the state and fair and safe labour conditions and the protection of the labour rights and health of the workers.

More than 30 articles of the Labour Code are directly linked with issues of occupational safety and health. They include:

- Occupational safety and health requirements (Article 211);
- Ensuring safe and healthy labour conditions (Article 212);
- Instruction and training in OSH matters (Article 215);
- Regulation of working hours in hazardous occupations for workers performing special work and workers under 18 (Articles 116, 117 and 118);
- Terms of recruiting invalids for various jobs (Article 220);
- Providing first medical aid to workers who have fallen ill at work (Article 221); and

- Registration and investigation of accidents, supervision of labour conditions (Article 222) and others.

19.1.1.3 The Law of the Republic of Uzbekistan on Occupational Safety and Health

In pursuant ft Article 37 of the constitution of the Republic of Uzbekistan, the Oliy Majlis(parliament) on May 6, 1993 passed the law of the Republic of Uzbekistan on Occupational Safety and Health that laid the legal groundwork for the functioning of all the branches in managing the activities of enterprises of any form of ownership aimed at improving labour conditions and well-being at production facilities, at forming a system of socio-economic, organizational, technical, sanitary and medical preventative measures and providing the legal groundwork for occupational safety and health.

The Law on Occupational Safety in Hazardous Production Facilities passed on August 25, 2006 sets down the legal, economic and social terms of ensuring safe exploitation of hazardous production facilities and is aimed at preventing accidents and building the capacity of enterprises to liquidate their aftermath.

Under the Law of the Republic of Uzbekistan On Occupational Safety and Health, the following are the main principles of the state OSH policy:

- Priority of the life and health of the worker over the results of the enterprise activities;
- Coordination of osh activities with other areas of economic and social policy;
- Establishment of uniform osh requirements for all the enterprises irrespective of their form of ownership and management;
- Ensuring environmentally safe labour conditions and systematic control of the environment in the workplace;
- Supervision and monitoring of universal compliance with osh requirements at enterprises;
- State participation in funding osh;
- Training of osh specialists at higher and secondary specialized education institutions;
- Poviding incentives for the development and introduction of safe technology and means of protecting workers;
- Wide-scale use of the achievements of science, technology and the best domestic and foreign practices in the field of osh;
- Free provision of workers with special work clothes and footgear, individual protection means and medical-preventative nutrition;
- The conduct of a tax policy that stimulates occupational safety and health at enterprises;
- Mandatory investigation and registration of each occupational accident and occupational disease case and on that basis keeping the public informed about the levels of occupational accidents and diseases;
- Social protection of the interests of the workers who have become victims of occupational accidents or diseases;
- All-aound support for the activities of trade unions and other non-governmen tal associations, enterprises and individuals in the field of osh; and
- International cooperation in dealing with OSH problems

Supporting legislation passed pursuant to individual articles of the law include:

- Decrees of the Cabinet of Ministers of the Republic of Uzbekistan:
- No.538 of November 7, 1994 On State Management of Occupational Safety and Health;

- No.58 of February 16, 1995 On Managing Occupational Safety and Health of the Labour Ministry of the Republic of Uzbekistan;
- No. 286 of July 6, 1997 Regulations on Investigation and Registration of
- Occupational Accidents and Other Work-Related Impairment of the Health of Workers and other regulations:
- Model regulations on the organization of OSH;
- Model regulations on training in and testing the knowledge of OSH;
- Regulations on the OSH officer;
- Methodological guide to rational employment of invalids;
- Lists of hazardous jobs where work of persons under 18 is prohibited and where the use of women's labour is fully or partially prohibited, etc.;
- Methodology of assessing labour conditions and workplaces in terms of labour conditions;
- Procedure of attestation of workplaces where the labour of invalids is used;
- Regulations on the development of OSH instructions, etc.

19.1.1.4 Ordinance No. 30-31 Elimination of child labour, protection of children and young persons

Ministry of Labour and Social Security and the Ministry of Health of the Republic of Uzbekistan approving the list of hazardous jobs mentioned in Article 355, for which the employment of persons under the age of eighteen years is prohibited.

19.1.1.5 Joint Decree of the Ministry of Labour and Social Protection of the Population (No. 7) and the Ministry of Healthcare (No. 1)

Dated 30 May 2001 to approve the list of occupations with unfavorable working conditions to which it is forbidden to employ persons under 18 years of age.

19.1.1.6 Decree of the Cabinet of the Ministers No. 1011 of 22 December 2017

Decree name is "On Perfection of the Methodology of Definition of Number of People in Need of Job Placement, including the Methodology for Observing Households with Regard to Employment Issues, also for the Development of Balance of Labour Resources, Employment and Job Placement of Population". It cover Employment policy, promotion of employment and employment services. The decree establishes, introduces and set standards and procedures for;

- Form of the balance of labour resources, employment and job placement of population;
- Scheme of systematizing of information for the development of labour resources, employment and job placement;
- Scheme of organization of development of reporting and broadcasting balances of labour resources, employment and job placement;
- Methodology of calculation of unemployed people in need of job placement, also of development of the balance of labour resources, employment and job placement.

Decree of the Cabinet of the Ministers No. 965 of 5 December 2017 "On the Measures of Further Perfection of the Procedure of Establishment and Reservation of Minimum Number of Job Places for the Job Placement of Persons who are in need of Social Protection and Face Difficulties in Searching Employment and Incapable of Competing in Labour Market with Equal Conditions".

Decree No. 964 of 5 December 2017 "On the Measures for Perfection of the Activity of Self-Government Bodies Aimed at Ensuring Employment, Firstly for the Youth and Women".

19.1.1.7 International Labour Organization Labour Standards

The International Labour Organization (ILO) is devoted to promoting social justice and internationally recognized human and labour rights, pursuing its founding mission that social justice is essential to universal and lasting peace. The ILO aims to ensure that it serves the needs of working women and men by bringing together governments, employers and workers to set labour standards, develop policies and devise programs. The very structure of the ILO, where workers and employers together have an equal voice with governments in its deliberations, shows social dialogue in action. It ensures that the views of the social partners are closely reflected in ILO labour standards, policies and programs.

There are 19 ILO conventions and 1 protocol ratified by Uzbekistan, which will be applied:

- C029 - Forced Labour Convention, 1930 (No. 29)
- P029 - Protocol of 2014 to the Forced Labour Convention, 1930
- C047 - Forty-Hour Week Convention, 1935 (No. 47)
- C052 - Holidays with Pay Convention, 1936 (No. 52)
- C081 - Labour Inspection Convention, 1947 (No. 81)
- C087 - Freedom of Association and Protection of the Right to Organise Convention, 1948 (No. 87)
- C098 - Right to Organise and Collective Bargaining Convention, 1949 (No. 98)
- C100 - Equal Remuneration Convention, 1951 (No. 100)
- C103 - Maternity Protection Convention (Revised), 1952 (No. 103)
- C105 - Abolition of Forced Labour Convention, 1957 (No. 105)
- C111 - Discrimination (Employment and Occupation) Convention, 1958 (No. 111)
- C122 - Employment Policy Convention, 1964 (No. 122)
- C129 - Labour Inspection (Agriculture) Convention, 1969 (No. 129)
- C135 - Workers' Representatives Convention, 1971 (No. 135)
- C138 - Minimum Age Convention, 1973 (No. 138)
- C144 - Tripartite Consultation (International Labour Standards) Convention, 1976 (No. 144)
- C154 - Collective Bargaining Convention, 1981 (No. 154)
- C167 - Safety and Health in Construction Convention, 1988 (No. 167) (The Convention will enter into force for Uzbekistan on 09 Jun 2023.)
- C182 - Worst Forms of Child Labour Convention, 1999 (No. 182)
- C187 - Promotional Framework for Occupational Safety and Health Convention, 2006 (No. 187) (The Convention will enter into force for Uzbekistan on 14 Sep 2022)

19.1.2 Lenders Requirements

19.1.2.1 AIIB Environmental and Social Policy

AIIB recognizes the important role played by workers, employers and their representatives in the development process, and their contribution to sustainable economic growth. It believes that the following measures taken under Projects help to support sustainable development: providing workers with living wages; providing safe and healthy working conditions and putting measures in place to prevent accidents, injuries and disease; avoiding activities involving forced labor and harmful or

exploitative forms of child labor; having good human resources management; and having a sound labor management relationship based on equal opportunity, fair treatment, nondiscrimination, freedom of association, right to collective bargaining and access to a workplace grievance redress mechanism, consistent with national law (including international agreements adopted by the Member) governing the Project. The Bank also recognizes the need for Clients to identify, avoid and mitigate the environmental and social risks and impacts of labor influx into Project communities.

19.1.2.2 Equator Principles IV

Equator principles mentions about general framework on management of E&S risks of projects. EP IV refers to IFC performance standards for identification and addressing the social and economic impacts of a project. The key standard for addressing and identifying risks main regulation is;

- IFC Performance Standard 2 Labour and Working Conditions.
- IFC Performance Standards 2 has following objectives;
- To establish, maintain and improve the worker-management relationship
- To promote the fair treatment, non-discrimination and equal opportunity of workers, and compliance with national labor and employment laws
- To protect the workforce by addressing child labor and forced labor
- To promote safe and healthy working conditions, and to protect and promote the health of workers

In according to IFC PS2 there is a requirement to follow following conventions;

- ILO Convention 29 on Forced Labour;
- ILO Convention 87 on Freedom of Association and Protection of the Right to Organize;
- ILO Convention 98 on the Right to Organize and Collective Bargaining;
- ILO Convention 100 on Equal Remuneration;
- ILO Convention 105 on the Abolition of Forced Labour;
- ILO Convention 138 on Minimum Age (of Employment);
- ILO Convention 182 on the Worst Forms of Child Labour;
- ILO Convention 111 on Discrimination (Employment and Occupation);
- UN Convention on the Rights of the Child, Article 32.1; and
- UN Convention on the Protection of the Rights of all Migrant Workers and Members of their Families.

In addition to above conventions and standards, the Project will also be required to adhere to the United Nations Guiding Principles on Business and Human Rights to ensure that it complies with all applicable laws and to respect human rights

19.1.2.3 IFC Guidance on Gender Based Violence (GBV) in the Construction Sector and COVID-19

There is growing recognition that operators in the private, public and non-profit sector need to address GBV more proactively. For the private sector, this is motivated by the need to prevent the physical, sexual, emotional and financial harm GBV causes to individuals, as well as the financial, reputational and legal risks it poses to businesses and investors.

GBV is widespread. It affects both men and women, but is most often perpetrated by men against women and girls, with more than one in three women having experienced some form of physical or

sexual violence during their lifetime.1 GBV is not inevitable, however, and can be prevented. When it does happen, it is important that it is responded to in a responsible and effective way.

Addressing GBV in the private sector is a relatively new and complex area. CDC, the IFC recognize the need for companies and investors to have access to practical guidance. All three organizations jointly commissioned this guidance note, which outlines emerging practices in addressing GBV in operations and investments. These practices are drawn from recent experience in the private sector, as well as a larger body of work from the non-profit sector. The guidance provides an opportunity to engage with stakeholders to refine practices as those in the private sector collectively gain implementation experience.

Steps to manage GBV risks derived from workforce can be seen in Figure 246.

In the context of COVID-19 pandemic, the following Interim Advice Notes published by the IFC will also be applicable to the Project:

- Tip Sheet for Company Leadership on Crisis Response: Facing the COVID-19 Pandemic
- Interim Advice for IFC Clients on Preventing and Managing Health Risks of COVID-19 in the Workplace
- Interim Advice for IFC Clients on Supporting Workers in the Context of COVID-19
- Interim Advice for IFC Clients on Developing a COVID-19 Emergency Preparedness and Response Plan (EPRP)
- Addressing Increased Reprisals Risk in the Context of COVID-19

Interim Advice for IFC and EBRD Clients on Migrant Workers and COVID-19

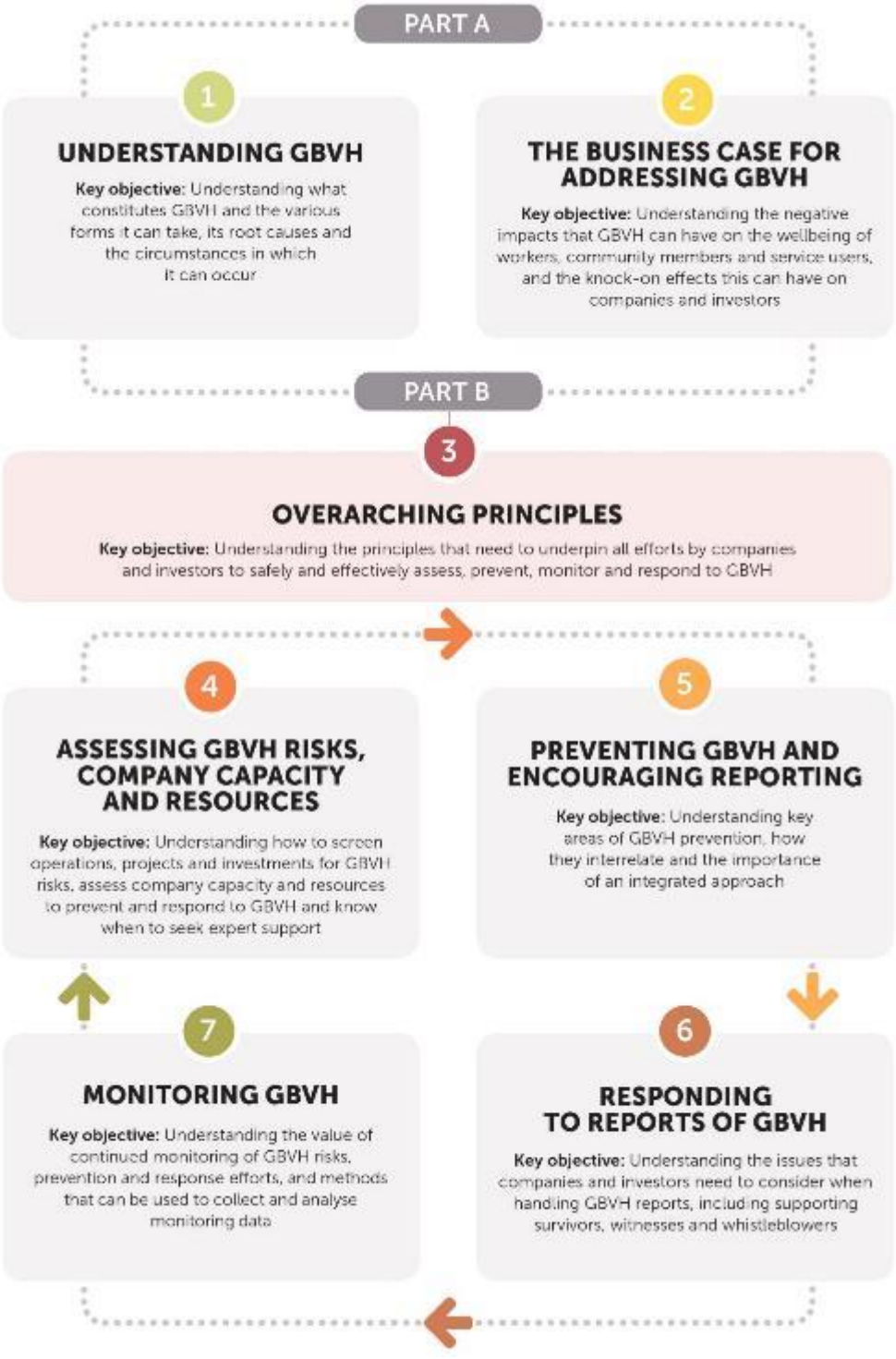


Figure 246: GBV Risk Management Flow Scheme

The assessment, prevention, monitoring and response measures in regards to GBV should be underpinned by the following principles:

- Survivor Centred: The rights of GBV survivors need to be consistently prioritized and used as the starting point for all decisions on efforts to assess, prevent, monitor and respond to GBV.
- Safe: Survivors, witnesses and those who report and seek to address GBV can be at risk of retaliation, including threatening and violent behavior, often from those who do not like their position of power being challenged. Companies should prioritize the safety of those who have experienced, witnessed and reported GBV.
- Context specific: All measures need to be rooted in a thorough understanding of the local context. Investors and companies should understand the legal and social context and identify the support mechanisms that are in place.
- Collaborative: Companies should seek inputs from a range of internal and external stakeholders to increase the likelihood of broader buy-in and make GBV prevention more effective.
- Inclusive: Companies should recognize the heightened risks of GBV faced by certain groups who are subject to discrimination and marginalization. High risk groups often include people with disabilities, single parents, migrants and ethnic minorities and sexual and gender minorities. The system should also account for illiterate or non-literate people who may not be able to access written information on GBV reporting mechanisms.
- Integrated: Processes, efforts to assess, prevent, monitor and respond to GBV needs to be integrated as much as possible into existing processes and management systems, such as occupational health safety, security management systems, future environmental and social management systems (ESMS) and human resources (HR) policies and procedures.
- Non-discriminatory: All survivors need to be listened to and treated equally and promote diversity in the work place.
- Well-informed: Companies should draw on relevant expertise when developing prevention and response measures. The grievance mechanism and investigation procedures should be set up to ensure they are appropriate, relevant and safe in the local context.

According to the guidance, the benefits of addressing GBV include:

- Improves workers' physical and emotional wellbeing and strengthens occupational health and safety.
- Avoids reputational damage, financial risks and legal liabilities for companies, investors and construction contractors.
- Builds relationships and social license to operate in communities. This can result from regular dialogue to understand and track project GBV risks as well as the effective use of measures to prevent and respond to GBV.
- Broadens the pool of potential workers that companies can draw upon, including women workers from nearby communities because of lower perceived risk of GBV.

19.1.2.4 Equator Principles Guidance on Implementation of the Equator Principles During the Covid-19 Pandemic

The guidance recommends that the borrower should consider the following in the engagement of workforce and management of risks:

Engagement of Workforce

- Communicate its approach to COVID-19 management to its workforce (including contractors) and provide information and advice about the virus.
- Engagement methods should ensure the ability to provide frequent updates with a central information communication network that allows workers to access all the latest information and guidance.
- Consider the need for a 24-hr hotline.
- Design communication in a way that avoids risks of stigma associated with infection in line within available good practice.

Managing Health Risks

It is recommended that the borrower shall develop a range of actions/procedures to manage workers risks. These procedures must align with the latest guidance/requirements at national/regional levels and WHO guidelines. It should also ensure that up to date information is maintained at the Project level and liaise with national/local authorities as applicable.

Welfare and Livelihoods

Where travel restrictions lead to workers remaining on site for longer rotations, fatigue management procedures are recommended. The following measures are also recommended in instances where workforce reduction maybe required:

- Consultation with workers/representatives during the entire process of evaluating viable options.
- Options for avoiding redundancy should be considered in the first instance (e.g. paid/unpaid leave, reduced hours/pay) with retrenchment taken as the last option.
- Reduction in workforce should be undertaken incrementally where possible and regularly reviewed.

Consideration should also be given to risks posed to vulnerable workers i.e. casual workers, woman, workers with childcare issues, supply-chain workers and their needs and support provided as required.

Relevant guidance notes published by the EP and applicable to the Project ESIA include the following:

- EP Guidance Note on Implementation of Human Rights Assessments Under the EP (2020)
- EP Guidance Note on Climate Change Risk Assessment (2020)
- EP Guidance Note on Biodiversity Data Sharing for EPFI Clients (2020)
- EP Guidance Note on Implementation of EP during the COVID-19 Pandemic (2020)

19.2 Observations and Baseline Conditions

Any construction project will introduce health and safety risks associated with the use of plant, machinery and construction processes. Risks can be severe depending on the type of activities required, materials used and site condition.

Due to an influx of workers in the Project area from other regions/countries consideration will be needed to be given in relation to accommodation facilities, worker welfare, sanitary provision, health care, hygiene, food and potable water etc.

Forced labour is a general practice in the country especially on cotton industry. Uzbekistan continued to demonstrate major progress in the eradication of child labour and forced labour in the 2020 cotton harvest. As in previous years, there were only isolated cases of minors below the legal working age picking cotton. The share of people experiencing forced labour during the harvest was reduced by 33 percent compared to 2019 (ILO 2020).

- The ILO continues to find that systematic child labour is no longer used during the cotton harvest in Uzbekistan. Schoolchildren and students were not mobilized for cotton picking; however, isolated cases of child labour still occurred.
- Systematic forced labour did not occur during the 2020 cotton harvest. Reforms are implemented step-by-step and continue to have a significant positive impact; yet there are still challenges with uneven implementation in certain provinces and districts. The monitors could work unhindered and in confidentiality.
- The nation-wide share of forced pickers declined by 33 percent in 2020. The vast majority of pickers participated in the harvest voluntarily but about 4 percent were subject to direct or perceived forms of coercion. Some provinces and districts had very few or no forced labour cases in 2020.

According to the same ILO report there are cases of forced labour outside of cotton industry. In total, 106 forced labour cases were recorded in 2020 across the country covering primarily landscaping, cleaning and construction works. The trend of identifying forced labour cases outside the cotton harvest is positive and speaks to increased awareness and attention to the issue. 22 representatives of private employment agencies were brought to justice for violations of legislation on recruitment of people for work abroad in line with the articles 168 and 228 of the Penal Code.

The Uzbekistan government has already got a hotline for reporting forced labour incidents. Namangan, Jizzakh, Tashkent and Surkhandarya provinces had the most cases in the Ministry of Employment and Labour Relations (MELR) Feedback Mechanism.

Beside the above mentioned ILO report, a news channel reports that there were a large scale riot in a thermal power construction project in Qashqadarya Viloyat (state) which is neighbor of Surkhandarya region due to unpaid salaries and weak food services and accommodation (RFERL, 2020).

Common activities undertaken during construction such as the movement of heavy machinery, excavation, handling of chemicals, works undertaken at height etc. can all introduce significant risk to the health and safety for the associated work force. In particular, risks are more likely to be apparent for those who are not familiar with the type of works undertaken and/or the associated hazards.

The type of hazards attributable to a construction site will vary significantly depending on the construction methods employed and the degree of control implemented by the contractor and affiliated

sub-contractor. It is therefore of the utmost importance that the contractor and affiliated sub-contractors demonstrate consideration of health and safety risks as part of their chosen construction methods and that these risks are appropriately mitigated.

General risks expected during the construction phase are;

- Over exertion
- Slips and fallas
- Work in heights
- Struck by Objects
- Moving Machinery
- Dust
- Confined Spaces and Excavations
- Other Site Hazards (Chemicals, hazardous materials)

19.3 Potential Impacts, Mitigation, Management & Residual Impact

The risks and impacts associated with labour and working conditions in the Project's construction and operation phases are described here, encompassing both contractors and subcontractors (main and lower tier), and the mitigation measures to be taken to mitigate identified impacts.

To identify Project-related risks and impacts on labour and working conditions, the WBG General EHS Guidelines (OHS, Construction and Decommissioning for general impacts) and industry specific WBG EHS Guidelines have been considered, including the OHS risks and impacts outlined below.:

- Risks and impacts associated with labour and working conditions during the construction and operations phases (including on-site and off-site accommodation conditions of the Contractor and subcontractor personnel during the construction phase)
- OHS risks due to emergency situations (including COVID-19 pandemic related risks) during the construction and operation phases
- OHS risks and impacts associated with general and job-specific hazards during the construction and operation phases

19.3.1 Construction Phase

19.3.1.1 Health Risks Associated with Covid-19

The current COVID-19 pandemic poses potential risks to the health and safety of the workers and the development of the Project. It is expected that there will be approximately 2000 workers at the peak of the Project construction Phase. These workers will be sourced locally but will also include migrant workers from other regions of Uzbekistan and from other countries and thus heightening the risk of infection (i.e. some workers may come from regions/countries with higher COVID-19 infection cases). Such a high number of workers working in close proximity or confined spaces increases the risk of infection. Risk of exposure will also be potentially high in shared accommodation areas, canteens and transportation buses. The contractor will therefore be required to conduct a COVID-19 Construction Risk Assessment which must be regularly updated in line with national/local and WHO requirements and guidance.

19.3.1.2 Working Conditions

Labour exploitation on construction sites unfortunately has become a reality in some parts of the world. Inequalities in income, education and opportunities has led to opportunistic immoral practices with labourers and site staff suffering as a consequence of the exploitation.

To ensure the wellbeing of the staff associated with the project, the EPC and associated subcontractors will need to plan for necessary provisions relative to the requirement of the required workforce. This includes appropriate labour accommodation plans and mechanism for inspections and corrective actions.

The EPC Contractor shall adhere to good practice measures regarding worker welfare on and off site particularly in terms of sanitation facilities on site, and having adequate checks and balances regarding timely payment of salaries and having necessary redressal access in case of forced retrenchment.

Due to the ongoing COVID-19 pandemic, movement of workers to their families or home region/countries may be restricted which could leave some feeling isolated, fatigued and could lead to mental health issues if not properly addressed. In addition, some workers may be required to work from home in cases where schools are closed in order to take care of their children. In such instances, women may be more disproportionately affected than the men.

As with occupational health & safety risk, worker conditions are a defined aspect of site planning rather than a potentially environmental impact as such, its significance is not assessed further in this ESIA. Risks associated with worker welfare during construction will be managed through effective project planning, and the enforcement of fair and just treatment throughout the construction phase.

Working hours and shifts will be regulated in compliance with the requirements of the national law as summarized below:

- Single shifts are foreseen to be used throughout the project. However, additional shifts would be organized based on need, with the employees allocated to said additional shifts working within the legal limits mentioned above.
- The work week is anticipated to comprise 6 working days of 7.5 hours each for a total of 45 work hours per week, which is the legal minimum requirement for full-time labour employment as per the national Labour Law.
- As mandated by the Labour Law, Employees will have one rest day per week.
- Where needed and contingent on the employee's consent, overtime work will be regulated and compensated in accordance with the Labour Law, up to the legal upper limit of 11 hours per day.

The Project Company will have a Human Resources (HR) Policy and the following management plans developed to address management of labour, working and accommodations aspects of the Project:

- Labour Management Plan (including off-site accommodation and covering management of risks stemming from Project's supply chain)
- Subcontractor Management Plan (covering the management of risks stemming from Project's supply chain)
- Camp Site Management Plan

In addition, the Contractor will develop and implement a Project-specific HR Policy as well as Camp Site, Subcontractor and Labour Management Plans and Internal Grievance Mechanism in line with the

requirements of IFC PS2. Through compliance with the requirements of the national legislation and implementation of the HR Policy and related management plans, the potential risks and/or impacts on Project personnel associated with labour and working conditions will be managed in line with the Project Standards.

As detailed in the stand-alone Project SEP and summarized in Chapter 17, engagement with the Project workforce and collection of their feedback, concerns, grievances and suggestions for integration to the Project implementation will be provided through the following channels:

- Verbally through Project directors, managers, chiefs, H&S specialists, CLOs, etc. and subcontractors (tobe conveyed to the Contract systematically)
- During monthly H&S committee meetings and other meetings with employees
- Through periodical employee satisfaction surveys

Through grievance and feedback and forms to be placed at the camp, work and accommodation sites, as appropriate

Young workers below the age of 18 require special protection and systems should be in place to ensure that a non-discriminatory but protective workplace for young workers, in which their occupational health and safety (OHS) is ensured. This includes implementing specific measures on contracting, working hours, onboarding and orientation, communication and ongoing OHS protection specifically aimed at young workers [118].

According to Article 77 of the Labor Code, a minor, that is a person under the age of 18, is allowed to start working from the age of 16.

It is also allowed to work from the age of 15 under some special cases that are determined by the Labour Code. A person under the age of 18 has the same rights as an employee over the age of 18. In addition, they are entitled to additional benefits in the areas of health and safety, working hours, vacation time, and other working conditions.

In particular, reduced working hours are set for minors, namely for workers between the ages of 16 and 18, working hours are set at no more than 36 hours per week, and for those between the ages of 15 and 16, no more than 24 hours per week.

Therefore, children under the age of 18 years will not be employed or permitted to work in any occupation or process during the construction and operation of the Project.

It will be ensured that the HR Policy to be developed by the Project Company will cover forced labour aspects. In addition, the EPC Contractor and subcontractor personnel will be provided with training on the Project-specific HR Policy and labour aspects including forced labour at the time of employment (refresher training will be provided annually and as required). The Project Company will develop and implement an internal audit system to check and monitor compliance of the Contractor, subcontractor and -to the extent possible and through feasible methods- primary suppliers' implementations with the forced labour related requirements of the following Project-specific documents:

- HR Policy
- Subcontractor Management Plan (covering management of risks stemming from Project's supply chain)
- Labour Management Plan (covering management of risks stemming from Project's supply chain)
- Internal Grievance Mechanism as part of Project SEP

In consideration of the remedies to be implemented by the EPC Contractor during the construction phase, the Project Company will establish and implement necessary mechanisms for the management of human rights impacts and risks of the Project in line with the Project Standards.

19.3.1.3 Gender Based Violence (GBV)

Influx in workers from outside the Project region will increase the likelihood of GBV. The constructions workers are likely to be predominantly young male coming from other regions of Uzbekistan and outside the country. These workers will be away from their families and removed from their normal social spheres. This could potentially result into peer pressure and involvement in unlawful behavior such as harassment of local women, young girls and boys or women within the Project workforce. Such behavior can lead to increase in exploitative sexual relationships and unwanted aggressive advances and harassment. This could also lead to disintegration of relationships in local households impacted by GBV.

During the construction phase, workers will also be vulnerable to various forms of harassment, exploitation and abuse, aggravated by traditionally male working environment. GBV is likely to be committed by co-workers or construction supervisors and can be attributed to gender stereotypes about the sexual availability of female construction workers. In addition, income earning opportunities for women through direct employment during the construction phase or through indirect employment has the potential to increase household tensions and expose women to harassment and violence in their homes or communities.

Some of the male workers who will be transporting Project machinery and equipment and goods will also be involved in long distance travel which in some cases will be between different countries. There is a risk that they can also be involved in GBV on the routes they use and at track stops associated with the Project even if it is outside the Project boundary.

In order to communicate the project's approach to prevention of GBV and raise awareness among the project staff, contractor and subcontractor personnel using off-site accommodation facilities will receive special training on, among other things, the project's social policy and contractor's code of conduct. As part of internal audit system to be established and implemented by the Contractor during the construction phase, potential risks of impacts of the Project due to off-site accommodation will be monitored and managed. Through the external and internal grievance mechanisms, such risks, if any, will be continuously identified, evaluated and managed to be operated as part of Project SEP implementation.

It will be crucial to regulate labor and working conditions given the nature and size of the Project. The Project is required to provide adequate working and accommodation conditions, promote fair treatment, nondiscrimination and equal opportunities to all personnel, including both the direct workers of the Contractor and contracted workers of the subcontractors. Due to the high number of potential lower-tier subcontractors to be involved in the Project, additional management and monitoring measures are anticipated to be required to ensure that the Project Standards are consistently fulfilled by the Project subcontractors.

Off-site accommodation will be covered by the Project-Specific Labour Management Plan, which will be developed and put into effect to control any potential effects during the construction phase. Contractor and subcontractor personnel using off-site accommodation facilities will be provided with special training on, inter alia, Project’s Social Policy and Contractor’s Code of Conduct to communicate Project’s approach to prevention of GBV and raise awareness among the Project personnel. As part of internal audit system to be established and implemented by the Contractor during the construction phase, potential risks of impacts of the Project due to off-site accommodation will be monitored and

managed. Such risks will further be continuously monitored, evaluated and managed through the external and internal grievance mechanisms to be operated as part of Project SEP implementation.

The potential benefits on the economies of the nearby settlements and district centers (such as rental incomes, supply of goods and materials, etc.), as well as the negative risks or impacts on the nearby district centers (such as increased demands on infrastructure, services, and utilities, development of illicit trade activities, inflation in local rent and other subsistence items, or risk of GBV, are anticipated.

19.3.1.4 Employment and Procurement

The Project shall develop a Human Resources Policy, Labour and Employment Plan as well as specific recruitment policies and procedures:

Project-specific Human Resources Policy, including the below labour aspects, will be developed and implemented in line with IFC Guidance Note 2:

- Grievance mechanism
- Child Labour
- Forced Labour Workers' organisations
- Working conditions and terms of employment
- Working relationship
- Non-discrimination and equal opportunity
- Retrenchment
- OHS
- Workers engaged by third parties
- Supply chain

The Project should prioritize the recruitment of workers and procurement of goods and services from within the Districts then to national companies.

This will not apply to the provision of highly technical equipment. The Project should develop a fair and transparent employment and procurement policy and processes to avoid any potential for nepotism or favoritism. The policy should be shared with the local community members and leadership.

Based on the indicators proposed by AIIB concerning gender balanced employment, the Project should also ensure female participating in technical internship with the target value of 15% for the year 2027 and 2028.

19.3.1.5 Occupational Health and Safety

Common activities undertaken during construction such as the movement of heavy machinery, excavation, handling of chemicals, works undertaken at height etc. can all introduce significant risk to the health and safety for the associated work force. In particular, risks are more likely to be apparent for those who are not familiar with the type of works undertaken and/or the associated hazards.

The type of hazards attributable to a construction site will vary significantly depending on the construction methods employed and the degree of control implemented by the EPC and affiliated sub-contractor. It is therefore of the utmost importance that the EPC and affiliated sub-contractors demonstrate consideration of health and safety risks as part of their chosen construction methods and that these risks are appropriately mitigated. As occupational health and safety is a risk rather than a potentially defined impact, its significance has not been assessed further in this ESIA. Health and

safety risks to the site force will be managed through effective risk assessment, development and implementation of an Occupational Health & Safety Plan.

A structured Grievance Redress Mechanism (GRM) shall be implemented at the plant level in multiple languages anonymously (online and hardcopy) so that workers have access to express their concerns. The human resources department shall be responsible for implementing the GRM for the facility.

Table 329: Impacts Significance of the Labour and Working Conditions during– Construction Phase

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Occupational Health and Safety	**Project Employees**	**High**	**Medium**	**Major**	Workers will be provided with a safe and healthy work environment, taking into account inherent risks and specific classes of hazards associated with the project. The contractor will set, implement and maintain an Occupation Health and Safety (OHS) system. The risks associated with project specific locations, and processes should be assessed by competenet OHS professionals in the project. Legal requirements and duty of care should be considered. The Contractor will be responsible for ensuring that all sub-contractors, sub-sub-contractors and suppliers comply with the OHS management system of the project. The OHS management system will be in-line with recognised international best practice and as a minimum, this plan will include: Means of identifying and minimising, so far as reasonably practicable, the causes of potential H&S hazards to workers. Provision of preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances. Provision of appropriate equipment to minimise risks, and requiring and enforcing its use. Training of workers, and provision of appropriate incentives for them to use and comply with H&S procedures and protective equipment. Documentation and reporting of occupational accidents, diseases and incidents. Emergency prevention, preparedness and response arrangements	**Moderate**
Risks Associated with Covid- 19	**Project Employees and Stakeholders**	**High**	**Medium**	**Major**	Covid-19 construction phase risk assessment should be developed during the mobilization phase. The risk assessment should be evaluated regularly by the project management and risks and measures should be updated in line with international and national legal requirements, WHO guidelines. Develop a COVID-19 specific communication procedure for the workforce. Set up a 24/7 hotline Infected employee must be isolated and cared in specific rooms. Free rooms for covid infected personnel should be ready at construction camp. Identification of any vulnerable groups (i.e. those with pre-existing conditions) working in the Project site (for the contractor and sub contractors) and taking precautionary measures in accordance with the national and WHO guidelines. Providing testing for staff as required at no cost to them. Ensuring that social distancing measures are put in place i.e. allowing some of the office staff to work from home, working in shifts etc. Promotion of personal hygiene among the workers and providing training, posters remind workers to wash their hands regularly, cleaning their work areas and equipment, proper sanitation etc. Masks should be free for project at all times and proper PPE for health personnel should be provided at no cost. While designing the accommodation facilities, social distancing, proper ventilation and hygiene must be considered. The transportation of workers and access to the site shall be coordinated and regulated i.e. through reduced bus occupancy, temperature and PPE checks etc.	**Moderate**

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
					The Contractor will provide a flexible or hybrid working regime for those workers who may prefer to work from home due to health issues, child care, home schooling etc without fear of victimisation.	
Employment, non-discrimination and Equal Opportunities	**Project Employees**	**High**	**Medium**	**Major**	The contractor shall submit a plan showing how the terms and conditions of employment comply with national labour, social security and occupational health and safety legislation. The employment relationship shall be based on the principle of equal opportunity and fair treatment and shall not discriminate with respect to any aspect of the employment relationship, including recruitment, remuneration (including wages and benefits), terms and conditions of employment, including maternity/paternity leave provisions, access to training, promotion, termination of employment or retirement, and discipline. The contractor will not make recruitment decisions on the basis of personal characteristics such as gender, race, nationality, ethnic origin, religion or belief, disability, age or sexual orientation which are unrelated to the inherent job requirements. SEA/SH will not be tolerated and the Contractor will include this in the Worker Code of Conduct, which will be made available in local languages. The Contractor will document and communicate to all workers their terms and conditions of employment, including their entitlement to wages, hours of work, overtime rules and overtime pay, and any benefits (such as sick leave, maternity/paternity leave or holiday). The contractor will base the employment relationship on the principle of equal opportunity and fair treatment and will not discriminate in relation to any aspect of the employment relationship, including recruitment and hiring, remuneration (including wages and benefits), terms and conditions of employment, accommodation, access to training, promotion, termination of employment or retirement and disciplinary action. Special measures of protection or assistance to promote local employment opportunities or selection for a particular job based on the inherent requirements of the job which are in accordance with national law, will not be deemed discrimination.	**Moderate**
Forced Labour and Child Labour	**Minors, Project Employees and Stakeholders**	**Medium**	**High**	**Major**	The contractor will not use forced labour, which is any work or service that is not voluntarily performed and is required of a person under threat of force or punishment. This includes any type of involuntary or forced labour, such as indentured labour, debt bondage, or similar labour contracts. The policies and procedures of HR will be adapted to the size of the workforce required for the project. Policies and procedures shall be developed to comply with the requirements of national legislation and IFC PS 2. HR Policies shall include the ability of workers to join a Trade Union and ensure workers' right to collective bargaining. The contractor will comply with all relevant national legislation, the requirements of the lender and ILO regulations relating to the employment of minors. In all cases, the contractor will not employ children in a manner that is economically exploitative or that risks interfering with the child's education or	**Moderate**

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
					harming the child's health or physical, mental, spiritual, moral or social development. Young people under the age of 18 will not be employed in hazardous work and all work undertaken by persons under the age of 18 will be subject to an appropriate risk assessment.	
Wages, Benefits and Retrenchment	**Project Employees**	**Medium**	**Medium**	**Moderate**	HR Policies and procedures shall be reasonably adapted to the size of the work force required for the project. Policies and procedures shall be developed to comply with the requirements of national legislation and IFC PS 2 and shall include a code of conduct on GBV. The overall wages, benefits and working conditions offered should be comparable to those offered by equivalent employers in the relevant region of the country/area and sector. Wages for all workers (skilled and unskilled) must be such as to ensure a living wage for all workers. If the Contractor anticipates mass layoffs related to the proposed project, the Contractor will develop a plan to mitigate the adverse effects of layoffs that complies with national laws and good industry practise and is based on the principles of non-discrimination and consultation. Without prejudice to more stringent national legislation, workers' representatives and, where appropriate, the competent authorities shall be informed of the changes in employment within a reasonable period of time so that the redundancy plan can be jointly considered with a view to mitigating the adverse effects of the redundancy on the workers concerned. The outcome of the consultations will be incorporated into the final job reduction plan. Where workers need to be made redundant due to the economic impact of COVID -19 this will be done in a phased manner and options to avoid redundancies will be considered, with redundancies being the last option. Employees/representatives will be involved in all downsizing actions, including those related to COVID -19.	**Minor**

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Sub-contractors,Suppliers, Sub-sub- contractors	**Employees of Sub-contractors, Suppliers, Sub-sub-contractors**	**High**	**Medium**	**Major**	The Contractor shall establish a supply chain management system to ensure that the above measures are implemented by all subcontractors. Assess any high risk supply chain at risk in relation to the COVID -19 pandemic and ensure appropriate involvement of key suppliers in the supply chain. The Contractor will require its suppliers and subcontractors to provide GBV training to their staff in accordance with the Code of Conduct. Applicants will not be required to make payments if they apply for or obtain employment under the proposed project. The project will ensure that recruitment processes are transparent and monitored to ensure that individuals hired declare their actual experience, geographic location, health status, and age, and that local employment requirements are met. The project will develop and implement a programme of worker education, training, and development to help workers access opportunities associated with the project and find employment after their contracts end. The Project will provide training on health and safety and quality standards required by the Project for the provision of goods and services to the Project to ensure that local businesses have the opportunity to benefit. The project will ensure that contracts are unbundled so that multiple small businesses can supply goods and services rather than a single large subcontractor monopolising supply.	**Moderate**
Worker's Grievance Mechanism	**Project Employees**	**High**	**Medium**	**Major**	The contractor will establish a grievance mechanism for workers to raise legitimate workplace concerns. The contractor will inform the workers about the grievance mechanism at the time of recruitment and make it easily accessible to them. The mechanism should involve an appropriate level of management and address the concerns promptly. It should use an understandable and transparent process that provides feedback to those affected without retaliation. The mechanism should not impede access to other judicial or administrative remedies available under the law or through existing arbitration procedures, nor should it replace grievance mechanisms provided for in collective agreements. The grievance mechanism is intended to monitor employee morale, understand how employees are affected and what concerns they have COVID -19 and address urgent matters promptly. The grievance mechanism provides for confidential reporting and a support system for all workers who report issues related to GBV. The grievance mechanism also allows for verbal reporting for those who cannot write.	**Moderate**

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Human Rights	**Project Employees**	**Medium**	**Medium**	**Moderate**	In addition to adhering to the national human rights requirements, the Contractor will put in place a human right's policy in line with the UN Guiding Principles on Business and Human Rights. The statement policy will: Be approved at the most senior level of the company; Informed by relevant internal and external expertise; Stipulate the EPC's human rights expectations of personnel, local communities, sub-contractors and other suppliers directly linked to the construction of the project; Be publicly available and communicated internally and to the relevant stakeholders; Be reflected in the other policies and procedures to embed it throughout their construction phase activities.	**Minor**
Gender Based Violation (GBV)	**Project Employees, Local community**	**High**	**Medium**	**Major**	Workers shall be provided, as part of their employment contract, with information on the Workers' Code of Conduct in the local language, which includes provisions for reporting, investigation, termination, and disciplinary action against those who engage in GBV. The contractor shall conduct mandatory periodic training and sensitization of the workforce on GBV against members of the local community and their colleagues, especially women, and shall indicate the availability of a grievance mechanism for reporting GBV cases. Educate staff on the laws and regulations that make SEA/SH and GBV a criminal offence subject to prosecution. Ensure balanced representation of women in the HSE team who are easily approachable by the female employees. Provide appropriate training to project staff responsible for receiving complaints of GBV on how to deal with such complaints. It is recommended that staff be trained where available. Female workers will be included in the grievance committee to assist female workers and host community members to voice their complaints. The contractor will provide safe and separate living quarters and sanitary facilities for male and female workers (lockable sanitary facilities are mandatory for women) in compliance with the **IFC/EBRD Worker Accommodation Guidelines**. In this respect, a "Worker Influx Management Plan" in accordance with the "Influx Management Plan" prepared by the Project Company will be developed and implemented by the EPC Contractor. Associated monitoring activities will be included in this sub-management plan and performed by the EPC Contractor accordingly in order to ensure compliance with the relevant guideline. The contractor will endeavour to find a suitable local workforce to minimise the need to bring in large numbers of workers from other regions or countries. This could also help the contractor to reduce the cost of providing accommodation if the majority of workers are employed locally. Provide opportunities for workers to return regularly to their families who may be located far from the project site. The Contractor will provide opportunities for workers to access entertainment opportunities outside of the host communities. The contractor will allow for the filing and investigation of anonymous complaints of SEA/SH by workers and members of host communities and will protect the confidentiality of complainants.	**Moderate**

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Project-related worker influx	**Project Employees and Stakeholders, Local Communities**	**High**	**Medium**	**Major**	The contractor will provide targeted training (including on life skills such as leadership and decision making) and awareness raising for vulnerable workers such as women. • Project-specific SEP, including external grievance mechanism, will be implemented. Through the implementation of SEP, local women will be specially informed by qualified Project personnel/representatives about the following following: - Project external grievance mechanism and privacy policy - Women's rights - Self-protection in cases of GBV and SEA/SH - Emergency phone numbers, and - Contact information of the institutions and organisations that can be applied to • Contractor and subcontractor personnel (accommodating on-site and off-site) will be provided with training on Project's Social Policy and Project Company's Code of Conduct covering Project's approach to relations with the local communities, prevention of GBV and SEA/SH, at the time of employment (refresher training will be provided annually and as required). Trainings willcover, the following; - Definition of violence against women in national and international documents, - Types of violence (physical, sexual, economic, emotional), - Legal sanctions. • Project CLOs and Project Company's Human Resources (HR) team will be specially trained on GBV. • Project-specific Labour Management Plan, Camp Site Management Plan and Contractor Management Plan will be developed and implemented. • The Project Company and Contractor will develop and implement an internal audit system to check and monitor compliance of the Contractor and subcontractor implementations with the requirements of the Labour Management Plan covering the off-site accommodation aspects. • The Project Company and Contractor will develop and implement an internal audit system to check and monitor compliance of the Contractor and subcontractor implementations with the requirements of the following Project-specific documents; - Social Policy - HR Policy - Subcontractor Management Plan - Labour Management Plan - Internal Grievance Mechanism as part of Project SEP. Subcontractors will be contractually required to maximise use of local workforce.	**Moderate**
Impacts on life conditions: Roads, access and traffic issues	**Stakeholders, Local Communities**	**High**	**Medium**	**Major**	• Project-specific Community Health, Safety, and Security Management Plan that will identify the current access restriction issues (access to private and public lands and access to the centres of the districts, provinces, and social services) and describe the management/resolution measures to be implemented to eliminate them	**Moderate**

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
					• Project-specific SEP, including external grievance mechanism, will be implemented. The Project Company and Contractor will engage with the local communities through the implementation of Project SEP to receive their feedback and suggestions. • The Contractor will consult and work with the residents of the affected settlements to identify the locations where there are current and there may be potential future access restriction issues. These feedback and suggestions will be evaluated and feasible measures will be planned, incorporated to the Community Health, • Safety and Security Management Plan and implemented to eliminate existing access restriction impacts and avoid/minimise access restrictions due to the Contractor's activities. A Traffic Safety Management Procedure will be developed and implemented by all Project personnel (direct and contracted) (details are provided in Chapter 12 on Traffic and Transportation). The suggestions of the PAPs (e.g. enforcement of speed limits, placing warning signgs, for the management of traffic-related impacts, collected through social surveys, will be reflected in the Procedure as relevant.	
Impacts on infrastructure	**Stakeholders, Local Communities**	**Medium**	**Medium**	**Moderate**	• Project-specific SEP, including the external grievance mechanism, will be implemented to inform the residents and communities about potential interruptions on local infrastructure services and collect relevant concerns and grievances for further management/resolution. • Work sites and access routes to be used by the contractors and subcontractors will be clearly identified to avoid potential off-site impacts on local infrastructure. • Damage caused by the Project (by contractor or subcontractor) on electrical infrastructure, local water supply/irrigation infrastructure, etc. will be reinstated/repaired immediately after the completion of construction activities at respective work sites in collaboration with the related authorities. Where necessary, the Project Company will enforce and monitor the corrective actions to be taken by the subcontractors.	**Moderate**
Impacts on social services (education and health)	**Stakeholders, Local Communities**	**Medium**	**Medium**	**Moderate**	• Project-specific SEP, including the external grievance mechanism, will be implemented. On-site infirmary service will be provided at the construction camp sites for direct and contracted employees in order to reduce the load on public health facilities. The medical personnel and facilities to be provided on-site will meet the requirements of the applicable national legislation.	**Moderate**
Impacts on local employment	**Stakeholders, Local Communities and Businesses**	**Medium**	**Low**	**Minor**	• In order to enhance Project benefits around employment opportunities, the Project will adopt the policy of localisation of workforce, where possible. The Project Company will set localisation targets for the employment of unskilled, semiskilled and skilled workers (direct and contracted) within the Labour Management Plan to be developed and implemented. • General Job applications will be collected from the settlements. • Project Company will develop and implement Subcontractor Management Plan (covering employment, procurement and supply chain aspects). Project-specific SEP, including the external grievance mechanism, will be implemented.	**Minor**
Impacts on procurement of required goods, materials and	**Local Businesses**	**Medium**	**Low**	**Minor**	• Localisation of procurement of goods and services wil be prioritised. • Consultations will be held with local businesses to inform them about the potential local procurement of goods and services.	**Minor**

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
services					• Subcontractor procurement will be monitored by the Project Company on a monthly basis through a system to be established.	

19.3.2 Operational Phase

19.3.2.1 Occupational Health and Safety

The risks associated with the operational phase of the project are anticipated to be significantly less than during the construction phase due to reduced site activity and requirements for heavy plant and machinery.

There will be occupational health and safety risks attributable to the operational phase associated with maintenance and inspection requirements. Maintenance and inspection will also require the use of site vehicles and activities that pose risks to human health and safety. An Occupational Health Safety Management Plan and Standart Operation Procedures shall be prepared and be implemented during the operation period.

A structured Grievance Redress Mechanism (GRM) shall be implemented at the plant level in multiple languages anonymously (online and hardcopy) so that workers have access to express their concerns. The human resources department shall be responsible for implementing the GRM for the facility.

The severity and likelihood of risks during the operational phase will be dependent on the frequency and requirements for planned and unplanned maintenance. The operation and maintenance team will need to ensure that a robust plan is in place to appropriately manage these risks.

19.3.2.2 Health Risks Associated to Covid-19

Even though the number of workers expected during the operational phase of the Project will be much lower, the risk of COVID-19 infection cannot be ruled out. Based on the prevailing conditions, the Project Company will be required to conduct a COVID-19 Operational Risk Assessment which will be regularly reviewed based on new information and guidelines/requirements provided by the national government and WHO.

19.3.2.3 Workers Conditions

No long-term accommodation requirements are anticipated for the project. However, as with construction, operational activities will need to plan for and enforce just and just and fair treatment of operation and maintenance staff (including any engaged contractors) in accordance with lender requirements and relevant Uzbekistan national requirements. Allowance will also need to be made for site staff welfare facilities including sanitation, rest, recreational and medical facilities.

Even though there will be reduced workforce during the operational phase of the project, the risk of GBV will remain. There will still be a limited level of interaction between the operational phase team and the host communities. As a result, measures will be put in place to ensure that exploitative sexual relationships and unwanted aggressive advances and harassment are prevented and addressed.

Table 330: Impacts Significance of the Labour and Working Conditions during – Operation Phase

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Occupational Health and Safety	**Project Employees**	**High**	**Medium**	**Major**	**Workers will be provided with a safe and healthy work environment, taking into account inherent risks and specific classes of hazards associated with the project. The Project Company will set, implement and maintain an Occupation Health and Safety (OHS) system. The risks associated with project specific locations, and processes should be assessed by competenet OHS professionals in the project. Legal requirements and duty of care should be considered. The Project Company will be responsible for ensuring that all contractors, sub-contractors and suppliers comply with the OHS management system of the project. The OHS management system will be in-line with recognised international best practice and as a minimum, this plan will include: Means of identifying and minimising, so far as reasonably practicable, the causes of potential H&S hazards to workers. Provision of preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances. Provision of appropriate equipment to minimise risks, and requiring and enforcing its use. Training of workers, and provision of appropriate incentives for them to use and comply with H&S procedures and protective equipment. Documentation and reporting of occupational accidents, diseases and incidents. Emergency prevention, preparedness and response arrangements**	**Moderate**
Risk Associate with Covid-19	**Project Employees and Stakeholders**	**High**	**Medium**	**Major**	**The Project Company shall develop a COVID -19 Operational Risk Assessment at the beginning of the operational phase, which will be periodically reviewed in accordance with evolving national and WHO requirements/guidelines. Develop a COVID -19 specific workforce communication procedure. Provide a 24-hour emergency hotline. Isolate/care for ill and potentially infected staff and employees. Identify all vulnerable groups (i.e., individuals with pre-existing conditions) working on the project site and take precautions in accordance with national and WHO guidelines. Providing testing to employees at no additional cost to them. Ensuring social distancing measures i.e. allowing some of the office staff to work from home, shift work etc. Promoting personal hygiene among workers and providing training, posters reminding workers to wash their hands regularly, clean their work areas and equipment, proper sanitation facilities, etc. Provide COVID -19 PPE to all workers. Worker transportation and access to the site will be coordinated and regulated, e.g. reduced bus occupancy, temperature and PPE controls, etc. The Project Company will provide a flexible working system for those workers who wish and are able to work from home for health reasons, childcare, home schooling etc without fear of harassment. Mental health issues are addressed during induction and information is provided on how to seek help from local professionals.**	**Moderate**

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
					There is regular review and updating of information/requirements in the ever changing situation, including a daily cheque of COVID -19 updates from WHO, national/regional health authorities etc.	
Employment, Non Discrimination and Equal Opportunities	**Project Employees**	**Medium**	**Medium**	**Moderate**	**The Project Company shall submit a plan showing how the terms and conditions of employment comply with national labour, social security and occupational health and safety legislation.** **The employment relationship shall be based on the principle of equal opportunity and fair treatment and shall not discriminate with respect to any aspect of the employment relationship, including hiring, compensation (including wages and benefits), terms and conditions of employment, including maternity/paternity leave provisions, access to training, promotion, termination of employment or retirement, and discipline.** **The Project Company shall not make hiring decisions based on personal characteristics such as gender, race, nationality, ethnic origin, religion or belief, disability, age or sexual orientation that are unrelated to the inherent job requirements.** **The Project Company shall document and notify all employees of their terms and conditions of employment, including their entitlement to wages, hours of work, overtime arrangements and overtime pay, and any benefits (such as sick leave, maternity/paternity leave or holiday).** **The Project Company will base the employment relationship on the principle of equal opportunity and fair treatment and will not discriminate in relation to any aspect of the employment relationship, including recruitment, remuneration (including wages and benefits), working conditions, accommodation, access to training, promotion, termination of employment or retirement and disciplinary action. Special protective or supportive measures to promote local employment opportunities or selection for a particular job on the basis of the requirements associated with the job, in accordance with national law, shall not be deemed to be discrimination.**	**Minor**

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Child Labour and Forced Labour	**Minors, Project Employees and Stakeholders**	**High**	**Medium**	**Major**	**The Project Company will not use forced labour, which is any work or service that is not voluntarily performed and is required of a person under threat of force or punishment. This includes any type of involuntary or forced labour, such as servitude, debt bondage, or similar labour contract arrangements. The policies and procedures of HR shall be adapted to the size of the workforce required for the project. Policies and procedures must be developed to be consistent with the requirements of national legislation and IFC PS 2 and include a code of conduct on GBV. HR policies must include the ability of workers to join a Trade Union and ensure workers' right to collective bargaining and comply with the requirements and ILO provisions related to the employment of minors. In all cases, the Client will not employ children in a manner that is economically exploitative or likely to be hazardous or detrimental to the child's education or harmful to the child's health or physical, mental, spiritual, moral or social development. Young people under the age of 18 will not be employed in hazardous work and all work undertaken by persons under the age of 18 will be subject to an appropriate risk assessment.**	**Moderate**
Wages Benefits and Retrenchment	**Project Employees**	**Medium**	**MEdium**	**Moderate**	**Wages, benefits and working conditions offered should be comparable overall to those offered by equivalent employers in the relevant region of the country/area and sector. Wages for all workers, including unskilled workers, must be sufficient to provide a living wage. If the Project Company anticipates mass layoffs related to the proposed project, it will develop a plan to mitigate the adverse effects of layoffs that complies with national laws and good industry practise and is based on the principles of non-discrimination and consultation. Without prejudice to stricter national legislation, employee representatives and, where appropriate, the competent authorities will be informed of the changes within a reasonable period of time so that the redundancy plan can be jointly considered with a view to mitigating the adverse effects of the redundancy on the affected employees. The outcome of the consultations will be incorporated into the final job reduction plan. Where workers need to be made redundant due to the economic impact of COVID -19 this will be done in a phased manner and options to avoid redundancies will be considered, with redundancies being the last option. Employees/representatives will be involved in all downsizing actions, including those related to COVID -19.**	**Minor**

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Worker's Grievance Mechanism	**Project Employees**	**High**	**Low**	**Moderate**	**The Project Company will establish a grievance mechanism for workers to raise reasonable workplace concerns, including GBV. The client will inform the workers about the grievance mechanism at the time of recruitment and make it easily accessible to them. The mechanism should involve an appropriate level of management and address concerns promptly. It should use an understandable and transparent process that provides feedback to those affected without retaliation. The mechanism should not impede access to other judicial or administrative remedies available under the law or through existing arbitration processes, nor should it replace grievance mechanisms provided for in collective agreements.** **The grievance mechanism should be used to monitor employee morale, understand how employees are affected and what concerns they have COVID - 19 and address urgent matters promptly.**	**Minor**
Human Rights	**Project Employees**	**Medium**	**Medium**	**Moderate**	**In addition to complying with national human rights requirements, the Project Company will adopt a human rights policy in accordance with UN Guiding Principles on Business and Human Rights. The policy statement will:** **Be approved at the highest level of the company;** **Be supported by relevant internal and external expertise;** **Set out the Project Company's expectations in relation to the human rights of staff, local communities and other suppliers directly associated with the operational phase of the project;** **Be publicly available and communicated internally and to relevant stakeholders;** **Be reflected in the other policies and procedures to embed them in all operations phase activities.**	**Minor**

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Gender Based Violance (GBV)	Project Employees, Local community	High	Medium	Major	Workers shall be provided, as part of their employment contract, with information on the Workers' Code of Conduct in the local language, which includes provisions for reporting GBV (either in person or anonymously), the investigation process, termination, and disciplinary action against persons who commit GBV. The Project Company shall conduct mandatory periodic training and sensitization of the workforce on GBV against members of the local community and their colleagues, especially women. Workers are educated on the laws and regulations that make SEA/SH and GBV a criminal offence punishable by law. Mandatory and regular training for workers on required lawful conduct in host communities and the legal consequences for non-compliance, including dismissal. The Project Company shall provide safe and separate living quarters and sanitary facilities for male and female workers (lockable sanitary facilities are mandatory for women) in compliance with the IFC/EBRD Worker Accommodation Guidelines. In this respect, the developed "Influx Management Plan" will be implemented by the Project Company. Associated monitoring activities are included in this sub-management plan and performed by the Project Company accordingly in order to ensure compliance with the relevant guideline. Provide opportunities for workers to return to their families on a regular basis. The Project Company shall allow for the filing and investigation of anonymous complaints of SEA/SH by workers and host community members and protect the confidentiality of complainants. The Project Company will investigate, in close coordination with local authorities, all complaints of GBV in host communities as they relate to project workers. The Project Company will identify local GBV organisations that can provide support to those experiencing violence or harassment.	Moderate

20. COMMUNITY HEALTH, SAFETY AND SECURITY

This Chapter presents Project's approach regarding the management of the community health and safety (CHS) management practices to ensure compliance with the relevant national legislation as well as international standards.

This Chapter is to read in conjunctions with below listed chapters of this ESIA report where relevant baseline conditions and mitigation measures to be taken to avoid/minimize potential risks and impacts of the projects are elaborated in detail.

- Chapter 6 on Air Emissions and Ambient Air Quality, which focuses on the baseline concentrations of the relevant air pollutants and the assessment of impacts of air and GHG emissions on the nearby receptors to be caused by the construction and operation activities of the Project, Chapter 7 on Noise Level, presents the background environmental noise levels and calculation/assessment of environmental noise at the nearby residential receptors to be caused by the construction and operation activities,
- Chapter 11 on Solid Waste and Wastewater Management, which covers management of hazardous and non-hazardous wastes generated during construction and operation stage
- Chapter 12 on Traffic and Transportation, which present information on the current condition of the roads and additional load that may arise due to the project activities,
- Chapter 16 on Socio-economy, which covers management of social impacts
- Chapter 19 on Labour and Working Conditions, which covers management of CHS issues and/or risks that may be sourced by Project-related accommodation arrangements, including on-site and off-site accommodation, interaction/communication between Project personnel and local communities mainly during the construction phase, and CHS risks that may be posed by the activities of the O&M workforce, etc.

It should be noted that a separate chapter is prepared regarding Stakeholder Engagement activities and a stand-alone Stakeholder Engagement Plan which is prepared in line with IFC PSs is presented in Volume 3. The SEP includes a grievance mechanism and will be an instrumental document to manage CHS related issues, risks and impacts throughout the whole project life.

The Project may change the community exposure to safety risks and impacts arising from construction activities and operations activities, such as equipment accidents, traffic accidents, collisions, structural failures, releases of hazardous materials, and pedestrians crossing the railway line. To minimize these potential impacts on the community, Contractor should develop and implement a Community Safety Management Program in line with the requirements of the "IFC EHS Guidelines for Thermal Power Plants", to identify, assess and manage the potential risks to Community Health, Safety and Security, during the design, construction and operations phases of the Project. Standards and Regulatory Requirements.

20.1 National Requirements

SANPIN № 0350-17

Chapter 6 "Sanitary-technical classification of production enterprises, thermal power plants, storage facilities and the sizes of the minimum sanitary protection zones (SPZ) for them". Thermal power plants having an equivalent electric capacity of 600MW or more, operating on gas or gas-oil fuel, are classified as Class II and must create a 500m health protection zone (HPZ) around each stack, according to the law.

Resolution of the Cabinet of Ministers No.555 Dated 2.07.2019:

This law states that security guards of all other legal entities' agencies, organizations and industrial facilities are allowed to use weapons under the category of "civilians". Where any entity wants to protect the life and health of the employees, property and natural resources, the special contract can only be provided by the National Guard in the Republic of Uzbekistan.

Other relevant national legislations include:

- SanPiN № 0224-07 dated 29.03.2007 "On sanitary standards for using PC, video displays and office equipment"
- SanPiN 0203-06 dated on 24.05.2006 "Sanitary standards for the microclimate of industrial premises."

20.2 Lenders Requirements

AIIB Environment and Social Policy

ESS1 requires to assess community health and safety measures applicable to the Project and the Bank requires the Client to use an ESMPF which should cover community health and safety aspects described in ESS 1

International Finance Corporation Performance Standard 4 (IFC PS4)

IFC Performance Standard 4 expects project activities, equipment and infrastructures can increase community exposure to risks and impacts related with community health and safety. And aims to safeguard local communities from potential risks associated with the Project including impacts associated with introduction of communicable disease, site access and operation, material use etc.

The key objectives of PS4 are:

- To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances.
- To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.

In terms of community security aspects PS4 requires companies to do the followings (IFC,2017);

- Assess the security risk their operations may have or could create for communities;
- Develop ways to manage and mitigate these risks;

- Manage private security responsibly;
- Engage with public security; and
- Consider and investigate allegations of unlawful acts by security personnel.

IFC Guidance on Gender Based Violence (GBV)

According to the guidance, addressing GBV can build relationships and provide a Project with a social license to operate in communities. This can result from regular dialogue to understand and track project GBV risks as well as the effective use of measures to prevent and respond to GBV. In addition, it broadens the pool of potential workers that companies can draw upon, including women workers from nearby communities because of lower perceived risk of GBV.

World Bank Good Practice Note on Addressing Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) In Investment Project Financing Involving Major Civil Works

The World Bank GPN is structured around three key steps that cover project preparation and implementation. These steps include:

- Identifying and assessing the risks of SEA/SH, including social and capacity assessments.
    - Undertaking social risk assessment of community-level risks.
    - Assess capacity and availability, safe and ethical services of survivors.
    - Review ability of the client to respond to SEA/SH risks.
    - Rate project for overall risk using several Bank tools including the SEA/SH Risk
    - Assessment Tool.
    - Establish procedures to review and update risk assessment during the project implementation.
- Establishment of mitigation, reporting and monitoring measures.
    - Based on risks identified, identify the corresponding mitigation measures and
    - Implement actions suggested to mitigate project related risks of GBV in the project area.
    - Monitor effectiveness of the mitigation measures and adapt as appropriate.
- Project response actions for GBV cases.
    - Provide essential services for survivors.
    - Report case through the GM as appropriate keeping survivor information confidential and anonymous.
    - Document and close cases brought through the GM.

United Nations Guiding Principles on Business and Human Rights

In addition to adhering to human rights requirements under the Uzbekistan laws and lenders requirements, the project construction and operational phases will be required to adhere to the United Nations Guiding Principles on Business and Human Rights. The Guiding Principles are grounded in recognition of the role of business enterprise as specialized organs of society required to comply with all applicable laws and to respect human rights.

Equator Principles Guidance on Implementation of the Equator Principles During the Covid-19 Pandemic

The guidance recommends that the borrower should:

- Review potential risks on local communities, including direct and indirect impacts of COVID-19 and other impacts relating to worker interfaces and how any Project changes during this period might affect the community.
- Assess its mitigation approach to Project related impacts.
- Identify opportunities to support communities mitigate wider COVID-19 risks/impacts either through new initiatives or building on existing programs i.e. provision of food for vulnerable people in isolation, test kits medical facilities and equipment etc.

Voluntary Principles on Security and Human Rights

Created in 2000, the Voluntary Principles is a multi-stakeholder initiative that promotes the implementation of a set of principles that guide companies on providing security for their operations while respecting human rights.

Through the VPs Initiative, companies are better able to align their corporate policies, procedures, and internal assessments with internationally recognized human rights principles in the provision of security for their operations. In so doing, companies communicate to employees, contractors, shareholders, and consumers their commitment to the Principles: (1) through sharing of best practices and lessons learned with one another, and (2) by collaborating on difficult issues.

20.3 Observations and Baseline Conditions

Project related activities might result in the increase of risks associated with those who live near the Project site or may visit areas in and around active Project sites.

There is not any settlement within the sanitary buffer zone (500m around the project area) according to drawings provided by the project owner. The closest residential receptors to the project site are about 1.8 kms away from the project's north west border. Beside settlements, project is expected to has direct impact on Uchkizil Reservoir's water quality during construction, commissioning and operation phases.

Uchkizil and Kattakum villages are located within 5 km area of influence of the project which is defined in Chapter 4. However, other settlements within 10 km radius around the project area are listed below

- Bahor
- Dehqonbirlashuv
- Ilgor
- Karvon
- Ayran
- Madaniyat
- Markaz
- Qoshtegirmon
- Tallashqon
- Zang Gilambop
- Zartepa

- Namuna
- Orol
- Khalqobod

20.3.1 Sanitary Protection Zone

To fulfil the requirements, set out in SanPiN No 0350-17 of establishing a 500 m sanitary protection zone, consultation letters shall be sent out to the Director of the Agency for Sanitary and Epidemiology Surveillance of the Ministry of Health of the Republic of Uzbekistan. The sanitary protection zone for the Project site is as given in Figure 30.

20.4 Potential Impacts, Mitigation, Management & Residual Impact

20.4.1 Construction Phase

Permanent staff including contractors, sub-contractors, specialists, supply chain personnel will be hired during construction phase of the project. During construction, this need is expected to lead an increase in the population as it is the case on such sites.

During the construction phase, safety fencing, security and equipment associated with the construction phase will be fenced and trespasses will be restricted to the project area. The project area will occupy only 0,3 kms of reservoir's shore. There may be informal tracks or pathways used by community members to access reservoir or for recreational purposes such as fishing and swimming. These activities will be limited for users.

20.4.1.1 Accommodation

The Project construction will require involvement of significant workforce and the maximum workforce will be around 2050 during the peak construction period. Approximately 30% of the workforce will be unskilled and the remaining will be either skilled or semi-qualified staff. It is anticipated that 50% of the workforce will be third-party nationals. Temporary migration of such work force might lead conflicts between local community and project workers due to cultural, religious and behavioral issues.

The provision of accommodation for self-sufficient worker accommodation will be responsibility of the contractor. It is expected that the workforce required for the construction activities will accommodate in nearby cities and there will no accommodation in the project area. All worker accommodation facilities will be designed and operated in accordance with IFC Workers Accommodation Guidance. The workforce will be transferred to the project area by shuttle buses.

The adverse risks or impacts of off-site accommodation on the nearby district centres, such as increased demands on infrastructure, services and utilities, development of illicit trade activities, inflation in local rent and other subsistence items or risk of GBV , as well as the potential benefits on the economies of the nearby settlements and district centres (e.g. rental incomes, supply of goods and materials, etc.), are anticipated to be temporary.

The Contractor will arrange service busses for the personnel to be transported to the work sites either from camp sites or their local houses including rental houses in the nearby district or neighborhoods/villages.

In the construction phase, camps will typically include preparation and installation of canteens/mess halls, material storage, water tanks, clean water treatment plant, generators, workshops and maintenance areas, laboratories, fuel storage, offices, clinics, recreation areas, parking areas, and a precast and work area. provision of worker's accommodation is often associated with the importation of an external workforce into an area.

It is anticipated that 50% of the workforce will be third-party nationals. Temporary migration of such work force might lead conflicts between local community and project workers due to cultural, religious and behavioral issues.

The EPC Contractor shall confirm how many people are required for the construction process and where they will come from and conduct Housing Needs Analysis prior to construction. For each construction activity type, the Housing Need Analysis shall assess;

- Worker type (white collar, blue collar)
- Duration of contract
- Estimated number of people for that activity
- Estimated number of local workers available who may require housing
- Need of any specific accommodation requirements
- Estimated number of suitable beds in the project area
- Surplus needed

The EPC Contractor shall also perform housing availability and suitability analysis and assess location, approximate distance from the site, number of rooms/beds, compliance with the IFC/EBRD Guidance note for the available housing.

The EPC Contractor shall;

- Obtain prior approval from the Employer for the accommodation approach (Employer to consider the need for further assessment of E&S impacts once the final accommodation strategy is defined).
- Ensure all Accommodation shall be in line with the IFC/ERBD Guidance note – Workers' Accommodation: Processes and Standards
- Develop Contractor Accommodation Management Plan (for coordination of accommodation strategy)
- Provide transport arrangements for All contractor and sub-contractor workers to and from suitable locations within TEMEZ
- Contractor to Conduct regular accommodation walkarounds and inspections of different accommodation used by the Project.
- Perform a risk assessment considering such things as emergency response, legionella, water quality, security etc.
- All accommodation residents to adhere to project Workers Code of Conduct
- Accessible record containing the full list of where all contactor and sub-contractor workers requiring accommodation are being housed

During the construction period, it is recommended that the Project Company shall monthly inspect and audit accommodation conditions of the EPC Contractor. Besides, it is recommended that the EPC Contractor weekly inspect and monitor different accommodation facilities and ensure number worker complaints relating to the workers' accommodation (Worker grievance mechanism (# of worker

grievances defined by accommodation sub-category) are recorded and responded. It should be aimed that 100% of accommodation locations meet the requirements of IFC/ERBD Guidance note – Workers' Accommodation: Processes and Standards.

20.4.1.2 Illnesses and Diseases

Due to expected increase in local population and close-knit mixing of workers on sites and in accommodation facilities, there is a great risk of increase in number of communicable diseases and illnesses within the project. This may also impact upon communities where interactions take place. Such diseases include Sexually Transmitted Illnesses (STIs), skin infections, waterborne diseases. Vector borne diseases are not expected to see in the project. Since 2011, zero autochthonous malaria cases were reported in the Uzbekistan. In 2016, the country requested WHO's technical assistance to prepare for the certification of malaria elimination (WHO,2014). There will also be a potential risk of transmitting COVID-19 between the workers and the communities near the project site and off-site accommodation areas.

There is also potential for construction excavation activities on the site to create breeding grounds for bacteria and parasites which will not only affect the workers but the local communities too. Any potential contamination from the site such spillage of raw sewage or hazardous materials could potentially result into water related and water borne diseases through contamination of surface and groundwater.

20.4.1.3 Sexually Transmitted Diseases

The increase in population due to the influx of a large number of employees into the project area could lead to an increase in the transmission rate of sexually transmitted diseases. It is expected that employees will come from different regions of Uzbekistan and some international employees will be separated from their families, posing a health risk to both employees and the community. Therefore, during the construction, testing, commissioning and operation phases of the project, the contractor will launch several campaigns for the community and project staff to avoid negative impacts of STD influx. Free condoms will also be provided to the project workers.

20.4.1.4 Storage of Hazardous Materials and Chemicals

Risks associated with hazardous materials or chemical storages will be managed during construction phase according to good international industrial practices on HAZMAT management, Environmental and Social Emergency Response Procedure and as defined in ESMP. Environmental and Social Emergency Response procedure shall have Environmental and Social Emergency scenarios including but not limited to flood, fire, accidental spills, accidents and public protests and traffic accidents involving community members. Contractor will avoid and/or minimise the potential for community exposure to hazardous materials and substances that may be used within the Project activities and will establish mitigation measures to minimise the exposure of workers and communities to the impacts of hazardous materials within the scope of the Hazardous Materials Management Plan.

Hazardous Materials Management Plan to be developed and implemented by the Contractor, will include the management of pesticide usage, in case pesticides use is practices as a control method for vegetation at camp sites or other work areas.

20.4.1.5 Traffic and Pedestrian Safety

Material transport vehicles, shuttle buses and vehicles transporting the waste generated at construction sites may result an increased traffic on off-site roads during the construction period. According to the project schedule, early site works and mobilization will start in November 2022 and the commissioning activities will start in August 2024. Thus, material transportation will be spread over time reducing the intensity of Project-related traffic due to material transport but lengthening the duration of the impact.

Children, elderly people and pedestrians are at greatest risk when the Project vehicles are using roads near or through the settlements. In such cases, it is important to prioritise designating alternative access routes to avoid use of village roads, where feasible. Therefore, the EPC Contractor will develop a Traffic Management Plan.

20.4.1.6 Security Personnel

The project area will require site-based security at the gates and on patrol around the site and access road during construction in order to prevent the public from trespassing to the construction areas. This is so as to minimize the potential for construction site incidents or damage of construction machinery. It is anticipated that the security personnel will be unarmed. The security officers will be subjected to a basic training which includes following aspects;

- Security Measures
- Security Systems and Devices
- Basic First Aid
- Fire Safety and Natural Disaster Response Style
- Information on Drugs
- Effective Communication
- Crowd Management
- Person Protection (against the risk of assassination)
- Relations with General Law Enforcement
- Information on Weapon and Shooting Practice

There is also a risk that the security personnel who are mandated with providing protection to the workers can abuse their position of power and status and become perpetrators of GBV either to the members of the workforce or the community.

Following suitable security risk assessment by the EPC Contractor, the security arrangements will require to be guided by UN Code of Conducts for law enforcement officials, the IFC's Good Practice Handbook on the Use of Security Forces: Assessing and Managing Risks and Impacts, IFC's and the UN Basic Principles on the use of Force and Firearms by law enforcement officials in case security at the site will be armed and Voluntary Principles on Security and Human Rights.

In addition to this, security personnel will receive internal training in regard to receiving grievances, reporting such grievances and conduct for dialogue with any members of the local community. The workers on the project site will additionally receive cultural awareness training with regard to local customs as such guidance can provide a ready resource on the do's and don'ts of culture centred behavior.

20.4.1.7 Worker Influx

The adverse risks or impacts of off-site accommodation on the nearby district centres, such as increased demands on housing, infrastructure, services and utilities, development of illicit trade activities, inflation in local rent and other subsistence items or risk of GBV, as well as the potential benefits on the economies of the nearby settlements and district centres (e.g. rental incomes, supply of goods and materials, etc.), are anticipated to be temporary.

During the site surveys and meetings with the local authorities, it has been assessed that there are available houses / apartments in the vicinity of the Project area especially in Termez District. The site surveys revealed that the worker influx will have an positive impact on the local economy by renting these available houses/apartments.

One of the common and indirect impacts of infrastructure projects on social services (health, education) occurs when the roads used by the public to access the services coincide with the roads used for construction works.

Construction vehicles may increase the traffic load on the public roads used to access health and education services, which in turn may result in health and safety issues.

Also, the influx of construction workers may put additional load on the healthcare services, if the projects do not have adequate infirmary facilities on-site. The Project will have on-site infirmary services at the construction camp sites for direct and contracted employees in order to reduce the load on public health facilities.

The Project-related employment and procurement opportunities to be provided during the construction phase will result in short-term impacts on the welfare level of local communities.

The short-term benefits of the Project will be enhanced through Project's policy on localization of workforce to the extent possible.

Additional Potential Impacts and Mitigation and Management Measures will be added to Table 227: Impacts Significance of the Labour and Working Conditions during– Construction Phase.

In summary, the high number of worker during the construction stage may have risks on the community regarding the following aspects:

- Increased pressure on natural resources/ecosystem services (deforestation, soil degradation, water pollution, land pollution),
- Unplanned growth in housing development.
- Increased pressure on available land for food demand and supply, consequently triggering food inflation, which may result in serious health consequences for vulnerable populations.
- Potential for women and children to be abandoned when the construction phase ends and the migrants move on, leaving single, vulnerable, female heads of households.
- Impact on demography/community dynamics
- Social conflicts resulting from out-sourcing of skilled labour
- Cultural conflicts result in the potential breakdown of traditional institutions, leadership structures and cultural norms from the influx of temporary labour from other regions of Uzbekistan and other countries
- Increased risk of illicit behaviour and crime from the influx of temporary labour from other regions of Uzbekistan and other countries.

- increased demand on existing infrastructure from the influx of additional population ("followers").
- Increased risk of communicable diseases and burden on local health services from the influx of temporary labour from other regions of Uzbekistan and other countries.
- Community unrest due to lack of information on job opportunities.
- Local inflation of prices and economic vulnerability as a result of increased business due to workers from other regions of Uzbekistan and other countries residing in local villages.
- Increased pressures on accommodation and rents from the influx of workers from other regions of Uzbekistan and other countries.
- An increase in transportation-related accidents increased traffic from local communities to the site.

20.4.1.8 Worker Influx with Gender Based Violence (GBV)

Influx in workers from outside the Project region will increase the likelihood of GBV. The constructions workers are likely to be predominantly young male coming from other regions of Uzbekistan and outside the country. These workers will be away from their families and removed from their normal social spheres. This could potentially result into peer pressure and involvement in unlawful behavior such as harassment of local women, young girls and boys or women within the Project workforce. Such behavior can lead to increase in exploitative sexual relationships and unwanted aggressive advances and harassment. This could also lead to disintegration of relationships in local households impacted by GBV.

During the construction phase, workers will also be vulnerable to various forms of harassment, exploitation and abuse, aggravated by traditionally male working environment. GBV is likely to be committed by co-workers or construction supervisors and can be attributed to gender stereotypes about the sexual availability of female construction workers. In addition, income earning opportunities for women through direct employment during the construction phase or through indirect employment has the potential to increase household tensions and expose women to harassment and violence in their homes or communities.

Some of the male workers who will be transporting Project machinery and equipment and goods will also be involved in long distance travel which in some cases will be between different countries. There is a risk that they can also be involved in GBV on the routes they use and at track stops associated with the Project even if it is outside the Project boundary.

In order to communicate the project's approach to prevention of GBV and raise awareness among the project staff, contractor and subcontractor personnel using off-site accommodation facilities will receive special training on, among other things, the project's social policy and contractor's code of conduct. As part of internal audit system to be established and implemented by the Contractor during the construction phase, potential risks of impacts of the Project due to off-site accommodation will be monitored and managed. Through the external and internal grievance mechanisms, such risks, if any, will be continuously identified, evaluated and managed to be operated as part of Project SEP implementation.

It will be crucial to regulate labor and working conditions given the nature and size of the Project. The Project is required to provide adequate working and accommodation conditions, promote fair treatment, nondiscrimination and equal opportunities to all personnel, including both the direct workers of the Contractor and contracted workers of the subcontractors. Due to the high number of potential lower-tier subcontractors to be involved in the Project, additional management and

monitoring measures are anticipated to be required to ensure that the Project Standards are consistently fulfilled by the Project subcontractors.

Off-site accommodation will be covered by the Project-Specific Labour Management Plan, which will be developed and put into effect to control any potential effects during the construction phase. Contractor and subcontractor personnel using off-site accommodation facilities will be provided with special training on, inter alia, Project's Social Policy and Contractor's Code of Conduct to communicate Project's approach to prevention of GBV and raise awareness among the Project personnel. As part of internal audit system to be established and implemented by the Contractor during the construction phase, potential risks of impacts of the Project due to off-site accommodation will be monitored and managed. Such risks will further be continuously monitored, evaluated and managed through the external and internal grievance mechanisms to be operated as part of Project SEP implementation.

The potential benefits on the economies of the nearby settlements and district centers (such as rental incomes, supply of goods and materials, etc.), as well as the negative risks or impacts on the nearby district centers (such as increased demands on infrastructure, services, and utilities, development of illicit trade activities, inflation in local rent and other subsistence items, or risk of GBV, are anticipated.

The EPC Contractor's and subcontractor's personnel will be provided with training on Project's Social Policy and Contractor's Code of Conduct covering Project's approach to prevention ofGBV and SEA/SH, at the time of employment (refresher training will be provided annually and as required).

Trainings will cover but not limited to:

- - Definition of violence against women in national and international documents,
- - Types of violence (physical, sexual, economic, emotional), and
- - Legal sanctions.

Workers will be trained on the laws and regulations that make SEA/SH GBV a criminal offence punishable by law. Mandatory and regular training for workers will be delivered on required lawful conduct in host communities and the legal consequences for non-compliance, including dismissal and local service procurement.

20.4.1.9 Sexual Harassment and Sexual Exploitation and Abuse (SEA/SH)

The infrastructure sector presents a high-risk environment for incidents of SEA/SH.

GBV is an umbrella term for any harmful act that is perpetrated against a person's will and that is based on socially ascribed (that is, gender) differences between male and female individuals. GBV includes acts that inflict physical, mental, or sexual harm or suffering; threats of such acts; and coercion and other deprivations of liberty, whether occurring in public or in private life (IASC, 2015). Manifestations of GBV includes, but is not limited to, physical violence, such as slapping, kicking, hitting, and the use weapons; emotional abuse, such as systematic humiliation, controlling behavior, degrading treatment, insults, and threats; sexual violence, which includes any form of non-consensual sexual contact; forced marriage, which is the marriage of an individual against her or his will; and denial of resources, services, and opportunities, also known as economic abuse, such as restricting access to financial, health, educational, or other resources with the purpose of controlling or subjugating a person (Arango et al. 2013). Trafficking, abduction and coerced transactional sex may also constitute forms of GBV.

SEA/SH is a facet of GBV that is defined as any actual or attempted abuse of a position of vulnerability, differential power, or trust for sexual purposes, including but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another. Sexual abuse is further defined as "The

actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions" (IASC, 2016). In the context of Bank-supported projects, SEA/SH occurs against a beneficiary or member of the community.

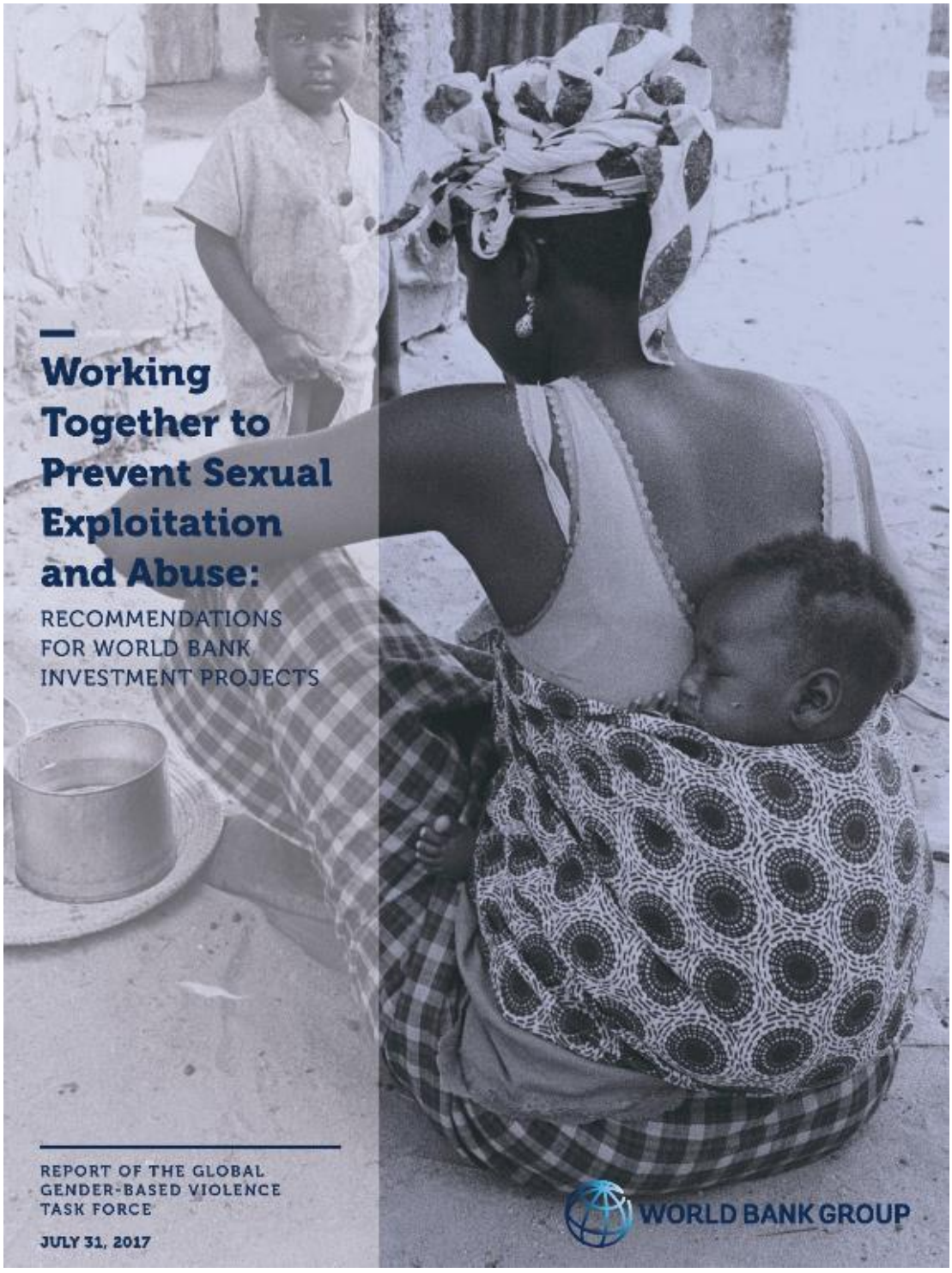


Figure 247: Recommendations for Prevention of SEA/SH WB

The proposed project will lead to an influx of workers during the construction phase majority of whom will be young men who will be away from their families. This may increase the demand for sex workers and put women from other regions in Uzbekistan at the risk of being trafficked to the Project area for the purposes of sex work. Influx of workers could pose a risk to young adolescent girls who may be at risk of being forced into early marriages to project workers who are perceived to have better wages. It could also increase the risk of GBV and SEA/SH against the children in the community who have no ability to give consent, are not empowered to refuse any sexual advances made towards them or anticipate the implications of any actions against them.

In addition, the presence of young men in the project area could also lead to shift in the community's power dynamics and within households. This may be manifested through male jealousy if the workers are believed to be interacting with the women in the community triggering violence towards the women.

Table 331: Impacts Significance of the Community Health, Safety and Security during– Construction Phase

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Labor Influx	**Project Affected Community**	**Medium**	**Medium**	**Moderate**	**Worker accommodation areas will be managed in accordance with the IFC Workers' Accommodation: Processes and Standards.** **The provision of good quality living accommodation, services and amenities will likely reduce the need for mixing with local communities.** **Project induction training will include a section on code of conduct when engaging with local community members. This will include an overview of culturally and religious appropriate measures and etiquette to bear in mind.** **SEA/SH in and out of the Project site will not be tolerated and the EPC Contractor will work with local community leaders, gender-based organizations and government officials to ensure that any complaints are addressed in accordance with the law.** **The Contractor will develop a Worker Influx Management Plan to provide a clear set of actions that will be undertaken for the management and mitigation, monitoring and evaluation of impacts related to worker influx in the Project area.** **Additional management and mitigation measures will be in accordance with the World Bank guidance note on Managing the Risks of Adverse Impacts on Communities from Temporary Project Induced Labor Influx (WB, 2016).** **A complete ban on wildlife harvesting (hunting/trapping/fishing) for all project personnel** **All persons housed in the local community to be transported to and from the site daily by project transportation as per centrally managed mass worker transit program.** **Focus groups to work with the community to monitor influx** **Local procurement strategy and requirement for all local businesses to be vetted prior to contract.**	**Minor**
Community Health	**Project Affected Community**	**Medium**	**Medium**	**Moderate**	**The Project should develop an STD Management Plan designed to minimize the spread of HIV infection and other STDs. The plan should be prepared with the assistance of a specialist in sexually transmitted diseases. A typical plan would include, among other things, the following measures:** **An HIV/AIDS training course and on-going education on transmission of HIV/AIDS and STDs, to employees, through workshops, posters and informal information sessions;** **Encouragement of employees to determine their HIV status;** **Supply of condoms/ femidoms at the construction site(s)/ Construction Camp; and** **Development of a comprehensive Construction Camp Management Plan, including rules for on-site behavior, entrance and exit policies and prohibition of sex workers on site.** **As part of STD Management Plan, information should be provided to workers on STD prevalence rates in Uzbekistan and/ or the relevant Counties as well as the expectations of local communities if a woman is made pregnant by a worker (e.g., marriage, financial implications etc.).** **Workers should have access to confidential health care for the treatment of STDs through medical facilities/ health care at Project sites.** **Workers will be thought on how to access testing in public hospitals.** **Information regarding the transmission of HIV/AIDS will be prepared and disclosed in a culturally sensitive manner and targeted towards young adults of consenting age.**	**Minor**

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
					A Grievance Mechanism should be developed, whereby affected people can raise issues and concerns associated with social vices, prostitution and the behavior of workers and drivers. **As part of the SEP, the Project should consult with local leaders such as Area leaders and village elders, amongst others. The consultations should be aimed at finding ways of ensuring social vices such as prostitution are minimized either through punitive or rehabilitative measures.** **During construction, staff will have access to medical professionals and suitable medical facilities, which will aim to prevent the spread of diseases internally and externally. Site personnel will only be cleared for work after with a medical fitness certificate from an authorized medical center.** **Any reportable disease will be diagnosed by the authorized occupation health center doctor. Diagnosis includes identifying any new symptoms, or any significant worsening of existing symptoms.** **Any external and internal spreading diseases will be diagnosed and taken the precautions as per the instructions from the national/ local medical authority.** **The potential for exposure to water-borne, water-based, vector-borne diseases and communicable diseases as a result from project activities will be avoided or minimized.** **Potholes within the site, access road and wells excavated in the area will be filled immediately to prevent the breeding of bacteria and parasites that may pose a risk to the health of the communities near the site.** **The Contractor in coordination with the local authorities will conduct awareness campaigns regarding the transmission of STIs in the communities near the Project site.** **The Project shall prepare a site Community Response Action Plan which shall define the site action to support community stakeholders in planning, responding and recovering from the COVID-19 outbreak especially when outbreaks are directly linked to the Project workers.** **Due to the health risk posed by COVID-19, workers will be screened in accordance with the Uzbekistan guidelines and WHO. They will also be provided with PPE and training on how to safely use them during induction and as part of the toolbox talks.** **If any cases of COVID-19 are reported on site, the Contractor will notify the relevant health officials and isolation of concern individuals performed immediately.** **The workers will ensure minimal interaction with community members as long as COVID-19 continues to be a health risk. In addition, community members working on the site will be trained on how to ensure proper hygiene when working on the site and when they go home.**	
Community Safety	**Project Affected Community**	**High**	**High**	**Major**	**The employees during the construction phase shall undergo a Code of Conduct training to ensure smooth coordination with the neighboring community.** **Risks to public safety will be appropriately addressed and prepared for in the construction phase 'Emergency Preparedness and Response Plan' and training.** **The plan will include the appropriate procedure to respond to any such incidents, as well as site specific contact details and details of external agencies who may be required.** **Project induction training will include a section on code of conduct when engaging with local community members. This will include an overview of culturally appropriate measures and etiquette to bear in mind.** **All high-risk areas including fuel storage areas will be secured with internal fencing and will be patrolled by security throughout the day.**	**Moderate**

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
					Smoking will be prohibited at chemical and fuel storage areas. **Appropriate mechanisms for emergency control (e.g. well-equipped firefighting equipment) will be placed at suitable positions around the site.**	
Community Security	**Project Affected Community**	**Medium**	**Medium**	**Moderate**	**The project will employ its own security staff who will provide 24/7 security control across the Project site and dedicated security staff at gatehouses.** **The security personnel will be regularly trained on GBV code of conduct including how to handle grievances related to GBV from the community.** **All vehicles entering the site will require pre-approved clearance and will need to be registered. Project security will record all instances of incoming vehicles.** **CCTV will be installed at key locations around the site and at gatehouses.** **Appropriate lighting will be provided at gatehouses for security personnel to prevent unauthorized access.** **Project personnel will only be provided access to the construction site with valid ID cards and permits to work in line with HSE requirements.** **Security risk based on** **Project security personnel must be trained based on Voluntary Principles on Security and Human Rights (VPSHR, 2021). The training program must cover following topics;** **Global human rights framework and security practices** **Human rights and ethics** **Roles and responsibility of security personnel** **Use of force** **Crowd control** **Background check must be done for any security personnel to be hired during hiring process. In case any criminal record finds of applicant, hiring process should be canceled.**	**Minor**
Sexual Harrassment and Sexual Exploation and Abuse (SEA/SH)	**Severe**	**High**	**High**	**Major**	**The contractor will conduct a SEA/SH risk assessment in consultation with relevant stakeholders including women leaders and those working with young adolescent girls and boys. This will also include the identification of potential interventions and risk mitigation measures.** **Awareness training will be mandatory for all Project workers regarding the SE/SH risks and the workers responsibilities and the legal consequences of being a sexual or violence perpetrator.** **Training will be provided to the community members on the risks of SEA/SH and information provided on how to report any cases of SEA/SH and the services that will be made available to offer support to any of the survivors.** **Trainings on code of conduct, gender sensitivities (including GBV and SEA/SH) and local cultural sensitivities will be provided to security personnel or the company the security service is procured from will provide evidence that the personnel received these trainings from qualified trainers. The trainings will ensure force is used only for preventive and defensive purposes and in proportion to the threat.** **Approach towards SEA/SH prevention, mitigation and response will be survivor centered and ensure confidentiality, dignity and respect to them.** **The Project staff will be trained on how to preserve the safety of the women, girls, boys when interviewing them and collecting information about their experiences on SEA/SH.** **The Project will provide essential services for survivors such as access to counselling services, support groups, legal support etc. at no cost to them.**	**Moderate**

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
					All identified cases of SEA/SH will be referred to relevant legal entities in the Project area for further investigation and prosecution. **The project grievance mechanism will be made available to project workers and community members and will ensure that survivors' information is confidential and kept anonymous.** **All cases relating to SEA/SH shall be documented and closed.** **The Project will prepare and implement a SEA/SH Prevention and Response Action Plan which will put necessary protocols and mechanisms to address the risks of SEA/SH and how to address any allegations that may arise in accordance with the World Bank Good Practice Note on Addressing SEA/SH in Investment Project Financing involving Major Civil Works.**	
Grievance Mechanism	**Project Affected Community**	**Medium**	**Medium**	**Moderate**	**The project will implement an appropriate system to allow external parties to raise grievances in regard to the Project.** **The Grievance Mechanism will be clearly defined, transparent and accessible to identified stakeholders.** **Contractor will appoint a community liaison officer preferably from the local community who will maintain communication with the local leaders and community members.** **The grievance mechanism will be confidential and provide referral and support system for any workers reporting cases of GBV**	**Minor**

20.4.2 Operation Phase

20.4.2.1 Community Safety

During the operation phase, the project will have various risks that might has negative impact capability on the receiving communities. These impacts might be transferred to the outside of the project due to nature of the risks. Such impacts might be fires, NOx in exhaust gases, explosions, security breaches or spillage of pollutants.

In some of above-mentioned impacts, third party company involvement for the solution might be needed such as fire department, police department, consultants etc.

Public risks during operation have the potential to result in incidents, which could have a significant impact upon neighboring communities and populations. Risks to public safety will be appropriately addressed and prepared for in the operational phase 'Emergency Preparedness and Response Plan' and via appropriate training of staff.

20.4.2.2 Security Personnel

Due to the generation of power, the project is considered a vital facility. Site-based security will be present at the project's main entrance and on patrol throughout the site.

As is consistent with the construction phase, the Project Company will undertake a security risk assessment to determine the appropriate level of security required at the facility. Security arrangements should be guided by UN Code of conducts for law enforcement officials, Voluntary Principles on Security and Human Rights and UN basic principles on the use of Force and Firearms by law enforcement officials if security personnel will be armed.

Beside the requirements set in above guidelines and principles, security personnel will have in house training in regards of grievance and reporting such grievances and dialogue with any members of the local community.

20.4.2.3 Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH)

Even though the Project's employment will be reduced throughout the operational phase, the risk of SEA/SH, will persist, particularly for women, children, and boys. The operational phase team and the host community will still have a limited amount of interaction.

As a result, measures will be taken to avoid and address exploitative sexual relationships, as well as undesired aggressive advances and harassment.

Table 332: Impacts Significance of the Community Health, Safety and Security during – Operation Phase

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Community Security	**Project Affected Community**	**Medium**	**Medium**	**Moderate**	**The project will employ its own security staff who will provide 24/7 security control across the Project site and dedicated security staff at gatehouses.** **The security personnel will be regularly trained on GBV code of conduct including how to handle grievances related to GBV from the community.** **All vehicles entering the site will require pre-approved clearance and will need to be registered. Project security will record all instances of incoming vehicles.** **CCTV will be installed at key locations around the site and at gatehouses.** **Appropriate lighting will be provided at gatehouses for security personnel to prevent unauthorized access.** **Project personnel will only be provided access to the construction site with valid ID cards and permits to work in line with HSE requirements.**	**Minor**
Community Health and Safety	**Project Affected Community**	**Medium**	**Medium**	**Moderate**	**Risks to public safety will be appropriately addressed and prepared for in the operational phase 'Emergency Preparedness and Response Plan' and training.** **The plan will include the appropriate procedure to respond to any such incidents, as well as site specific contact details and details of external agencies who may be required.** **The employees during the operational phase shall undergo a Code of Conduct training to ensure smooth coordination with the neighboring community.** **Appropriate mechanisms for emergency control (e.g. firefighting equipment) will be placed at suitable positions around the site.** **Grievance Redressal Mechanism shall be made accessible to the community to ensure that community members raise grievances to the Project leadership.** **SEA/SH in and out of the Project site will not be tolerated and the O&M Company will work with local community leaders and government officials to ensure that any complaints are addressed in accordance with the law.** **The Health and Safety teams on site will provide advice during training/inductions on exposure to disease including preventative measures e.g. TB, STDs and HIV/AIDS.**	**Minor**

Potential Impacts	Receptor	Sensitivity of receptor	Magnitude of impact	Significance of Impact (without Impact Mitigation Measures)	Mitigation and Management Measures	Significance of Residual Impact
Human Rights	**Project Affected Community**	**Medium**	**Medium**	**Moderate**	**In addition to adhering to the national human rights requirements, the Project Company will put in place a human right's policy in line with the UN Guiding Principles on Business and Human Rights. The statement policy will:** **Be approved at the most senior level of the company;** **Informed by relevant internal and external expertise;** **Stipulate the Project Company's Human rights expectations of personnel, local communities and other suppliers directly linked to the operational phase of the project;** **Be publicly available and communicated internally and to the relevant stakeholders;** **Be reflected in the other policies and procedures to embed it throughout the operational phase activities.**	**Minor**
Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH)	**Project Affected Community**	**Medium**	**Medium**	**Moderate**	**The Project Company will conduct a SEA/SH risk assessment in consultation with relevant stakeholders including women leaders and those working with young adolescent girls and boys. This will also include the identification of potential interventions and risk mitigation measures.** **Awareness training will be mandatory for all Project workers regarding the SEA/SH risks and the workers responsibilities and the legal consequences of being a sexual or violence perpetrator.** **Training will be provided to the community members on the risks of SEA/SH on culturally sensitive manner and information provided on how to report any cases of SEA/SH and the services that will be made available to offer support to any of the survivors.** **Approach towards SEA/SH prevention, mitigation and response will be survivor centered and ensure confidentiality, dignity and respect to them.** **The Project staff will be trained on how to preserve the safety of the women, girls, boys when interviewing them and collecting information about their experiences on SEA/SH.** **The Project will provide essential services for survivors such as access to counselling services, support groups, legal support etc. at no cost to them.** **All identified cases of SEA/SH will be referred to relevant legal entities in the Project area for further investigation and prosecution**	**Minor**

21. HUMAN RIGHTS IMPACT ASSESSMENT

As mentioned earlier, additional social site survey is being performed to interview with relevant parties not only limited to collect social baseline data but also to scan human right issues.

21.1 Overview

With new additions to Equator Principles 4, assessment of adverse Human Rights impacts become mandatory as part of ESIA. Human rights standards of the project shall be in line with the United Nations Guiding Principles on Business and Human Rights (UNGPs)

Human Rights are described in international standards aimed at securing dignity and equality for all. Every human being is entitled to enjoy them without discrimination. As a minimum, relevant human rights are those expressed in the International Bill of Human Rights – meaning the Universal Declaration of Human Rights, the International Covenant on Civil and Political Rights and the International Covenant on Economic, Social and Cultural Rights and the principles concerning fundamental rights set out in the International Labor Organization's Declaration on Fundamental Principles and Rights at Work.

The project should respect human rights within its area of influence and shall be ensure that third party companies are respecting human rights too, including sub-contractors, sub-sub-contractors and suppliers. This means that they should avoid infringing on the human rights of others and should address adverse human rights impacts with which they are involved.

21.2 Standards and Regulations

21.2.1 National Context and Regulations

Uzbekistan, as a UN member, supports and implements all of the UN's major international instruments relating to the protection of human rights and freedoms, including the UN Universal Declaration of Human Rights, Human Rights Council Resolution No. 30/15 on human rights and preventing and countering violent extremism, and the Convention on the Elimination of All Forms of Discrimination.

The State Policy on Human Rights in Uzbekistan aims to prevent infringement of human rights and freedoms, as well as to develop the necessary organizational, legal, social, economic, spiritual, and moral grounds for human rights protection

21.2.1.1 Constitution of the Republic of Uzbekistan (1992)

The constitution asserts that "democracy in the Republic of Uzbekistan shall be based upon common human principles, according to which the highest values shall be the human being, his life, freedom, honor, dignity and other inalienable rights."

Also, the constitution has a dedicated chapter for "Guarantees of human rights". The chapter X Guarantees of human rights and freedoms has following articles;

- Article 43. The state shall safeguard the rights and freedoms of citizens proclaimed by the Constitution and laws.
- Article 44. Everyone shall be entitled to legally defend his rights and freedoms, and shall have the right to appeal any unlawful action of state bodies, officials and public associations.
- Article 45. The rights of minors, the disabled and the single elderly shall be protected by the state.
- Article 46. Women and men shall have equal rights.
- The Oily Majlis (parliament) has an elected and authorized person to deal with human rights issues. The authorized person is a part of republic of Uzbekistan's Legislative Chamber.

21.2.1.2 The Protection of Women Against Harassment and Violence Act (2019).

- The Act defines the various forms of violence - sexual, physical, economic, psychological against women. Protection from harassment and violence is defined as a system of urgent measures of economic, social, legal, organizational, psychological and other nature in order to eliminate the danger to women's life and health, to ensure their safety and to prevent repeated illegal actions against them.
- Other relevant legislations include:
- The National Human Rights Strategy was approved by Presidential Decree on 22
- June 2020. No. PD-6012;
- Law on guaranteeing equal rights and opportunities for women and men (2019);
- The Law on Mediation (2018);
- Law on Public Control (2018); and
- Law on Administrative Procedures (2018)

21.2.2 Lender Requirements

21.2.2.1 Equator Principle IV

The equator principles states; We, the EPFIs, have adopted the Equator Principles in order to ensure that the Projects we finance and advise on are developed in a manner that is socially responsible and reflects sound environmental management practices. EPFIs acknowledge that the application of the Equator Principles can contribute to delivering on the objectives and outcomes of the United Nations Sustainable Development Goals (SDGs). Specifically, we believe that negative impacts on Project-affected ecosystems, communities, and the climate should be avoided where possible. If these impacts are unavoidable they should be minimized and mitigated, and where residual impacts remain, clients should provide remedy for human rights impacts or offset environmental impacts as appropriate. In this regard, when financing Projects:

- We will fulfill our responsibility to respect Human Rights in line with the United Nations Guiding Principles on Business and Human Rights (UNGPs) by carrying out human rights due diligence;
- We support the objectives of the 2015 Paris Agreement and recognize that EPFIs have a role to play in improving the availability of climate-related information, such as the Recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) when assessing the potential transition and physical risks of Projects financed under the Equator Principles; and
- We support conservation including the aim of enhancing the evidence base for research and decisions relating to biodiversity.

In addition to above preamble related with Human rights, other principles related with human rights, corporate social responsibility and responsibilities of corporates responsibilities on community according to EP are as following;

- Principle 11: Business enterprises should avoid infringing on the human rights of others and should address adverse human rights impacts with which they are involved.
- Principle 12: The responsibility of business enterprises to respect human rights refers to internationally recognized human rights – understood, at a minimum, as those expressed in the International Bill of Human Rights and the principles concerning fundamental rights set out in the International Labor Organization's Declaration on Fundamental Principles and Rights at Work
- Principle-13: The responsibility to respect human rights requires that business enterprises avoid causing or contributing to adverse human rights impacts through their activities, and address such impacts when they occur;
- Principle-14: The responsibility of business enterprises to respect human rights applies to all enterprises regardless of their size, sector, operational context, ownership and structure. Nevertheless, the scale and complexity of the means through which enterprises meet that responsibility may vary according to these factors and with the severity of the enterprise's adverse human rights impacts
- Principle-15: Business enterprises should have policies and processes appropriate to their size and circumstances in place, including:

The following Operational principles should also be taken into consideration.

- Principle-16: Policy commitment
- Principle-17 to 21: Human rights due diligence
- Principle 22: Remediation

21.2.2.2 United Nations Guiding Principles on Business and Human Rights (UNGP)

The UNGP is the key framework for the project's assessment of human rights and to set management system.

The responsibility to respect human rights is a global standard of expected conduct for all business enterprises wherever they operate. It exists independently of States' abilities and/or willingness to fulfil their own human rights obligations, and does not diminish those obligations. And it exists over and above compliance with national laws and regulations protecting human rights.

Addressing adverse human rights impacts requires taking adequate measures for their prevention, mitigation and, where appropriate, remediation.

Business enterprises may undertake other commitments or activities to support and promote human rights, which may contribute to the enjoyment of rights. But this does not offset a failure to respect human rights throughout their operations.

Business enterprises should not undermine States' abilities to meet their own human rights obligations, including by actions that might weaken the integrity of judicial processes.

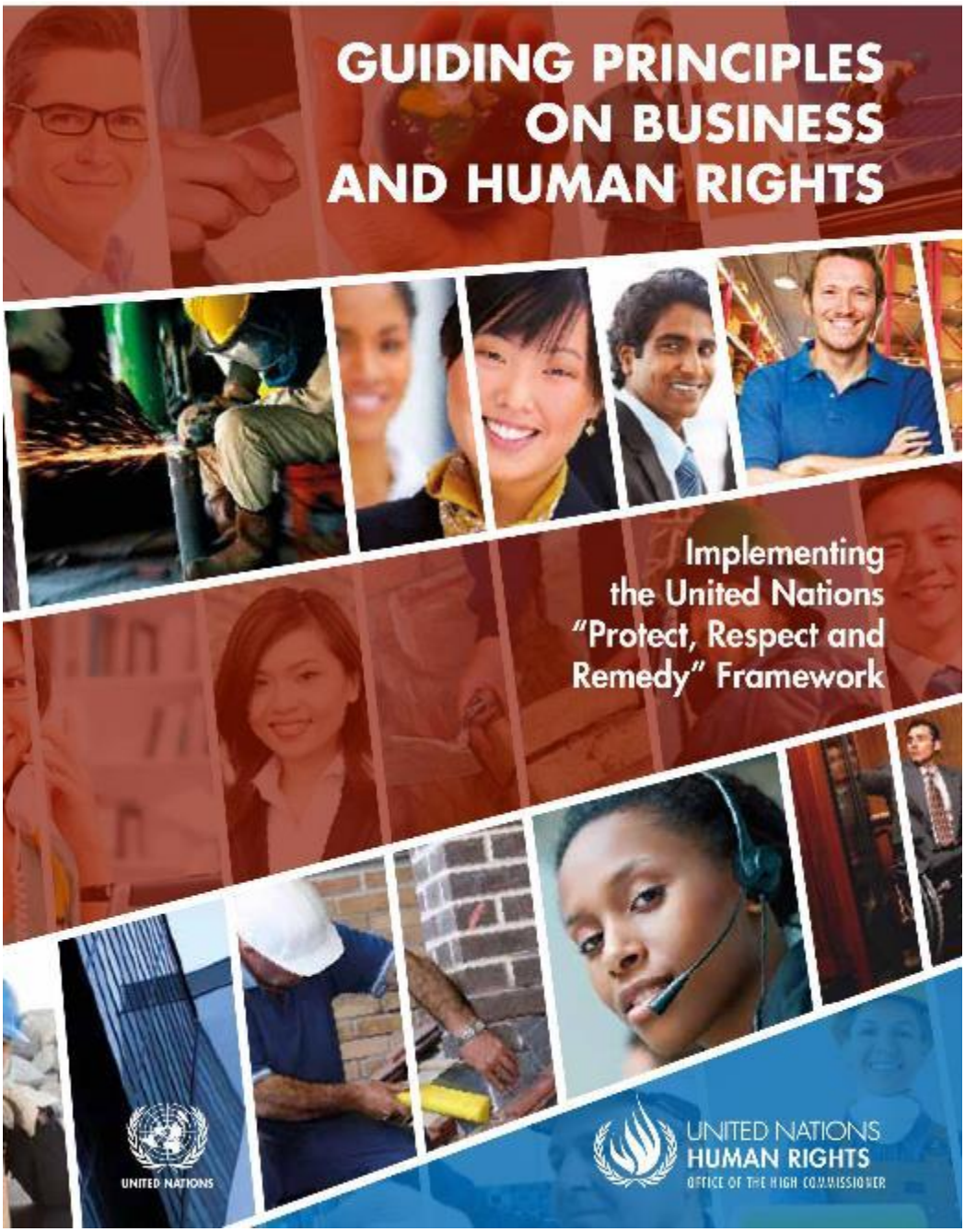


Figure 248: UN Guiding Principles on Business and Human Rights

21.3 Potential Impacts upon Human Rights

21.3.1 Construction

Note: Several of the potential impacts on Human Rights, in particular, those affecting workers have already been assessed with mitigation included in section 18 "Labor and Working Conditions".

21.3.1.1 Indigenous Peoples

Under the UN Guiding principles, the rights of indigenous people should be protected. This includes ensuring prior, free informed consent is provided before any Project development is allowed to take place on their land.

Uzbekistan is Central Asia's most populous country. The last census was conducted in 1989, but according to official estimates updated in 2017, out of a total of 32.1 million people, the ethnic Uzbek majority totaled just over 26.9 million (83.8 per cent of the population) while ethnic Tajiks made up 1,544,700 (4.8 per cent). Other sizable minorities include Kazakhs 803,400 (2.5 per cent), Russians 750,000 (2.3 per cent), Karakalpaks 708,800 (2.2 per cent), Kyrgyz 274,400 (0.9 per cent), Tatars 195,000 (0.6 per cent), Turkmens 192,000 (0.6 per cent), Koreans 176,900 (0.6 per cent) and Ukrainians 70,700 (0.2 per cent). (MRGI, 2021)

Other minorities include Meskhetian Turks and Jews.

The bulk of citizens are at least nominally Sunni Muslim while most of the Russian minority is nominally Orthodox Christian; in practice many citizens of all ethnicities identify with smaller movements like Sufism, Ahmadiyya and various forms of evangelical Christianity.

While the nominally autonomous republic of Karakalpakstan occupies 37 per cent of the country's territory, ethnic Karakalpaks represent about a third of the Karakalpakstan's population, and a very slight proportion of the country's total population.

The ethnic Tajik population is widely thought to be much greater than official statistics indicate, given that many Tajiks and Tajik speakers may classify themselves as Uzbeks to improve their career opportunities.

Uzbekistan is made up of a number of traditional populations of Turkic (Uzbeks, Kazakhs, Karakalpaks), Semitic (Bukhara Jews), and Iranian origins (Tajiks), as well as more recent minorities which arrived in the country during the Russian and Soviet domination (Russians, Crimean Tatars, Meskhetian Turks, Koreans and some Jews).

Since 1991 however, there has been a two-way flow of population which is continuing the dramatic change to the country's demographics. While there are thousands of ethnic Uzbeks who had been working outside of the country have been returning to Uzbekistan from Russia and other neighboring countries, other minorities which are of more recent origin such as the Russians, Crimean Tatars and others have also been emigrating in large numbers.

Only ethnic group known in the area are Ethnic Turkmens. There are over 150,000 ethnic Turkmen live in border regions of Uzbekistan including Khorezm, Surkhandarya and Karakalpakstan. (IWPR, 2010)

However, as part of the consultation process, desktop researches, no indigenous people or ethnic minorities have been identified in or nearby the Project location. Therefore, no further assessment has been undertaken in regards to indigenous people or ethnic minorities.

21.3.1.2 Local Communities

The Project site is located nearby in a lake. The closest settlements are at least 0.9kms away from project border. Based on the Project's area of influence (as per potential impacts upon different environmental and social parameters), there are expected to be specific Project impacts to communities relating to health, safety and security etc. Impacts on community health and safety and mitigation measures are discussed in previous chapter 19 Community Health and Safety. The impacts related with human rights on community will be kept under control by implementing and improving maturity of grievance redress and stakeholder engagement processes.

21.3.1.3 Project Workers

The project will have several parties during the construction and test and commissioning phases. As mentioned in the preamble of this section, many human rights impacts on project personnel are covered in the "Section 18 Labor and Working Conditions". There will likely be various internal processes and protocols related to HR and worker management for each party. The project shall be ensure that compliance to Human rights issues are achieved in sub-contractors, Sub-contractor's sub-contractor and suppliers.

Certain parties will also engage contract staff (e.g. from agencies), where additional manpower is required. There will also be suppliers/service providers (e.g. for deliveries, waste management) who will have access to the site and will be exposed to certain risks of exploitation.

ILO's "2020 third-party monitoring of child labour and forced labour during the cotton harvest in Uzbekistan" (ILO, 2021) reports have shown that there were instances of forced labor, labor with poor contracting conditions, or lacking processes in 2020. As previously assessed, this is a potential impact for the Project, especially for contract staff, or those of sub-contractors. Such risks will need to be carefully safeguarded through policy and internal processes (including monitoring and audit) including sub-contractors, sub-sub-contractors and suppliers.

According to Article 77 of the Labor Code, a minor, that is a person under the age of 18, is allowed to start working from the age of 16.

It is also allowed to work from the age of 15 under some special cases (students of secondary schools, specialized secondary schools, and vocational schools who have reached the age of 15 with the written consent of one of their parents or one of the persons acting as a parent, i.e., a guardian or trustee) to perform light work in their free time, which does not harm their health, moral development and does not disrupt the educational process that are determined by the Labour Code.

A person under the age of 18 has the same rights as an employee over the age of 18. In addition, they are entitled to additional benefits in the areas of health and safety, working hours, vacation time, and other working conditions.

In particular, reduced working hours are set for minors, namely for workers between the ages of 16 and 18, working hours are set at no more than 36 hours per week, and for those between the ages of 15 and 16, no more than 24 hours per week.

Article 241 of the Labour code prohibits the employment of persons under the age of 18 in jobs with unfavourable working conditions that may harm the health, safety and morals of this category of workers. Working conditions that are harmful to health and safety:

- performed underground, underwater, at dangerous heights or indoors;
- related to dangerous machines, tools and equipment;
- in dangerous conditions that may harm the health of minors under the influence of dangerous objects or processes, high levels of temperature, noise or waves;
- performed in difficult working conditions.

Therefore, children under the age of 18 years will not be employed or permitted to work in any occupation or process during the construction and operation of the Project.

21.3.2 Operational Phase

It is approximated that there will be limited workers compared with construction phase during operational phase of the Project which will be a big reduction compared to the construction phase. As a result, the only potential impact on human rights that could potentially be expected is the exploitation of workers.

21.3.2.1 Local Community

No adverse impact to the community Human Rights is expected during the operation phase. However, the company shall be in touch with local community elders, leaders and local governments to collect grievances efficiently as explained in "Chapter 19 Community Health and Safety" of this report.

21.3.2.2 Project Workers

As the vast majority of staff will be direct employees of the Project Company the potential risks associate with worker exploitation are expected to be limited due to consistent processes in place as part of the respective HR management systems, assuming they are appropriately designed and have adequate resources. However, where there is an agency/contract staff the risks of exploitation (particularly forced and child labour) may be more prevalent.

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