Munich, Germany

Climate Change Mitigation Measures Program: Effluent Pressure Pipeline

Addendum No. 2- Additional Measures

Environmental and Social Impact Assessment

Final

Partnership Information

May 2023

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TABLE OF CONTENTS

TABLES

FIGURES

ANNEXES

ABBREVIATIONS

CCMM	Climate Change Mitigation Measures
CESMP	Contractor's Environmental and Social Management Plan
CLS	Core Labour Standards
CO	Carbon Monoxide
DLS	Department of Land and Survey
DoA	Department of Antiquities
DoS	Department of Statistics
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
ESHS	Environmental and Social Health and Safety
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESS	Environmental and Social Standards
FC	Financial Cooperation
FTP	Final Treatment Plant
GBV	Gender Based Violence
GHG	Greenhouse Gases
GRP	Glass Reinforced Plastic
H&S	Health and Safety
HPP	Hydropower Plants
IBA	Important Bird Area
ILO	International Labour Organisation
JICA	Japan International Cooperation Agency
JS	Jordanian Standards
KBA	Key Biodiversity Area
MEGA	Middle Eastern Geodatabase for Antiquities
MoA	Ministry of Agriculture
MoE	Ministry of Education
MoEnv	Ministry of Environment
MoH	Ministry of Health
MoI	Ministry of Interior
MoL	Ministry of Labour
MoLA	Ministry of Local Administration
MoPIC	Ministry of Planning and International Cooperation
MoTA	Ministry of Tourism and Antiquities
MSDS	Material Safety Data Sheets
MSW	Municipal Solid Waste
MWI	Ministry of Water and Irrigation

NO	Nitric Oxide
NO_2	Nitrite
O_3	Ozone
O&M	Operation and Maintenance
OHS	Occupational Health and Safety
PEIA	Preliminary Environmental Impact Assessment
PM	Particulate Matter
PPB	Part per Billion
PPE	Personal Protective Equipment
RSCN	Royal Society for the Conservation of Nature
SO_2	Sulphur Dioxide
TMP	Traffic Management Plan
UPVC	Unplasticized Poly Vinyl Chloride
WAJ	Water Authority of Jordan
WWTP	Wastewater Treatment Plants
YWC	Yarmouk Water Company

1 Introduction

The KfW Development Bank has granted the Water Authority of Jordan (WAJ) a concessional loan from the German Government. The main purpose of the loan is to improve the sanitation infrastructure and reduce the stress caused by climate change, population growth, and the Syrian refugees crisis. This investment program will work on developing the existing reuse conveyance system delivering reclaimed water to the Jordan valley, nexus planning, and Climate Change Mitigation through the reduction of Greenhouse Gas (GHG) emissions.

The framework of this Investment is translated into two programs: Sanitation Programme – Nexus and Resource Protection, and Climate Change Mitigation Measures (CCMM) Programme.

Under the CCMM Programme, WAJ initiated ongoing works to improve system operation and efficiency through energy efficiency, sludge treatment and disposal, and acceptability towards reclaimed water for irrigation in the Jordan Valley. The consulting Contract between WAJ and the Joint Venture Partnership led by Dorsch International Consultants GmbH included three parts as follows:

- Part 1: Construction of As Samra Mono-Landfill: The construction, as well as the construction supervision services, has been completed as of 18th February 2020 and the project is now in the Defects Notification period.
- Part 2: Rehabilitation and Upgrading of Irbid Central and Wadi Arab Wastewater Treatment Plants (WWTPs): The consulting services comprise design, preparation of tender documents and prequalification of tenderers has been completed. The contract has been awarded and currently under construction.
- Part 3: Final Treatment Plant (FTP): The consulting services comprised of the preparation of a feasibility study and detailed design; both have been completed. Further consulting services have been suspended.

The Final Treatment Plant (FTP)'s main purpose is to ensure to the farmers' downstream that the combined effluent from Shallalah, Irbid Central and Wadi Arab WWTPs will comply with the Jordanian Standard for Class A irrigation use, even if the WWTPs failed to treat the effluent to the required standards. However, Part 2 of the CCMM provides comprehensive upgrading of Irbid and Wadi Arab WWTPs to be able to reliably achieve Class A effluent standards and this, together with the separate consultancy services related to the CCMM Accompanying Measures to improve the standards of operation, will ensure that the combined effluent quality overall complies with the standards. Under these conditions, assuming reliable, sustainable operations of the WWTPs, the additional treatment provided by FTP will not be needed; therefore, it was decided to suspend the implementation of the FTP.

Consequently, the remaining budget was reallocated. Additional measures to the CCMM Programme that were not foreseen in the original contract were introduced in Addendum No.2. The Contract for this Addendum was signed on July 1st, 2021 covering Wadi Arab Hydropower Plant (HPP) as well as the design and tender documents for a new pressurized effluent pipeline to replace the existing DN ranging from 500 to 600 mm concrete gravity effluent pipeline, which stretches over 13.5 km between Central Irbid Wastewater Treatment Plant (WWTP) and Wadi Al-Arab WWTP. The new effluent pressurized pipeline will provide improvement to the operational efficiency of the "Reuse System" to be utilized as a supplementary source of agricultural water for irrigation in the Jordan Valley.

This report covers the Environmental and Social Impact Assessment (ESIA) for the new pressurized effluent pipeline.

1.1 Project Background

1.1.1 Existing Reuse System

The reuse of treated wastewater has been highlighted within the Ministry of Water and Irrigation (MWI) Water Reuse Policy (2016) as one possible water source alternative for agriculture, aiming to reserve scarce- freshwater for domestic purposes. In general, the reuse system in the Northern Governorate is made of Wastewater Treatment Plants (WWTPs) and Conveyance Systems. The WWTPs include Wadi Shallalah WWTP (13,700 m3/d), Central Irbid WWTP (13,000 m3/d), and Wadi Al-Arab WWTP (Doaqarah) (18,000 m3/d).

The conveyance system is made up the following components:

- Pressure Pipeline L (9,463 m), DN (700 mm) between Wadi Al-Sallalah WWTP connecting with Gravity Pipeline L (3,444 m), DN (600 mm) and Irbid Central WWTP
- Gravity Pipeline L (11,283 m), DN ranging from (500 to 600 mm) between Irbid Central WWTP and Wadi Al-Arab WWTP
- Gravity Pipeline L (16,374 m), DN (800 mm) between Wadi Al-Arab WWTP and Wadi Al-Arab Dam (Shouneh)

The effluent is mostly discharged into the Jordan River due to a lack of conformity to the wastewater quality set in the Jordanian Standards (JS). The quality of the effluent can be disadvantageous for agricultural soils and irrigation infrastructure due to the presence of suspended solids and high salt levels.

1.1.2 Future Reuse System Improvement Needs

The intended water reuse applications dictate the extent of wastewater treatment required and the quality of the reclaimed water, WAJ initiated ongoing works to improve system operation and efficiency through the following “Capital Investment/ Improvement” measures:

1. **CCMM**: Expansion and rehabilitation of Wadi Al-Arab (Doaqarah) WWTP from (18,000 m3/d) to (27,000 m3/d) and rehabilitation of Central Irbid WWTP to be able to treat up to the design capacity of (13,000 m3/d).
2. **CCMM**: Installation of a new pressurized effluent pipeline between Central Irbid and Wadi Al-Arab (Doaqarah) WWTPs, with a diameter of 800 mm to replace the existing Gravity Pipeline L (11,283 m), DN ranging from (500 to 600 mm)- this component is covered in this ESIA Report.
3. **USAID Jordan Water Infrastructure** – Feasibility study for the Expansion of Ramtha WWTP from (5,400 m3/d) to (22,000 m3/d) and connection to the reuse system by constructing new Pipeline L (8,000 m), DN (600 mm) between Ramtha WWTP and Wadi Ash-Sallalah WWTP. The implementation and construction of this project was funded by AFD.
4. **CCMM**: In-pipe hydropower turbines along the system to utilize significant head difference for energy recovery at Wadi Al-Arab WWTP.
5. **Sanitation Programme – Nexus and Resource Protection C4**: In-pipe hydropower turbines along the system to utilize significant head difference for energy recovery at the toe of Wadi Arab Dam (Shouneh).

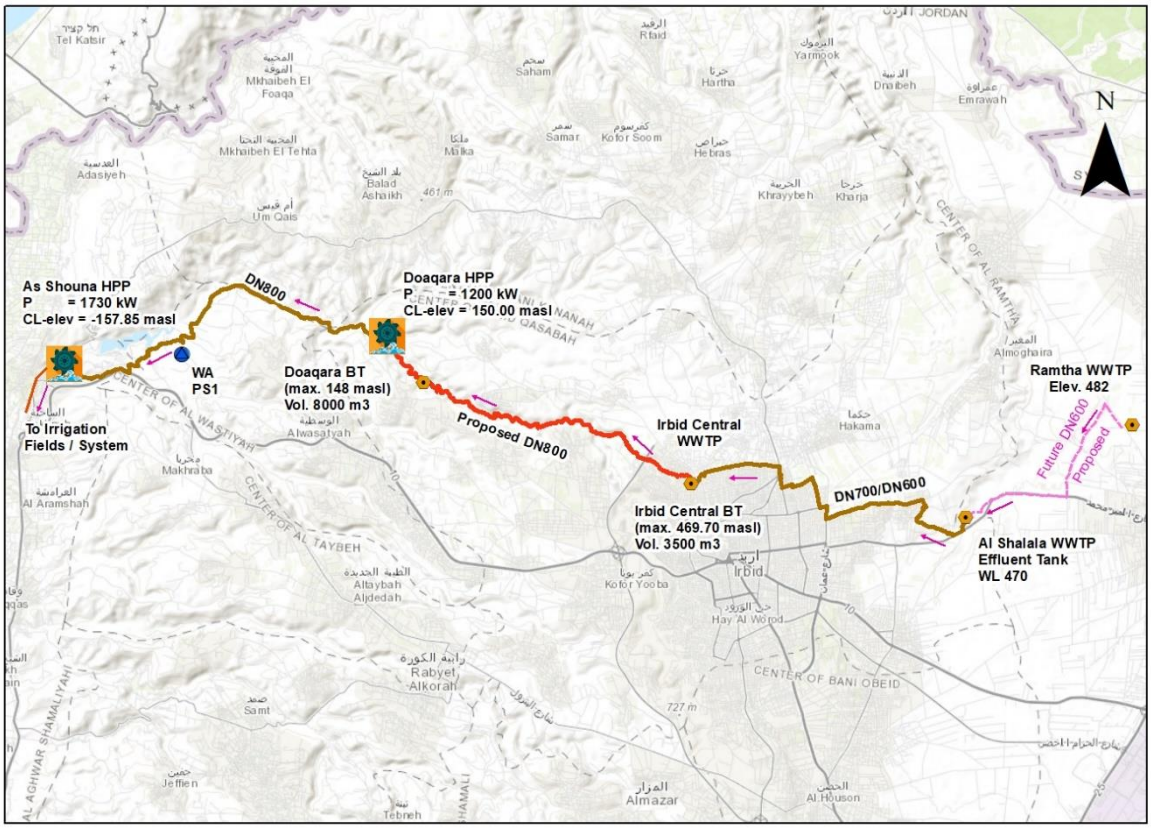


Figure 1: Components of the Reuse System

1.1.3 Project Objectives

The current gravity system will not be able to handle future flows. Therefore, and in order to reuse the treated effluent for irrigation purposes at As-Shouna, the existing effluent pipeline is to be replaced, in turn this will also resolve the current problems with the residents in the area (stealing manhole covers, flooding manholes for agricultural purposes)

The new pressurized pipeline, as mentioned earlier, will transfer the treated sewage effluent from Central Irbid WWTP to Wadi Al-Arab WWTP; the treated effluent will be utilized to generate hydropower at Wadi Al Arab WWTP through the difference in elevation. The generated power will supply both Wadi Al-Arab and Irbid Central WWTPs with electricity.

The detailed design for the Effluent pipeline have been concluded by the Consultant and approved by WAJ on June 1st 2022.

1.2 Project Proponent and Key Contributors

Different entities are involved in the planning and implementation of the Project. The table below summarizes each entity and their role:

Key Contributor	Main Roles
WAJ	• Project proponent and will be the <u>owner</u> of the Project • Approving the design of pipeline
KfW Development Bank	• An International Financing Institution who are the Project Lenders • Grants no objection on the design
The Consultant	• i.e. the engineer: Dorsch International Consultants, Orient Engineering Consultancy and Design, and Consolidated Consultants Group who are commissioned to prepare the detailed design, tender documents, surveys and ESIA for the Project as well as undertake construction and supervision.

Key Contributor	Main Roles
The Ministry of Public Works and Housing	• Ensure trench details are compliant and approve
The Ministry of Environment (MoEnv)	• MoEnv is responsible for the approval of the ESIA Study, if required, and is also responsible for granting the environmental clearance for the Project.
Yarmouk Water Company (YWC)	• Operator; Responsible for Operation and Maintenance (O&M) of the Project

Table 1: Project Proponent and Main Contributors

2 Project Description

2.1 Project Location and Setup

The project is located in Irbid governorate, north of Jordan. Based on the administrative settings set by the Ministry of Interior (MoI), the project is located in Qasabet Irbid District within Irbid Subdistrict. The project area extends from Central Irbid WWTP, along the existing DN600 gravity line up to the inlet of Wadi Al-Arab WWTP

Figure 2: Layout of Existing Pipeline

2.2 Scope of Project and Project Components

The scope of the Consultant's work for the proposed pressurized pipeline can be summarized as follows:

- Determine the connection details at Irbid Central WWTP and at Wadi Arab WWTP and coordinate the details with the Yamouk Water Co. (YWC) operations.
- Coordinate requirements for fibre optic cable to be laid with the pipeline. The pipeline trench cross sections will be prepared to show the cable locations within the trench excavation.
- Coordinate requirements for 11kV power cables, if required, to be laid with the pipeline.
- Confirmation of the detailed pipeline route and alignment along the wadi, parallel to the existing pipeline.
- Preparation of ESIA according to KfW criteria.
- Carry out geotechnical investigation
- Prepare hydraulic analysis, taking into account the option to include effluent flows from Ramtha WWTP.
- Design of pipeline ancillaries as required for full functioning and serviceability of the pipeline.
- Preparation of pipeline layout and profile drawings to scale 1;500 horizontally and 1:200 vertically (profiles).
- Preparation of standard details.
- Preparation of design report.
- Prepare bills of quantities
- Preparation of Tender Documents according to the KfW templates for FIDIC Red / Pink Book.

The main components of the project include:

- Steel DN800 Pipe
- Fibre Optic Cable in Unplasticised Poly Vinyl Chloride (UPVC) Pipes
- 11 kilovolt armored cable, if required.

2.3 Scope of the ESIA

The Consultant is required to undertake an ESIA for the project. The project is categorized as Category B: Medium Risk. The ESIA was required by KfW in accordance with their sustainability guidelines.

The Consultant has formally contacted the MoEnv to explain the Project and inquire what study is to be undertaken to obtain an environmental permit for the project. The MoEnv provided an official letter stating that they require a Preliminary Environmental Impact Assessment (PEIA). Although the formal procedures will follow the MoEnv requirements for a PEIA, the KfW requirements to carry out a full ESIA will also be complied with.

Taking the above into account, in order to avoid confusion and ensure consistency through this document, the Consultant will prepare a PEIA in accordance with the MoEnv's "Environmental Classification & Licensing Regulation No. 69 of 2020" and KfWs Sustainability Guidelines (2022).

This document covers the following in line with the requirements of MoEnv and KfW:

- Chapter 1: Introduction including project background
- Chapter 2: available information about the Project, to include its location, components and anticipated activities;
- Chapter 3: the applicable standards and legislations that are relevant to the project during its various phases;
- Chapter 4: analysis of Alternatives;
- Chapter 5: identify the methodology and scope of work that will be adopted for the study;

- Chapter 6: environmental and social baseline conditions;
- Chapter 7: nature of environmental and social impacts expected to result from the Project throughout its various phases;
- Chapter 8: identify mitigation measures and monitoring actions to eliminate or minimize impacts; and
- Chapter 9: stakeholder engagement.

This document presents the ESIA report prepared by the Consultant to be submitted to the MoEnv and KfW covering the Construction and Operation of the new DN800 Pressurized Effluent Pipeline between Irbid Central and Wadi Al Arab WWTPs.

The ToR report was prepared in accordance with the Jordanian Environmental Classification and Licensing Regulation and other international guidelines and performance standards mentioned below.

- Article (5) of the Environmental Protection Law Number (No.) (6) of the year 2017
- The Jordanian Environmental Classification and Licensing Regulation No. 69 for the year 2020 and its amendments
- The Ministry of Environment requirements

The ToR was reviewed by the ESIA Committee and approved by the Ministry of Environment (MoEnv). ToR approval letter was issued by MoEnv on July 21, 2022 as shown in Annex 3.

2.4 Workforce and Training

The project is expected to have 20 to 40 positions on site from the contractor and supervising Engineer. Each project of this nature shall include but not limited to a project manager, a civil engineer, health and safety engineer, surveyor, and labour. All positions will be available during the construction phase of the project (18 months).

2.5 Overview of Project Phases

Detailed Design Phase:

- Limited geotechnical investigation.
- Hydraulic analysis.
- Flow and effluent quality monitoring at Irbid Central, Wadi Al Arab and All locations.
- Confirmation of pipeline route.
- Design of pipeline ancillaries.
- Preliminary Environmental Impact assessment study as required by local authorities.
- Permitting and licenses for construction works.

Construction Phase (Duration 18 months):

- Transportation and delivery of project components to the project site.
- Setup the site and service area, including safety signs and equipment, and ensuring office space, resting area, WC, storage and waste management facilities are duly organized.
- Land preparation (levelling).
- Construction of civil structures, DN800 Pipeline, and fibreoptic control cable.

Operational and Maintenance Phase:

- Preventative maintenance – limited, routine services such as replacement of worn parts (valves) this will be limited to in-line valves in every 2-5 years and air valves every year.
- Corrective maintenance – repair of pipeline leakages, repair/replacement of damaged equipment and faults.

Decommission Phase:

- Disassemble pipeline.
- Dispose of/recycle system components.

- Reinstate land.

3 Applicable Standards and Legislations

3.1 Donor safeguard requirements and applicable standards

This section provides an overview of the donor safeguard requirements that will be taken into consideration in this project.

3.1.1 KfW Sustainability Guidelines

The KfW Development Bank aims to ensure sustainability and avoid adverse environmental, social and climate impacts and risks in all the Financial Cooperation (FC) Measures financed by the bank. Accordingly, assessing the environmental, social and climate aspects of the proposed project is crucial.

In this regard, the guiding document for the assessment is the KfW Sustainability Guideline last amended in the year 2022 in which FC measures are categorised as A, B, B+, or C depending on their potential of environmental and social risks.

Moreover, in the light of the COVID-19 pandemic, KfW Development Bank issued an Info-Sheet in April 2020 on Preventing and Managing related Environmental, Social, Health and Safety (ESHS) risks as a guidance document aiming to minimize the risks caused by the virus in the development context especially with regards to social topics and occupational health and safety. It is addressed to project executing agencies, implementation consultants, contractors, project's developer, private equity funds and financial institutions and includes namely recommendations on managing risks, communications with both employees and stakeholders, retrenchment, dealing with worker camps, etc.

The Contractor shall assess the COVID measures required, if any, as part of the ESMP subject to the approval of the Consultant.

3.1.2 World Bank Group Environmental and Social Standards and EHS Guidelines

World Bank Environmental and Social Standards

The World Bank issued an Environmental and Social Framework in 2018 that sets out several Environmental and Social Standards (ESS); these standards define the main requirements for clients with regards to identifying environmental and social risks for the project funded by the bank.

The main objective of these standards is to ensure sustainability, promote transparency, non-discrimination, accountability, participation, stakeholder involvement and governance. The ten ESS are listed below:

- ESS 1: Assessment and Management of Environmental and Social Risks and Impacts
- ESS 2: Labour 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

With relevance to this project, there are certain topics that are considered irrelevant or not important. This includes the above-mentioned standards ESS 7 and ESS 9, as per the following justifications:

- ESS 7 “Indigenous People”: as there are no such groups or communities within the project site area, nor are such groups affected by the Project
- ESS 9 “Financial Intermediaries”: as there are no FIs involved in this Project

World Bank Environmental Health and Safety (EHS) Guidelines

The World Bank developed EHS Guidelines that cover general technical performance aspects as well as industry specific measures. The general EHS Guidelines include the following:

- General EHS Guideline (1): Environmental
- General EHS Guideline (2): Occupational Health and Safety
- General EHS Guideline (3): Community Health and Safety
- General EHS Guidelines (4): Construction and Decommissioning

On an industry specific level, the World Bank has specific guidelines for the water and sanitation sector. These guidelines cover aspects related to the operation and maintenance of potable water treatment and distribution systems, and centralised and decentralised sewerage collection system and centralized treatment.

3.1.3 Core Labour Standards of the International Labour Organisation

The International Labour Organization (ILO) sets guidelines and requirements relating to labour relations and workers’ rights, all member states agreed to respect, promote, and apply all the Core Labour Standards (CLS) even those they haven’t ratified. The core labour standards are adopted by all International Financing Institutions including KfW. They are laid out in ten conventions:

- Freedom of association and the effective recognition of the right to collective bargaining (Convention No. 87 & No. 98).
- The elimination of all forms of forced and compulsory labour (Convention No. 29 & No. 105).
- The effective abolition of child labour (Convention No. 138 & No. 182).
- The elimination of discrimination in respect of employment and occupation (Convention No. 100 & No. 111).
- Promotion of occupational safety and health and safe working environment (Convention No. 155 & No. 187)

In general, Jordan has ratified several ILO Conventions as listed in the table below, however, it hasn’t ratified not Convention No. 87 (Freedom of Association and Protection of the Right to Organize Convention), one of the ten fundamental conventions.

List of ILO Conventions ratified by Jordan
• C 29 Forced Labour Convention, 1930 (No.29) ratified 06:06:1966
• C 81 Labour Inspection Convention, 1947 (No. 81) ratified 27:03:1969
• C 98 Right to Organize and Collective Bargaining Convention, 1949 (No.98) ratified 12:12:1968
• C100 Equal Remuneration Convention, 1951 (No.100) ratified 22:091966
• C105 Abolition of Forced Labour Convention, 1957 (No.105) ratified 31:03:1958
• C 111 Discrimination (Employment and Occupation) Convention, 1958 (No. 111) ratified 04:07:1963
• C 138 Minimum Age Convention, 1973 (No. 138) species at 16 years ratified 23:03:1998
• C182 Worst Forms of Child Labour Convention, 1999 (No.182) ratified 20:04:2000
• C 106 Weekly Rest (Commerce and Offices) Convention, 1957 (No.106) ratified 23:07:1979
• C 102 Social Security (Minimum Standards) Convention, 1952 (No.102) ratified in 12:02:2014
• C 116 Final Articles Revision Convention, 1961 (No.116) ratified 04:07:1963

List of ILO Conventions ratified by Jordan
• C 117 Social Policy (Basic Aims and Standards) Convention, 1962 (No. 117) ratified 07:03:1963 • C 118 Equality of Treatment (Social Security) Convention, 1962 (No. 118) ratified 07:03:1963 • C 119 Guarding of Machinery Convention, 1963 (No.119) ratified 04:05:1964 • C 120 Hygiene (Commerce and Offices) Convention, 1964 (No. 120) ratified 11:03:1965 • C 122 Employment Policy Convention, 1964 (No. 122) ratified 10:03:1966 • C 124 Medical Examination of Young Persons Convention, 1965 (No.124) ratified 06:06:1966 • C135 Workers' Representatives Convention, 1971 (No.135) ratified 23:07:1979 • C 142 Human Resources Development Convention, 1975 (No.142) ratified 23:07:1979 • C 144 Tripartite Consultation (International Labour Standards) Convention, 1976 (No. 144) ratified 05:08:2003 • C 150 Labour Administration Convention, 1978 (No. 150) ratified 10:07:2003 • C 159 Vocational Rehabilitation and Employment (Disabled Persons) Convention, 1983 (No. 159) ratified 13:05:2003 • C 185 Seafarers Identity Documents Convention (Revised), 2003 (No. 185) ratified 09:08:2004 and its amendments of 2016 to the annexes of the convention no. 185 ratified 08.07:2017 • MLC, 20006 Maritime Labour Convention, 2006 (MLC, 2006) ratified 27.04:2016

Table 2: ILO Conventions ratified by Jordan

3.2 National Context

This section covers the national Environmental Impact Assessment Process as well as lists the key legislation and regulator/entity relevant to this project. These legislations include: (i) those issued by MoEnv (laws, regulations and instruction), and (ii) the relevant national legislations issued by other line ministries (laws, regulations, instructions, standards).

3.2.1 Jordanian Environmental Clearance Process

The national environmental clearance process is governed by the “Environmental Protection Law No. (6) of 2017” and the “Environmental Classification & Licensing Regulation No. 69 of 2020".

In general, this process is carried out through two main steps. Firstly, and in accordance with the “Environmental Classification & Licensing Regulation No. 69 of 2020”, the project owner/representative shall apply for an „Environmental Consent” prior to undertaking the Environmental Impact Assessment EIA Study. Secondly, the EIA study is to be conducted for the Project as per the requirements of the MoEnv.

The entire process is described in more details as follows:

- The project owner/representative shall submit an application to the Committee granting Environmental Consents including all the documents stipulated in article 11-A of the “Environmental Classification & Licensing Regulation No. 69 of 2020”.
- The committee then reviews the application and arranges for a site inspection to evaluate how suitable the project location is. This is done with reference to annex 5 of the “Environmental Classification & Licensing Regulation No. 69 of 2020”.
- As part of the same process, the EIA Category and requirements are also determined. In general, projects will be classified into one of four categories, according to the severity of anticipated environmental impacts.
  - Category 1 projects with high risk and will require a comprehensive EIA;
  - Category 2 projects with medium risk and will require a preliminary EIA;
  - Category 3 projects with limited risk which will require an environmental consent; and
  - Category 4 project with low risk which does not require any coordination with the Ministry of Environment
- In the case that the project requires an EIA, the Project owner/representative shall choose a licensed Consulting entity to undertake the EIA.

- The EIA will be prepared in two main phases: Scoping Phase including public Consultations for which the main deliverable is the Terms of Reference, and the Assessment Phase to which the main deliverable is the EIA Report.
- Upon submission of the EIA, the Environmental Impact Assessment Committee will review the study and either grants environmental clearance or disapprove the study due to not meeting the needed environmental requirements.
- In the case environmental clearance is granted, the minister will grant the environmental license. Only when all the requirements set forth in the obtained license are applied and adhered to, will the project obtain the environmental permit.

For this specific Project, the national regulation does not require conducting a comprehensive EIA for effluent pipelines, in contrast to KfW guidelines. This was confirmed by the MoEnv in an official letter to WAJ (4/7/8827) attached in Annex 1 in which MoEnv requires only a Preliminary EIA.

3.2.2 Relevant National Legislative and Regulatory Framework

This section includes all relevant Jordanian legislations that must be adhered to by all parties.

Regulator	Relevant Legislation
Ministry of Environment	• Environment Protection Law No. 6 of the Year 2017 • Environmental Classification & Licensing Regulation No. 69 of 2020 • Waste Management Framework Law No 16 of 2020 • Climate Change Regulation No. 79 for the year 2019 • Soil Protection Regulation No. 25 of the Year 2005 • Air Protection Regulation No. 28 of the Year 2005 • Natural Reserves & National Parks Regulation No. 29 of the Year 2005 • Management of Solid Waste Regulation No. 44 of the Year 2022 • Management of Hazardous Material and Waste Regulation No. 68 for the year 2020 • Instruction for the Limitation and Control of Noise of the Year 2003 • Instructions for the Management and Handling of Hazardous Waste of the Year 2019 • Instructions for Recycling and Handling of Consumed Oils of the Year 2014 and its amendments in 2016 • Instructions for protecting birds and wild animals and organizing their hunting and trafficking of 2021 • Water Sector Green-Growth Action Plan (GGAP), 2021-2025 • The National Climate Change Policy of the Hashemite Kingdom of Jordan (2013-2020)
Ministry of Local Administration	• Local Administration Law No. 22 of 2021 • Professions Licensing Law No. 28 of 1999 and its amendments • Land Use Planning Regulation No. (6) For the Year 2007 • The Joint Services Councils By-Law No. 113 of 2016 • Prevention System, Charges and Waste Collection fees within Municipalities Areas and its amendment No.68 of the year 2016.
Ministry of Water and Irrigation	• Water Authority Law No. 18 for the Year 1988 amended as per law 22 for the year 2014 • Groundwater Control Regulation No. 85 of the Year 2002 and its amendment of 2019
Ministry of Agriculture	• Agriculture Law No. 13 of the Year 2015 and its amendments

Regulator	Relevant Legislation
	• Regulation for the use of reclaimed and treated wastewater, salt water, and brackish water for agriculture No. 7 for the year 2016 and its amendment in Year 2021
Ministry of Health	• Public Heath Law No. 47 of the Year 2008 and its amendments No.11 for the year 2017.
Ministry of Interior	• Traffic Law No. 49 of the Year 2008 and its amendments of 2020 • Civil defence Law No. 18 of 1999
Ministry of Labour	• Labour Law No. 8 of the Year 1996 and its amendments of 2019 • Anti-Trafficking Law No. 9 of the Year 2009 • Regulation for mandatory employment of Jordanian workers from the governorates in which the reconstruction projects are implemented No. 131 for the year 2016 • Regulation of Protection and Safety from Industrial Tools and Machines and Worksites No. 43 of 1998 • Regulation for the Establishment of Occupational Health and Safety Committees and Supervisors No. 7 of 1998 • Instructions for the General Health Conditions for Industries of 2019
Ministry of Energy and Mineral Resources	• Renewable Energy and Energy Efficiency law No. 13 of 2012, and its amendments no.33 for the year 2014 • General electricity law no.64 of the year 2002 • Energy Efficiency (EE) and Renewable Energy (RE) Policy, 2016-2025 • Energy Sector Strategy 2020-2030 • Energy Sector Green Growth Action Plan (GGAP), 2021-2025
Ministry of industry and Trade	• The Law of Control and Inspection of Economic Activities No. 33 of 2017
Department of Land and Survey	• The Real Estate Ownership Law No. 13 of 2019
Ministry of Tourism and Antiquities	• Antiquities Law No. 21 of 1988, and its amended for the year 2008 • Law No. 5 of 2005 on the Protection of Urban Heritage.
Jordan standards and metrology organization (JSMO)	• Ambient Air Quality Standards (JS 1140/2006) • Standards for the Maximum Allowable Limits of Air Pollutants Emitted from Stationary Sources (JS 1189/2006). • Standards for Water — Reclaimed domestic wastewater No. JS 893/2021. • Standard for Treated Sludge and Sludge Disposal (JS 1145/2016). • Standards for Lighting — Lighting levels in work environment No. JS 2253/2020 • Standards for Motor Vehicles — Emission - Diesel Engines No. JS 1054/1998 • Standards for Drinking Water JS 286/2015

Table 3: Relevant National Legislations

3.2.3 International Treaties and Conventions of Which Jordan is a Party/Signatory

- Basel Convention of Trans-boundary Movements of Hazardous Wastes and Their Disposal — 1989. Designed to reduce the movement of hazardous waste between countries and specifically to prevent transfer of hazardous waste from developed to undeveloped countries. Jordan signed on this convention in 1989, but it came into effect in 1992.

- Convention on Biological Diversity — 1992. The convention was dedicated to promote sustainable development. It recognizes that biological diversity is about more than plants, animals, and microorganisms and their ecosystems—it is also about people and their need for food security, medicine, fresh air, water, shelter, and a clean and healthy environment in which to live. Jordan has signed on this convention in 1992 and it became a party in 1994.
- Convention on the Conservation of Migratory Species of Wild Animals, Bonn Convention — 2000. The convention is aimed at protecting migratory species, their habitats, and migration routes.
- The United Nation Framework Convention on Climate Change — 1994. It is an international environmental treaty that aims to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.
- United Nations Convention to Combat Desertification — 1994. The convention aims to combat desertification and mitigate the effects of drought through national action programs that incorporate long-term strategies supported by international cooperation and partnership arrangements.

3.3 Gap Analysis in Relevant Environmental and Social Regulations

The following table presents the gaps that exist between the national environmental and social requirements in Jordan and the World Bank Standards particularly as they relate to the following key aspects: Environmental Permitting, Environmental Management, Labor and Working Conditions, Community Health and Safety, Land Acquisition, and Public Consultations and Disclosure.

No.	Word Bank Environmental and Social Standards (WB ESS)	Requirements	Gaps	Measures to Cover Gaps
1	Assessment and Management of Environmental and Social Risks and Impacts (WB ESS 1) & Resource Efficiency and Pollution Prevention and Management (WB ESS 3)	Environmental Permitting	• The ESIA is regarded as a permitting requirement to fulfil Jordanian legal requirements and is often commissioned after the project proponent has made key project decisions especially those related to project alternatives, site selection, project size, etc. According to the EIA regulation (Environmental Classification & Licensing Regulation No. 69 of 2022), the Ministry of the Environment is the sole authority responsible for requesting, screening, reviewing, and approving environmental impact assessment studies. • Larger projects in Jordan are often donor-financed (including the KfW) and so are appraised to donor requirements which are usually more stringent than national Jordanian requirements especially in areas related to social impacts, land acquisition, public consultation, and gender integration.	• KfW and WB requirements were used for aspects not covered by local Jordanian legislation especially related to public consultations and land acquisition.
		Environmental Management	• Jordanian legislation does not allocate sufficient resources to conduct post-permitting follow up regarding the implementation of the provisions of Environmental Management Plans especially during the construction phase (as the operation phase is mostly covered through the auditing process).	• The Project Executing Agency, in cooperation with the environmental authorities, to allocate sufficient resources to ensure the full and timely implementation by the Contractor and Operator of the requirements of the Environmental and Social Management Plan (which is part of this ESIA) including the monitoring and reporting requirements.

No.	Word Bank Environmental and Social Standards (WB ESS)	Requirements	Gaps	Measures to Cover Gaps
			• There are inadequate provisions for institutionalizing controls and performance requirements and applying them on contractors and project operators. • Projects that have obligations to monitor and report on environmental performance (e.g. air emissions, discharges, etc.) often do so under different legislation.	
2	Labor and Working Conditions (WB ESS 2)	• Labor Rights	• Shortcomings with regard to the implementation of occupational H&S standards at construction sites in Jordan. • Although there are safeguards for the implementation of non-discrimination and equal opportunities in employment in the national legislation. Child labor is still an issue in Jordan.	• Ensure that non-discrimination and child labor are addressed on a project level with the implementation of Human Resource Policy and procedures, as required in the ESMP. • Ensure that H&S implementation is enhanced through considerations included in the project specific ESMP. • Ensure that a grievance mechanism for workers in place for each project. • Incidents and accidents need to be reported. • All workers shall be provided with clear terms and conditions of employment. • The contractor(s) shall have insurance to cover accidental injury and death for all project workers. • Specific competency for OHS staff shall be assigned for the project (at site) and a construction supervisor will be at site to monitor all activities including those related to labor.
3	Community Health and Safety (WB ESS 4)	• Community Rights	• There are no specific considerations of community health and safety.	• Community H&S is addressed as part of the ESIA.

No.	Word Bank Environmental and Social Standards (WB ESS)	Requirements	Gaps	Measures to Cover Gaps
			• There is no existing legislation that addresses the matter of community health and safety and sets a clear provisional scheme to ensure that those aspects are being safeguarded.	• The ESMP includes consideration and mitigation measures on community H&S. The Conractor's ESMP should clearly portray these requirements. • The preparation of specific management plans should be considered by the Contractor prior to implementation (e.g. Emergency Preparedness and response Plan, Traffic Management Plan, Security Management Plan).
4	Land Acquisition, Restrictions on Land Use and Involuntary Resettlement (WB ESS 5)	• Resettlement and Land Acquisition	• The Jordanian Real Estate Ownership Law No. 13 of 2019 does not recognize displaced people (physically or economically) without formal legal rights. • Furthermore, it does not recognize the term 'involuntary resettlement'. • The focus in Jordanian legislation is confined to land and assets such as buildings, trees, and other fixed objects which may be expropriated or damaged by the project. • Resettlement assistance is not covered except for the provision of cash compensation for the loss of land or assets for persons with formal legal rights. • Loss of value and economic resettlement are not covered by the local legislation. • The Jordanian legislation does not require the preparation of Resettlement Action Plans or Livelihood Restoration Plans, nor to undertake a socio-economic survey prior to commencing project activities.	Under the terms of the contract, WAJ will: • Maintain open communication channels and on-going consultations with project affected people throughout the project lifecycle. • Implement a grievance mechanism to be accessible to all project affected people. • Conduct regular monitoring and reporting.

No.	Word Bank Environmental and Social Standards (WB ESS)	Requirements	Gaps	Measures to Cover Gaps
			• Furthermore, it does not require performing consultation with project affected people or conducting monitoring or reporting. • The Jordanian legislation offers the owner the right to negotiate to reach agreement over the compensation and to refer the case to the courts but only as it relates to the amount of the compensation. • Project affected persons and host communities have very limited opportunity under the law to participate in defining or agreeing eligibility criteria.	
5	Stakeholder Engagement and Information Disclosure (WB ESS 10)	• Public Consultations and Disclosure	• Jordan's local legislation require one or two consultation sessions during ESIA preparation that are open to the public and for which feedback can be obtained to feed into the study while WB requires stakeholder engagement throughout the duration of the project including during construction and operation to be appropriately considered. • The WB also requires full disclosure of all ESIA documents while this is not necessarily required by local legislation. • Consultation with stakeholders is legally required for only comprehensive ESIA process. • Vulnerable groups do not have special engagement considerations.	• Stakeholder engagement, including disclosure and dissemination of information, should be planned for and carried out in line with the principles of prior, informed and free engagement and informed participation, in order to lead to broad community support by the affected communities and longer-term sustainability of the project's activities. • WAJ must adopt, update, and implement the Project's Stakeholder Engagement activities and provide stakeholders with access to timely, relevant and understandable information, and to engage relevant internal and external stakeholders throughout the project life to ensure effective communication. • To ensure that the level of engagement corresponds to the type and scale of the potential impacts and will take the concerns

No.	Word Bank Environmental and Social Standards (WB ESS)	Requirements	Gaps	Measures to Cover Gaps
				of stakeholders into consideration in decision making. • A Grievance Mechanism should be in place for all stakeholders. • SEP will be developed to ensure proper engagement of all relevant stakeholders including vulnerable groups.

4 Project Justification and Alternatives

Treated effluent is currently being transferred from Irbid Central WWTP to Wadi Al Arab WWTP through a gravity system that consist of DN600/500 concrete pipes and approximately 200 manholes. It is proposed under this project to replace the existing system with a new pressurized system. This would solve all the pipe blocking problems and will expand the system capacity to accept more flows in the future. It will also allow electricity to be generated using the 300m difference in level between the two ends of the pipeline to reduce carbon footprint. The pipe will be laid parallel to the existing system for land availability.

Implementing the Hydropower plants at the end of the pipeline is under a separate project.

4.1 Site Selection Alternatives

There are no site alternatives since the new effluent pipeline will follow the existing effluent pipeline path in the wadi. Due to the steep terrain of the wadi, it is impractical to follow another route and the land easement of the pipeline is already under WAJ ownership.

4.2 Technological Alternatives

The project objective is to lay the effluent pressure pipeline parallel to the existing pipeline and then convert the flows into the pressure pipeline. Various materials can be used for the sake of this project. Potential material choices were steel, GRP, and Ductile Iron. Due to the levels and objective to generate electricity, the pipes must be rated for up to 40 bar pressure.

GRP was neglected due to technological reasons and the difficulty to ensure against leakages. Also, the size of GRP fittings, and since the existing effluent pipeline is a gravity pipe, some turns would require customized fittings to achieve the angles.

Both steel and ductile iron can interchangeably be used in such applications. Ductile Iron can be used with high alumina cement lining to be suitable for sewage use. In the event that the effluent may become anaerobic in the pipeline and forms hydrogen sulphide, the lining will be resistant to corrosion and will not be affected. Since the pipeline will remain completely full, there will be no potential for aerobic bacteria to form and convert the hydrogen sulphide, if any, to much more corrosive sulphuric acid.

On the other hand, steel can be used for various applications of different pressures. It all depends on the steel quality, pipe thickness and pipe lining.

For the connection of steel pipes, the welding technique is used with long lasting experience. Welding by automatic equipment is nowadays standard. The welded joint has the same strength as any other point of the pipe. Welding of pipes with different steel qualities is possible without technological complications.

Steel pipes can be bent on site up to a certain deviation by a cold bending machine. For cement-mortar-lined pipes, the bending has to be performed prior to the application of the lining. Alternatively, mitre bends or hot bends shall be used. Fittings are available in standard sizes as per international standards.

Steel pipes for water or wastewater transmission systems will generally have a protective internal lining and external coating. Different methods and materials are available. For the sake of this project, steel pipes with cement mortar inter lining and 3-layer polyurethane external coating shall be used. In addition, for buried pipelines, cathodic protection shall be installed as an additional measure for protection.

Since both can technically be used for the application in this project, Steel pipes were chosen for this project due to cheaper prices in the market.

4.3 Project Design Alternatives

An alternative would be to install a gravity pipe, similar to the existing one, but larger diameter. However, this have been excluded for the following reasons:

- No possibility to generate electricity.
- Farmers have been known to block the flow at the manholes so that the effluent can be used for local irrigation.
- People have also been known to dump solid waste into the manholes, which contaminates the effluent and can block the flow.

Note that the effluent will be used for irrigation in the Jordan Valley. Also, generating electricity from the effluent has been evaluated as economically as well as environmentally viable.

4.4 The 'No Project' Alternatives

The project concept was proposed due to the complaints of YWC staff. It was reported that manholes across the gravity lines keep getting blocked. YWC also reported that the manhole covers are continuously being stolen and they had to place big boulders of rock to close the manhole opening and avoid people throwing their garbage into it or even falling in the manhole.

Having a closed transmission system will solve the issues mentioned above and will also give an opportunity for energy generation through a Hydropower at the low point of the pipeline.

Not implementing the project means that YWC will have to find a way to reduce the stealing of manhole covers and prevent people from blocking the manholes. It will also eliminate the possibility of building a hydropower plant to generate power for the WWTPs.

5 ESIA Approach and Methodology

This section discussed the approach followed by the consultant and the procedure followed to assess environmental and social risks including the methodology for identifying baseline conditions and the approach to determine the significance of potential impacts and mitigation measures.

5.1 Environmental and Social Baseline Conditions

Baseline conditions describe the current conditions which would prevail in the case that the project is not implemented. Identifying the environmental and social baseline conditions and assessing the sensitivity of each environmental attribute is crucial to effectively assess the impacts of the project, the changes that will occur and consequently the best measures to mitigate the adverse risks.

Assessing the environmental and social baseline conditions is done through data collection from several sources including:

- Desktop studies and literature reviews
- Data from stakeholders and regulatory entities
- Site visits and surveys

The baseline conditions of this project are described in Section 6 for Socio-economic, Physical, and Biological environments.

5.2 Impact Assessment Methodology

The overall significance of impacts is defined through a generic set of criteria that is applied to each environmental and social attributes. The two main factors to determine the significance of impacts are the sensitivity of the receiving parameter/attribute as assessed in the baseline conditions, and the nature and magnitude of impact. The importance or sensitivity of the receiving attribute is determined throughout the baseline conditions assessment. The necessity of recognising the sensitivity lies within understanding the adaptability of the parameter to the identified impact.

The receptor (parameter/attribute) can be categorized as high sensitivity meaning that it is fragile to change, and recovery is difficult; medium sensitivity meaning that the receptor is likely to cope with change with certain residual impact; or low sensitivity which means the receptor is adaptable to change with a high level of resilience. Additionally, the nature of impacts and their criteria is shown in the classification table below:

Impact Criterion	Classification of the Impact	
	Expression	**Description**
Nature of Impact	Positive	Beneficial results (enhancing the existing environmental and social conditions)
	Negative	Harmful results with negative risk to the environment
Type of Effect	Direct	Impacts the are clearly attributed to a certain parameter
	Indirect	Impacts that are related or subsequent to a certain impact on a particular parameter
Magnitude	High	Huge change associated to variations in the baseline. Potentially a clear breach of accepted limits
	Medium	Noticeable change that may exceed certain accepted limits
	Low	Just about noticeable compared with the baseline conditions in which no thresholds are surpassed
Likelihood of occurrence	Unlikely	Probably will not occur, risks are included in this category
	Likely	May occur
	Certain	Will occur
Consequence	Marginal	Little impact
	Critical	Moderate impact
	Severe	High impact
Spatial influence	Local	Within the site premises
	Regional	Within the surrounding area of the project
	Global	Extends beyond the surrounding area
Temporal influence/ Duration	Short term	The impact shall last short period of time- within 1 year
	Medium term	The impact shall last medium period of time- within 5 years
	Long Term	The impact shall be permeant- over 5 years
Reversibility	Reversible	The influence of the impact can be reversed
	Irreversible	The influence of the impact cannot be reversed and shall be permanent

Table 4: Impact Classification and Nature

The below matrix presents how the two above-mentioned factors are considered in identifying significance which is essential to the entire ESIA process. For this project, this matrix was coupled with professional judgement in determining the significance of impacts.

Magnitude of Impact / Sensitivity of receptor	Low	Medium	High
Low	Not significant	Minor	Minor
Medium	Minor	Minor	Moderate
High	Minor	Moderate	Major

Table 5: Matrix of Impact Significance

After identifying the main Environmental and Social Impacts and their significance, it is a vital step of the ESIA to define certain actions and measures that would mitigate the impacts and lower the risks. This process takes place according to the mitigation hierarchy: avoid, minimize, restore and offset.

As part of this study, the feasible mitigation measures are identified for each negative impact as part of the Environmental and Social Management Plan (ESMP).

5.3 Development of an Environmental and Social Management Plan (ESMP)

Based on the environmental and socio-economic impacts assessed, actions have been identified to avoid to the extent possible and/or mitigate negative impacts, reduce risks, and monitor continual environmental performance constituting the ESMP.

The ESMP is a vital part of the ESIA and can be used as a stand-alone document. In general, it covers the requirements and procedures needed to manage potential negative environmental and social impacts related to the Project, as well as the responsible entity for the implementation of the mitigation measures. It is important that the ESMP is flexible in the nature and exact location of operations and should be easily utilized during the different phases of the Project by Developer, Contractor, Project Operator, MoEnv, and other responsible parties.

It should be noted that the ESMP is an integral part of the Tender Documents for the Contractor.

6 Environmental and Social Baseline Conditions

6.1 Physical Environment

This section describes the physical baseline of the proposed site based on the findings of data collection and documents review.

6.1.1 Landscape and Visual

No key visual receptors– such as recreational activities, environmental reserves, remarkable historical or cultural sites, or other natural structures normally seen as valuable by the human perception are found within or around the pipeline route. In general, the pipeline route flows within two existing wadis, Wadi Al Arab and Wadi Hamam, which can be categorized as a desert-like habitats that are barren with very limited and scattered vegetation coverage.

Figure 3: Segment of the pipeline route

Based on the brief analysis of the elevation profile, the highest point is located in Irbid Central WWTP with an elevation of 470m above sea level. Nonetheless, the elevation profile varies across the length of the pipeline, with a smooth elevation drop from East to West (min: 194m).

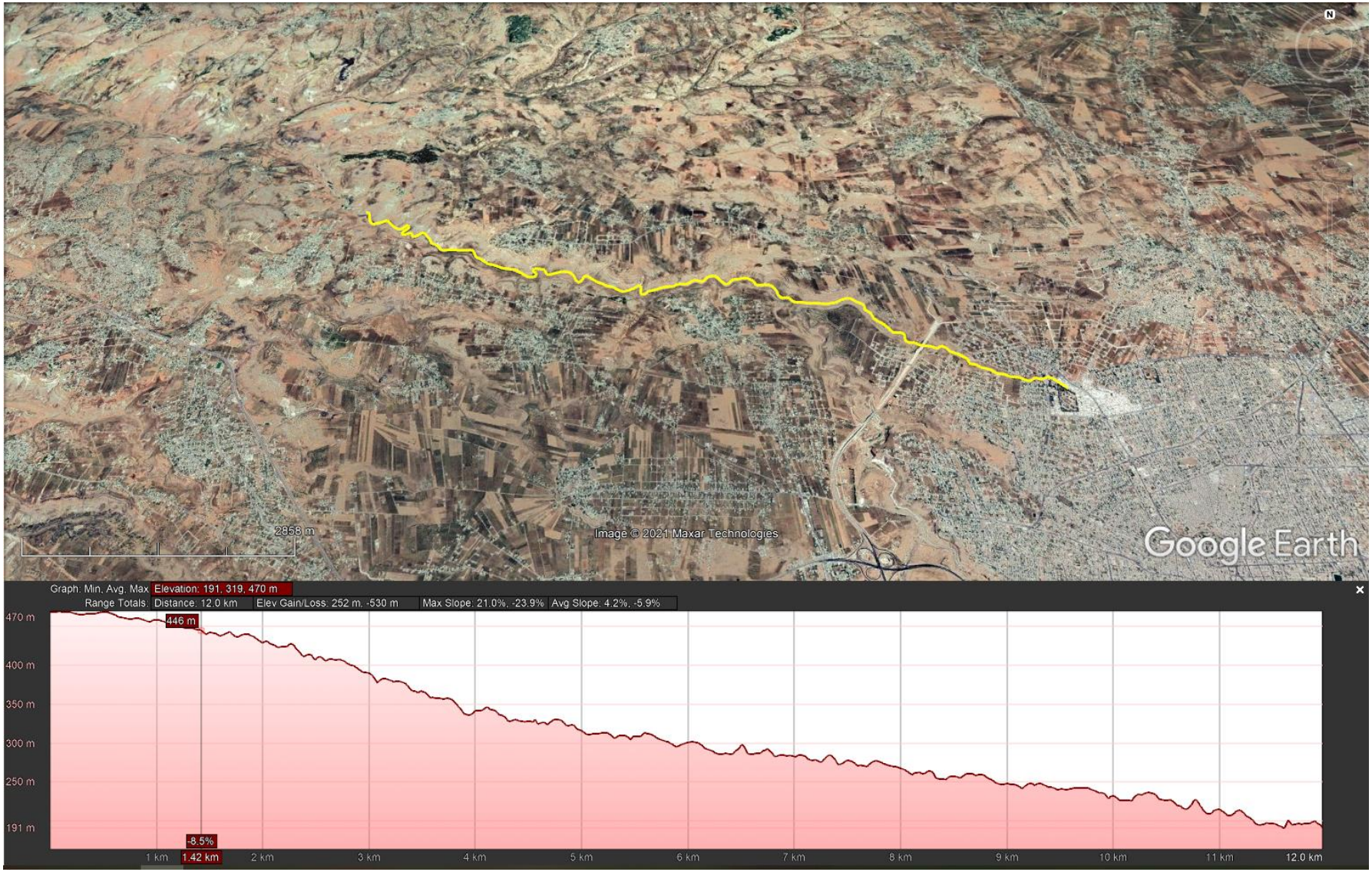


Figure 4: Elevation Profile for Pipeline Route (Google Earth)

6.1.2 Land Use

The project is located in an existing wadi where the route of the effluent pipeline will follow the route of the current gravity main. 0.5 km of the route are located in a built-up residential area while the rest falls within existing wadis. A study has been made along the path of the designed pipeline and the pipeline passes through 124 land plots. The Consultant optimized the path of the pipe to avoid as many land plots as possible. The final path designed passes through approximately 117 lands, 43 of them are privately owned. WAJ in coordination with Department of Land and Survey (DLS) have overlayed the exact shares of the lands owned by WAJ over the entire list of 43 lands mentioned above; they have concluded that only 24 of these lands require acquisition as the pipeline will pass through WAJ owned sections property in the remaining 19 lands. Out of these 24 lands, only a small area of four of the lands, will be acquired; consequently, the Consultant has changed the routing of the pipeline to exclude these lands thus minimizing the need and impact for acquisition to only 20 lands.

Figure 5: Beginning point of Pipeline route in Built-up residential area

In relation to the official and regulatory land use of the land plots to be acquired as per the municipalities, 86% are agricultural lands, 12% are public services lands while 2% are residential lands.

In general, the wadi is vacant with no major activities taking place. However, there are a number of farms (mainly olive trees) along the pipeline route. As evident from some fecal remains of livestock on site, grazing activities are most likely undertaken by the local communities within the Project site. The only structures in the route of the pipeline are the manholes of the existing gravity main.

Apart from the above, no evidence of any other informal land use was noted within the Project site.

6.1.3 Hydrology and Hydrogeology

Hydrology and Surface Water

Based on the Water Master Plan developed by Japan International Cooperation Agency (JICA) in 2017, the water transmission system to Irbid Governorate including Irbid City is presented in Figure 6 below.

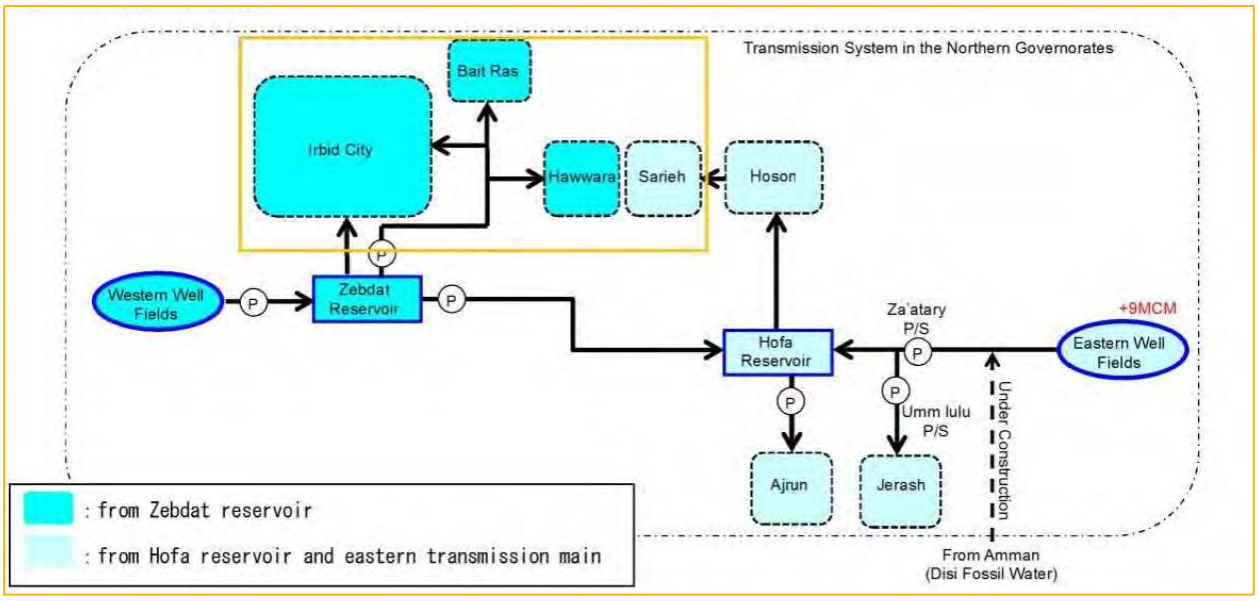


Figure 6: Water Transmission system in Irbid Governorate

Source: (JICA, THE STUDY ON WATER SECTOR FOR THE HOST COMMUNITIES OF SYRIAN REFUGEES IN NORTHERN GOVERNORATES, 2017)

Water from Wadi Arab and Tabaqet Fahel wells (Western well fields) is transmitted to Zebdat Reservoir (110,000 m^3) which in turn supplies water to Irbid city.

The surface water basins within Irbid Governorate include Yarmouk, Northern Side Wadi, and Jordan Valley basins. The main features of these basins are outlined in the table below.

Surface Water Basin	**Catchment Area** (km^2)	**Base Flow** (million m^3 per year)	**Total Flow** (million m^3 per year)
Yarmouk Basin	7,250[1]	264	355
Northern Side Wadis	946	37.37	49.39
Jordan Valley Basin	780	-	2.73

Table 6: Main Features of Surface Water Basins

Source: (JICA, The Study on Water Resources Management in the Hashemite Kingdom of Jordan- WATER RESOURCES MANAGEMENT MASTER PLAN)

The surface water basin that overlaps with the project site is the Northern Side Wadis.

Hydrogeology and Groundwater

Regarding groundwater sources, the northern governorate of Irbid includes mainly three groundwater basins Yarmouk, Jordan Valley and Rift Side Wadi (North Jordan Valley) Basins. In terms of area ratio of the groundwater to the governorate these figures translate to 45%, 38% and 19% respectively. The actual and safe yields of renewable groundwater for the mentioned basins are shown in table below.

Ground Water Basin	**Actual Yield** (million cubic meters)	**Safe Yield** (million cubic meters)
Yarmouk Basin	54.53	40
Jordan Valley	27.04	21
North Jordan Valley	45.6	15

[1] 1,426 km^2 located within the Jordanian borders

Table 7: Safe and Actual Yields for Ground Water Basins in Irbid

Source: ((MWI), 2017): Water Sector Facts and Number

The pipeline route falls within the North Jordan Valley groundwater basin.

6.1.4 Geology and Soil

Irbid governorate is predominated by three soil orders: Inceptisols, Aridisols and Vertisols. Inceptisols are silty soils with high carbonate and low organic content; they exhibit a moderate degree of soil development and lack significant clay accumulation in the subsoil. Moreover, they are widely distributed and occur across a wide range of ecological settings, parent materials and climatic conditions, and thus have a wide range of characteristics.

Aridisols are soils with dry moisture regime and weak soil development. They contain subsurface horizons in which clays, calcium carbonate, silica, salts and/or gypsum have accumulated. The dry climate and low humus content limit their arability without irrigation.

Vertisols are red soils with high clay content which making it a relatively homogenous soil order. These clay-rich soils are highly fertile with a high water-holding capacity that supports the cultivation of crops. Additionally, these soils contain a type of expansive clay that shrinks and swells dramatically with change in moisture content

The main great groups of soil in Irbid governorate are Haploxerepts (Xerochrept) under the Inceptisols order; Chromic Haploxererts (Chromoxeret) under the Vertisols order; and Haplocalcids and Haplocambids (Calciorthids and Camborthids respectively) under the Aridisols order.

As shown in figure below, the soil in the proposed route of the pressurized pipeline are Haploxerepts (Xerochrept) and Chromic Haploxererts (Chromoxeret).

6.1.5 Climate and Meteorology

According to the Annual Book on Water for the year 2018-2019 published by the ministry of Water and Irrigation, the rainy season in Jordan starts in October and ends in May, where rainfall is concentrated in the period between December and February. During the year 2018-2019 the average rainfall was 16% higher than the usual average annual rainfall rates.

Moreover, the temperature in the Jordan is highest during the months of July and August, and lowest during December to February.

The closest weather station that was studied in the Annual Book on Water for the year 2018-2019 is Samar Station (AD0034). This station is located[2] around 11 km away from the beginning of the effluent pipeline and around 14 km from the end of the pipeline (Wadi al Arab WWTP).

Samar Station is located in the North of Jordan where the average annual precipitation in dry years is less 300 mm and higher than 900 mm in wet years. In general, the average temperatures recorded in the weather station during the month of January is 11 degrees Celsius and between 25-26 degrees Celsius in July and August. The highest temperatures recorded in the weather station is in the months May, June and July which were higher in the year 2018-2019 (30-32 degrees Celsius) than the regular annual average (20-26 degrees Celsius).

As for evaporation rates in Samar weather station, they range between 2000-4000 mm which is considered high. In the year 2018-2019 the average evaporation rate was recorded to be 3300 mm.

[2] Straight line areal distance

6.1.6 Air Quality

The ministry of Environment monitors air quality as part of its effort to protect public health and ensure proper air quality in accordance with the Jordanian Standards 1140/2006 for Ambient Air Quality. The monitoring program aims to specify the level of certain pollutants including Particulate Matter (PM10), Nitrogen Oxides (NO and NO_2), Sulphur oxides (SO_2), Carbon Monoxide (CO), and Ozone (O_3) through an electronic program made of 12 state-of-the art air monitoring stations distributed amongst the busiest areas and industrial areas.

The closest monitoring station to the proposed project is Al Bareha Street station located approximately 2 km from the beginning of the line and 11 km from the end of the line[3].

According to the Ministry of Environments Report "Air Quality in Amman, Zarqa and Irbid for the year 2020" the annual level of measured pollutants in Al Bareha monitoring station is presented in the table below:

Pollutants measured in Al Bareha Station	Maximum allowed annual level (according to Jordanian Standards)	Measured Annual average
SO_2	40 Part Per Billion (ppb)	9 ppb
NO_2	50 ppb	18.5 ppb
O_3	-	52.1 ppb
PM10	70 µg/m^3	30.2 µg/m^3

Table 8: Level of Pollutants in Al Bareha Street

Source: ((MoEnv), 2020)

The monitoring results show that no exceedances were recorded for Ozone gas as the daily averages (mean for 8 hours) for Ozone gas were within the limits specified in the Jordanian Standards, where the highest-level measured (for 8 hours) was 75.6 ppb in Al Bareha Street in comparison to the maximum allowed level is 80 ppb.

The Jordanian standard also sets the maximum exceedance times for the hourly or daily measurements (or 8-hour measurements) as three times per year, during 2020 the only exceedances recorded for Al Bareha Street station was for PM 10. The total number of exceedances is 3 times for the entire year.

In general, 91.9% of the time the ambient air quality within Irbid Governorate is good where only 0.3% of the time the ambient air quality could cause risks for sensitive populations.

6.1.7 Archaeology and Cultural Heritage

The assessment of baseline conditions for this attribute was done through a literature review of publications, studies, and previous surveys all of which are available on the Department of Antiquities (DoA) main database: Middle Eastern Geodatabase for Antiquities (MEGA) – Jordan. Moreover, an official letter was sent to the DoA requesting that they confirm the presence of any archaeological sites.

According to MEGA Jordan database, along the pipeline no major archaeological and/or cultural heritage sites were recorded; however, there are two search sites that do not yet correspond to actual artefact or cultural heritage sites known as:

- Wadi Arab Survey Site 089 (MEGA Number 11522) that was added on July 1st, 2010. This site is still under review with no further information available.
- Wadi Arab Survey Site 093 (MEGA Number 11574) that was added on July 1st, 2010. This site is still under review with no further information available.

[3] Distance measured areal

Moreover, and in reference to a letter received from the Department of Antiquities (DoA) 5/4/4822 dated December 14th 2022, there are no archaeological remains or registered heritage sites along the pipeline route, thus there is no objection on the construction of the pipeline.

6.2 Biological Environment

6.2.1 Methodology

The biodiversity of the project area was assessed through comprehensive desktop studies and literature reviews. The literature review was conducted based on the biophysical and natural environment of western Irbid areas. This literature review included the important habitats and species diversity with more emphasis on red list, indicator, and key species. The review covers all available publications of scientific papers, books, technical ecological and biodiversity reports.

6.2.2 Biogeography of the study sites

The project is located in the Mediterranean biogeographical region which occupies most of the western mountains of Jordan and the upper Jordan valley, it extends from the north near Irbid to Ra's Al Naqb in the south. It consists of forested vegetation with representative vegetation of the coniferous forests of Aleppo pine (*Pinus halepensis*) and oak (*Quercus* spp.) woodlands with pistachio (*Pistacia palaestina, P. lentiscus*), and *Arbutus andrachne* as well as shrubland formations within non-forest Mediterranean areas characterized by high cover of the Thorny Burnet, *Sarcopoterium spinosum*. The altitude varies from 700 to 1500 m asl, with an average annual rain fall of 400-600 mm. The soil consists of several types, *terra rosa* and calcareous soil. This region is associated with high precipitation and lower average maximum temperature and is mostly suitable for rainfed arable agriculture and horticulture.

In general, the dominant vegetation types present in this biogeographical region, and specifically in Irbid, include mostly (in descending order) non-forested areas and dwarf shrub vegetation in batha areas; ever-green oak forests; deciduous oak forests; and transitional bathas. As noted below in the table below, the common and typical species in the abovementioned vegetation type are considered of least concern.

Vegetation Type	Species Name	IUCN Red List Status (2018)	Jordan Plant Red List
Non-forested areas	Thorny burnet *(Sarcopoterium spinosum (L.) Spach.)*	Not Evaluated	Not Evaluated
	Rhamnus palaestinus		
	White broom (Retama *raetam* Forssk. Webb.)		Least Concern
	Calycotome villosa		Not Evaluated
Evergreen oak	*Quercus calliprinos* Webb. (syn. *Q. coccifera* L. *var. calliprinos*)	Least concern	Vulnerable
	Pistacia palaestina Boiss	Not Evaluated	Not Evaluated
	Hawthorn (Crategus azarolus *L.)*	Least concern	Introduced
Deciduous oak	*Q. ithaburensis* Decne.	Least Concern	Vulnerable
	Pistacia palaestina	Not Evaluated	Not Evaluated
	carob (*Ceratonia siliqua* L.)	Least Concern	Least Concern
	Styrax officinalis L.	Least Concern	Not Evaluated

Vegetation Type	Species Name	IUCN Red List Status (2018)	Jordan Plant Red List
	common almond (*Amygdalus communis* L.)	Not Evaluated	Not Evaluated

Table 9: Status of Common species for each Vegetation type in Project Area

Sources: (IUCN, 2021)

6.2.3 Fauna and Avifauna

6.2.3.1 Reptiles

Within the northern Mediterranean region of Jordan Disi, 1991; Disi, 1996; Disi & Amr, 1998; Modry et al., 1999; Disi et al., 2001, 2004; Rifai et al., 2003; Damhoureyeh et al. 2009; Shwayat et al., 2009; Amr et al. 2011, Abu Baker and Amr, 2022 studied the ecology, taxonomy, distribution and zoogeographic affinities of reptiles of particular species or communities. The area enjoys a comparatively rich reptilian biodiversity. At least 27 species of reptiles and amphibians occur in this region. They include three amphibian, one tortoise (*Testudo graeca*), 14 lizards representing 6 families (Agamidae, Anguidae, Gekkonidae, Chamaeleonidae, Lacertidae and Scincidae), and 9 snakes including 3 families (Atractaspididae, Colubridae and Viperidae). Representative species are shown in Table 10.

Table 10: List of reptiles recorded from Western Irbid

Family Name	Species Name	Common Name	IUCN status
Bufonidae	*Bufotes* viridis	Green Toad	LC
Hylidae	*Hyla savignyi*	Savigny's Tree Frog	LC
Ranidae	*Pelophylax* bedriagae	Levant water Frog	LC
Testudinidae	*Testudo graeca*	Spurthighed Tortoise	VU
Gekkonidae	*Hemidactylus turcicus*	Turkish Gecko	LC
	Ptyodactylus guttatus	Fan-Footed Gecko	LC
	Ptyodactylus puiseuxi	Levant Fan-Footed Gecko	LC
Agamidae	*Stellagama stellio*	Roughtail rock agama	LC
	Trapelus ruderatus	Syrian Agama	LC
Chamaeleonidae	*Chamaeleo chamaeleon*	Chameleon	LC
Lacertidae	*Phoenicolacerta laevis*	Syrische Eidechse	LC
	Ophisops elegans	Snake-Eyed Lizard	LC
Scincidae	*Chalcides ocellatus*	Ocellated Skink	LC
	Chalcides guentheri	Günther's Skink	VU
	Ophiomorus latastii	Striped Legless Skink	DD
	Eumeces schneiderii	Orange-Tailed Skink	LC
	Heremites vittata	Bridled Skink	LC
Anguidae	*Pseudopus apodus*	European glass lizard	LC
Colubridae	*Natrix tessellata*	Dice Snake	LC
	Dolichophis jugularis	Large Whip Snake	LC
	Hemorrhois nummifer	Coin Snake	LC

	Platyceps rubriceps	Red-Headed Whip Snake	LC
	Eirenis rothi	Roth's Dwarf Snake	LC
	Psammophis schokari	Forskal's Sand Snake	LC
	Malpolon insignitus	Montpellier Snake	LC
Viperidae	*Daboia palaestinae*	Palestine Viper	LC
Atractaspididae	*Micrelops muelleri*	*Muller's Snake*	LC

LC = Least Concern, VU = Vulnerable and DD = Data Deficient

6.2.3.2 Avifauna

The avifauna of the region is diverse due to Jordan's location at the junction of three continents. The regions topographic, geological and climatic diversity provides habitats for a wide variety of bird communities (Andrews, 1995). Representative species are shown in Table 11.

Table 11: Checklist of the birds reported from Western Irbid

Name	Scientific name	Status in Jordan
Short-toed Eagle	*Circaetus gallicus*	**(PM,SV,B)/{PM,SV,B?}**
Long-legged Buzzard	*Buteo rufinus*	**(R,PM)/{R?}**
Kestrel	*Falco tinnunculus*	**(R,PM)/{R}**
Chukar	*Alectoris chukar*	**(R)/{R}**
Collared Dove	*Streptopelia decaocto*	**(R)/{R/SV,B}**
Palm Dove	*Streptopelia senegalensis*	**(R)/{-}**
Roller	*Coracias garrulous*	**(PM,SV,B)/(PM}**
Hoopoe	*Upupa epops*	**(PM,R,SV,B)/{PM,SV,B?}**
Swallow	*Hirundo rustica*	**(PM,SV,R,B)/{PM}**
Yellow-vented Bulbul	*Pycnonotus xanthopygos*	**(R)/{R}**
Wren	*Troglodytes troglodytes*	**(R)/{R}**
Blackbird	*Turdus merula*	**(R,B,PM,W)/{R}**
Blackcap	*Sylvia atricapilla*	**(PM,W)/{PM,W}**
Chiffchaff	*Phylloscopus collybita*	**(PM,W)/{PM,W}**
Palestine Sunbird	*Nectarinia osea*	**(R)/{R}**
Masked Shrike	*Lanius nubicus*	**(PM,SV,B)/{PM,SV,B}**
Woodchat Shrike	*Lanius senator*	**(PM,SV,B) / (PM,SV?,B?}**
Jay	*Garrulus glandarius*	**(R)/{R}**
Hooded Crow	*Corvus corone cornix*	**(R)/{R}**
Greenfinch	*Carduelis chloris*	**(R,B,W?)/{R,B}**
Goldfinch	*Carduelis carduelis*	**(R,B,WV)/{R,B}**
House Sparrow	*Passer domesticus*	**(R)/{R}**

R = Resident, PM = Passage Migrant, B = Breeder, SV = Summer Visitor, W = Winter Visitor and ? = Status Unclear

6.2.3.3 **Mammals**

The first comprehensive review of the mammal fauna of Jordan was that of Atallah (1977; 1978) which organized the earlier collections and records into a systematic review. Later, Amr et al (1987) and Amr and Disi (1988) published reports on collections of mammals made travelers and museums. Yet, the most comprehensive review on the Mammals of Jordan is those of Qumsiyeh (1996) and Amr (2000; 2012) which include detailed descriptions of all species' external characteristics, cranial measurements, distribution in the range countries and some useful remarks on the biology of the species.

Several reviews have been published on some groups and/or species of mammals occurring in the Mediterranean region of Jordan including: the carnivores (Qumsiyeh et al. 1993), artiodactyla (Qumsiyeh et al. 1996), stone matren (Al-Shafei et al. 1997), bats (Qumsiyeh et al. 1998, Benda et al 2010), the marbled polecat (Rifai et al. 1999), the striped hyena (Qarqaz and Abu Baker 2002), the badger (Abu Baker and Amr 2002), the Persian squirrel (Amr et al 2006), and the mice of the genus *Apodemus* (Abu Baker and Amr 2009). At least 28 mammalian species occur in the area western Irbid and its vicinity. They are represented by 14 families. Bats and rodents are the most common mammals with a total of 8 and 7 species respectively. Family Erinaceidae is represented by a single species, the European hedgehog, *Erinaceus concolor.* This is a true Mediterranean species of Palaearctic affinity. As for the carnivores, they are represented by 4 families; Canidae with 3 species, most impotently is the Asiatic jackal, *Canis aureus*. This species has a wide distribution in Jordan in areas with significant cover and water resources. Cats are represented by a single species, the wild cat, *Felis selvistris* which is regionally near threatened. Chiroptera or bats are represented by 8 species within 3 families. Horseshoe bats are exemplified by 3 species of which *Rhinolophus ferrumequinum* is the most common in the study site. The Lesser Horseshoe Bat, *Rhinolophus hipposideros,* is found as a solitary animal in caves, ruins, and other dark dwellings. Family Vespertilionidae includes three species, including *Myotis emarginatus, Myotis nattereri*, and *Pipistrellus kuhli.* Family Molossidae is represented by a single species, the European Free-tailed Bat, with a wide range of distribution. Order Rodentia is represented by 7 species within 4 families. The Indian crested porcupine is the largest rodent in Jordan and prefers rocky areas within the Mediterranean areas where it shelters in wadis of rocky nature and may live in small caves or in constructed burrows. It feeds on fleshy vegetation and bulbs such as *Urginea maritima*. The broad-toothed woodland mouse, *Apodemus mystacinus* is restricted to oak-dominated habitats, which makes up for its main food source. One species of Ungulates (the wild boar) is common in the region and often considered as a pest. Representative species are shown in Table 12.

Table 12: Mammals recorded from western Irbid and its vicinity and their IUCN Global status

Group	Family	Scientific Name	Common Name	IUCN status
Insectivores	Soricidae	*Suncus etruscus*	Pygmy, White-toothed Shrew	**LC**
		Crocidura suaveolens	Lesser, White-toothed Shrew	**LC**
	Erinaceidae	*Erinaceus concolor*	European Hedgehog	**LC**
		Hemiechinus auritus	Long-eared Hedgehog	**LC**
Carnivores	Hyenidae	*Hyaena hyaena*	Striped Hyena	**NT (EN)**
	Canidae	*Canis aureus*	Asiatic Jackal	**LC**
		Canis lupus	Wolf	**LC (EN)**

Group	Family	Scientific Name	Common Name	IUCN status
		Vulpes vulpes	The Red Fox	**LC**
	Felidae	*Felis silvestris*	The Wild Cat	**LC**
	Mustilidae	*Vormela peregusna*	Marbled Polecat	**VU**
		Martes foina	Stone Marten	**LC (EN)**
		Meles meles	Badger	**LC (VU)**
Bats	Rhinolophidae	*Rhinolophus blasii*	Blasius's Horseshoe Bat	**LC**
		R. ferrumequinum	Larger Horseshoe Bat	**LC (EN)**
		R. hipposideros	Lesser Horseshoe Bat	**LC (NT)**
	Vespertilionidae	*Myotis emarginatus*	Notch-eared Bat	**LC (EN)**
		Myotis nattereri	Natterer's Bat	**LC (EN)**
		Pipistrellus kuhli	Kuhl's Pipistrelle	**LC**
		Pipistrellus pipistrellus	Common Pipistrelle	**LC**
	Molossidae	*Tadarida teniotis*	European Free-tailed Bat	**LC**
Rodents	Hystricidae	*Hystrix indica*	Indian crested porcupine	**LC (VU)**
	Cricetidae	*Microtus guentheri*	The Levant Vole	**LC**
	Spalacidae	*Nannospalax ehrenbergi*	Palestine Mole rat	**LC**
	Muridae	*Acomys dimidiatus*	Eastern Spiny Mouse	**LC**
		Apodemus mystacinus	Broad-toothed field mouse	**LC**
		Gerbillus dasyurus	Wagner's Gerbil	**LC**
		Meriones tristrami	Tristram's jird	**LC**
Ungulates	Suidae	*Sus scrofa*	The Wild Boar	**LC**

LC = Least Concern, EN = Endangered, NT = Near Threatened, VU = Vulnerable

6.2.4 Site Visit findings

During the site assessment, scarce and scattered vegetation was noticed within the project area. This mainly included *Tamarix sp. (tetragyna), Prosopis sp. (juliflora), Castor oil plant (Ricinus communis)*, *Ficus.*

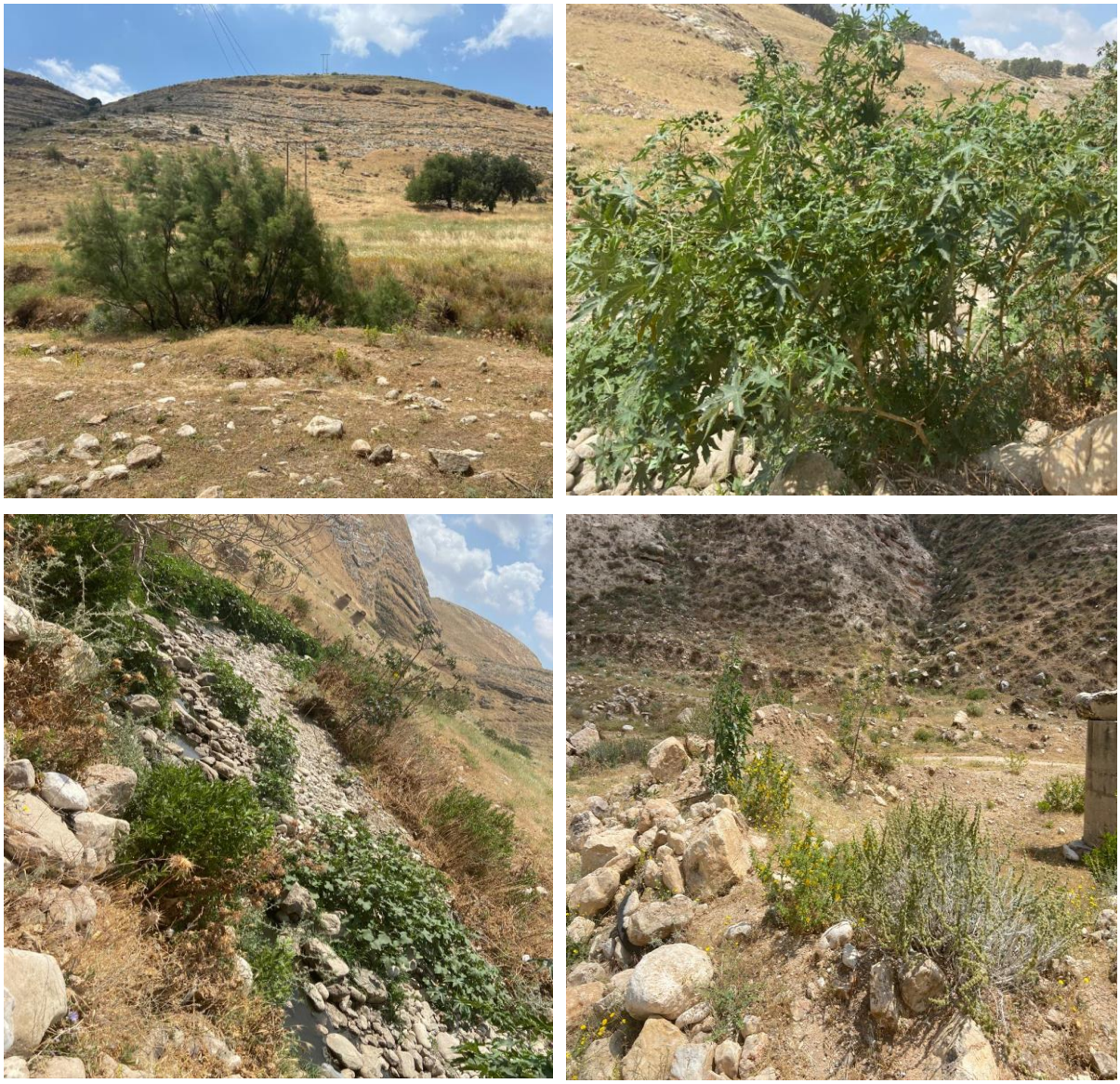


Figure 7: Pictures of Vegetation found around the site

6.2.4.1 Protected Areas and IBAs

Considering the natural biological environment, the flora / fauna information at the concerned site can be summarized as follows:

- The proposed site is not located in a preserved area. However, the closest IBA to the pipeline route is the Yarmouk River Important Bird Area (IBA).
- According to BirdLife International (2022[4]), the IBA is described as steep-sided valley running along the Jordan-Syria border with bits of Pinus woodlands, lush reedbeds Phragmites and oleander Nerium thickets along the Yarmouk. It is currently a military zone which provides indirect protection for the area. Additionally, the purpose of establishing the IBA was based on the presence of the Brown Fish-owl Ketupa (*zeylonensis*) and Griffon Vulture Gyps (fulvus) both of which are residents in the country and are restricted to the region. These two species are categorized as Least Concern as they have an extremely large range, and hence does not approach the thresholds for Vulnerable.

[4] (BirdLife International, 2022)

- The IBA is also considered a Key Biodiversity Area (KBA) which contains a number of elements triggering the KBA criteria including vulnerable and engendered mammals, critically endangered plants, and vulnerable and least concern reptiles.
- However, during the site visits, no threatened, rare or endangered species of fauna or flora were registered or known to exist along the pipeline route.
- No sensitive or fragile habitats were noted in relation to the extent and magnitude of the envisaged works.
- No species of fauna or flora that could be exploited for commercial purposes have noted in proximity to the proposed works.
- The current degree and extent of the proposed works does not interfere with any protected area.
- The areal distance between protected areas and the beginning and end points of the new effluent pipeline is summarized in table below:

Protected Area	Beginning of Effluent Pipeline- Irbid Central Balancing Tank	End of Effluent Pipeline- Wadi Al Arab WWTP
Important Bird Area (IBA)	7 km from Mafraq IBA	9 km from North Ghor IBA
Established Reserve	13 km from Yarmouk Forest Reserve	4 km from Yarmouk Forest Reserve

Table 13: Distance between Protected areas and Project Location

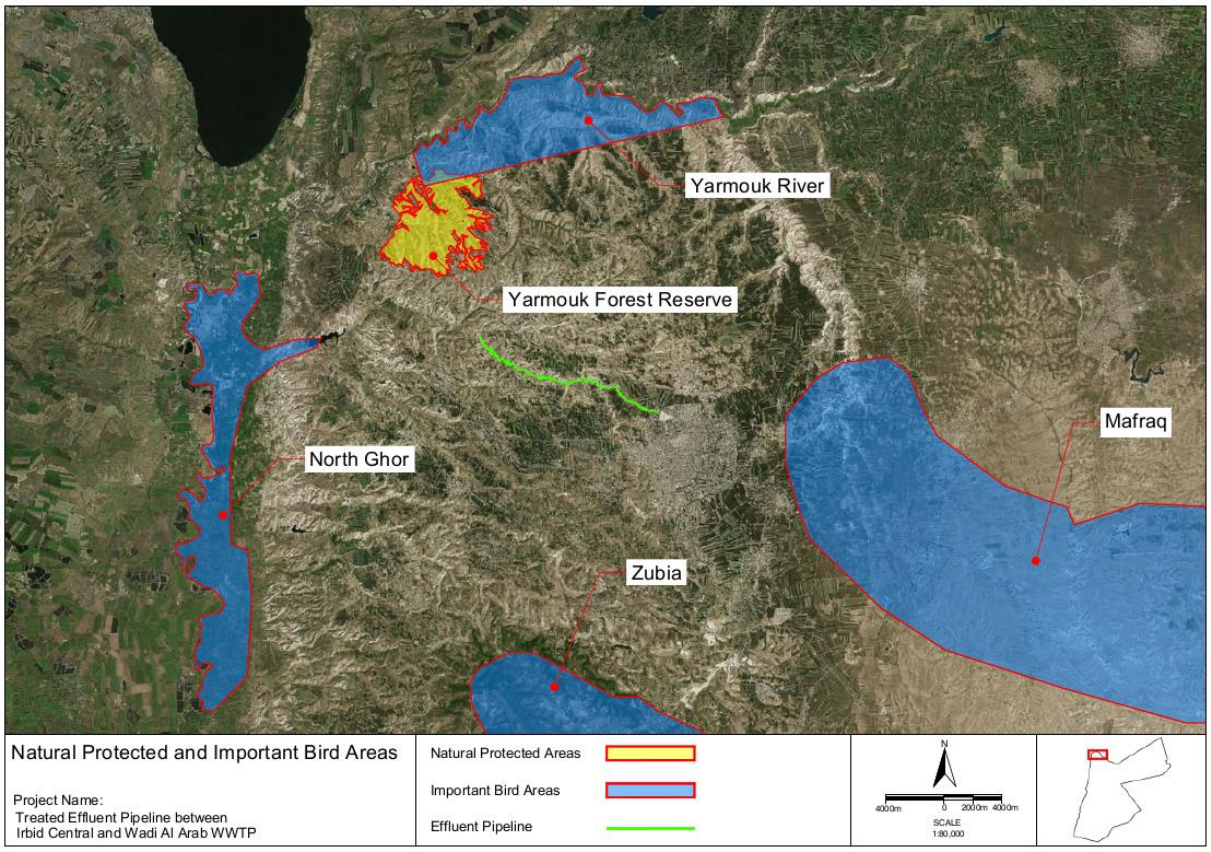


Figure 8: Map showing the Effluent Pipeline with regards to Protected Areas

6.3 Socio-economic Conditions

Based on the administrative settings set by the MoI, the project is located within Irbid governorate, specifically in Qasabet Irbid District within Irbid Subdistrict. The pipeline crosses several localities including Soom, Fo'arah, Doaqarah, Jijjien, Teqbel, Irbid, and Hoor which fall under several different municipalities including Greater Irbid Municipality, and West Irbid Municipality. In general, Irbid has a prosperous agricultural sector, with around 76% of its total area as agricultural land. In the governorate, there are also three industrial cities (Hasan Industrial City, Cyber City, and Jordan Valley crossing).

This section demonstrates the socio-economic baseline conditions of the project area. These conditions have been identified based on collection of secondary data from several governmental entities including the Ministry of Planning and International Cooperation (MoPIC) and the Department of Statistics (DoS) which provides data mainly at the governorate and district level and limited data at the local community level. It is important to note, the latest Population and Housing Census was carried out in 2015.

6.3.1 Population Profile

In 2015, and according to the Population and Housing Census, the population of Jordan was estimated to be 9,531,712, with a national population increase of 2.6%. 42% of the kingdom's population, approximately 1,770,158 are settled in Irbid Governorate. Specifically, 739,212 reside in Qasabet Irbid District in which the proposed project is located. As reported by the Department of Statistics the population in the District for the year 2021 was estimated to be 856,200.

This sub-section covers the estimated population of the abovementioned localities for the year 2021 according to the DoS.

Locality	Households	Population numbers		
		Male	Female	Total
Soom	2,452	6,350	6,005	12,355
Fo'arah	1,229	3,011	2,755	5,766
Doaqarah	1,992	5,125	5,049	10,174
Jijjien	1,377	3,460	3,033	6,493
Teqbel	313	770	710	1,480
Irbid	120,055	303,968	278,308	582,276
Hoor	821	2,018	1,985	4,003

Table 14: Estimated Population in Project area by Sex and households for the year 2021

Source: (DoS, Estimated population of the Kingdom by locality, sex and household for the end of 2021, 2022)

6.3.2 Economic Profile Activities and Livelihoods

According to DoS, the unemployment rate in Irbid in 2019 was 18.5%. Based on the Development Program of Irbid Governorate prepared by MoPIC for the years 2017-2019, the top sectors in which most of the population work are (in descending order) Public Administration, Defence and Social Security; Education; Wholesale retail and vehicle repairs; and Education. The exact number and percentages are shown in figure below:

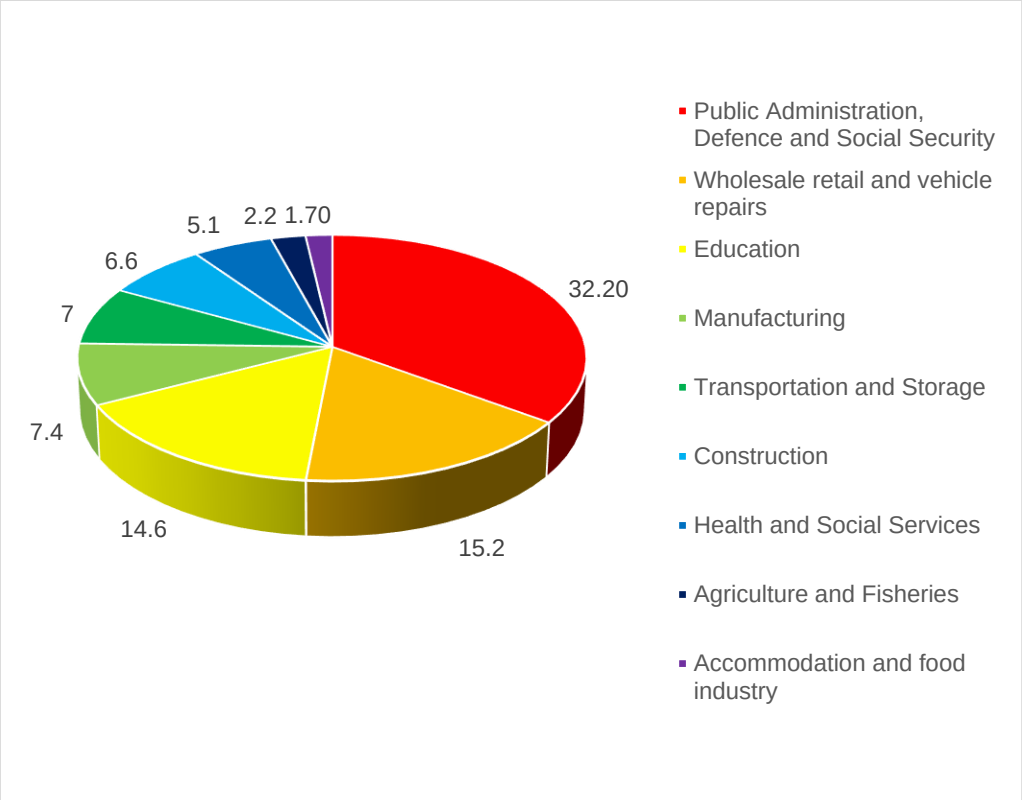


Figure 9: Percentage of Population working in each Sector

Source: ((MoPIC), 2017)

The program also highlighted the number of working economic establishments in the Governorate, shown in table below:

Economic Establishment/Business	Number
Establishments in the Industrial sector	4,171
Establishments in the Service provision sector	6,147
Establishments in the retail sector	16,334
Establishments in the transportation sector	108
Establishments in the construction sector	124
Total:	26,884

Table 15: Indicator on Local Economy/ Number of Establishments in each sector

Source: ((MoPIC), 2017)

6.3.3 Infrastructure and Utilities

Education

Education has always been a priority for the Jordanian government. In addition to two years of pre-school, the education system comprises of twelve years; ten years of basic education and two years of secondary academic or vocational schooling.

In Qasabet Irbid District, the statistics show that the number of teachers and students for the year 2021 are as follows:

Teachers			Students		
Male	Female	Total	Male	Female	Total
2,447	5,531	7,978	81,024	76,845	157,878

Table 16: Number of Students and Teachers in Qasabet Irbid District

Source: (DoS, Jordan Yearly Statistical Book , 2021)

According to DoS, in Qasabet Irbid directorate of Education there are a total of 521 schools, 382 of which are mixed schools, while 43 schools are girls only schools and 96 schools are boys only schools. Based on information provided on the Ministry of Educations (MoE) website, the table below shows the number of schools serving the above-mentioned localities:

Locality	Male Schools		Female schools	
	Basic School	Secondary School	Basic School	Secondary School
Irbid (specifically Al Bareha area affected by the project)	1	1	1	
Soom	1	1	2	1
Fo'arah	1	1		1
Doaqarah	1	1	1	1
Jijjien		1		1
Teqbel	1		1	
Hoor		1		1

Table 17: Number of Schools in the localities impacted by the Project

Source: ((MoE), 2021)

The governorate also has five universities, three of which are public and two are private with a number of a community colleges.

Health

The health services in Jordan are mostly provided by the Ministry of Health, the Royal Armed Forces, and the private sector. In Irbid governorate the health services are provided through 111 health centres, 11 of which are comprehensive centres, 78 are primary centres while 22 are secondary centres. The governorate also has 8 hospitals distributed all over its area providing 730 beds.

Hospital	Number of beds
Princess Basma Hospital	230
Princess Badee'a Hospital	86
Princes Rahmeh Hospital	112
Yarmouk Hospital	67
Princess Raya Hospital	100
Moath Bin Jabal Hospital	75
Abi Obaida Hospital	60

Table 18: Hospitals in Irbid Governorate

Source: ((MoH), 2017)

The number of personnel working in Qasabet Irbid health directorate is 759, out of which there are 7 specialized doctors, 54 general practitioners, 34 dentists, 22 pharmacists and 183 nurses.

According to the health directorate in Irbid, the Qasabet Irbid district has 3 comprehensive health centres, 24 primary centres, and 6 secondary centres. On a more detailed level, the health centres that provide the main health services in the relevant localities is presented in the table below:

Locality	Health Centre	Main Services provided	Average Number of patients/day
Soom	Primary Health Centre	General medicine, vaccination centre, motherhood centre, dental services.	64
Fo'arah	Primary Health Centre	General medicine, vaccination centre, motherhood centre, dental services.	51
Doaqarah	Primary Health Centre	General medicine, vaccination centre, motherhood centre, dental services, laboratory.	53
Jijjien	Primary Health Centre	General medicine, vaccination centre, motherhood centre, dental services.	33
Teqbel	Secondary Health centre	General medicine, vaccination centre, motherhood centre.	14
Irbid (Al Bareha)	Primary Health Centre	General medicine, vaccination centre, motherhood centre, dental services.	139
Hoor	Primary Health Centre	General medicine, vaccination centre, motherhood centre.	29

Table 19: Health Centres in the Localities impacted by the Project

Source: (MoH, 2017)

Water and Municipal Services

As presented in the MoPIC report, the share of water per capita in the Governorate is estimated at 120 L/day with 63% of households connected to the public water network. As for sewerage services, 52% of households in Irbid are connected to the sewage networks.

The road network in Irbid is estimated to be the length of 981 km, with primary, secondary and rural roads serving the entire governorate and connected it to the other governorates.

According to the Data Collection on Waste Management in Northern region accepting Syrian refugees Final Report, which was prepared by JICA, the Municipal Solid Waste (MSW) generation rate in Greater Irbid Municipality is 376 ton/day expected to rise to 506 ton/day in 2034.

The waste collection system covers 100% of Greater Irbid Municipality area but does not provide separate collection. MSW collected from the municipality is transferred to one of two existing transfer stations (Togbul and Al Shahinat). The final disposal of MSW is in Al Ekaider Disposal site without any previous treatment of waste. The Al Ekaider disposal site has a total area of 88 ha with an average of 1,000-1,200 tons of waste received per day.

The Greater Irbid municipality however does not collection any medical or industrial hazardous waste. It only provides collection services for general industrial wastes and agricultural wastes along with the MSW.

7 Environmental and Social Aspects and Impacts

7.1 Expected Environmental and Social Impacts

Landscape and Visual

Site preparation activities will take place including land clearing, excavations, laying of pipeline and underground cables, etc. These construction activities have an impact on the visual quality of the site and its surroundings, as the visual environment during the construction phase would include the presence of typical construction site elements including equipment and machinery (e.g., excavators, trucks, front end loaders, compactors and others).

This impact is considered negative but temporary and only limited to the construction phase. There are no sensitive visual receptors that could be impacted yielding this impact of minor significance. The detailed description of the impact is summarized in section 7.2.

During the operation phase of the Project, limited adverse impacts are anticipated to arise. Since the new effluent pipeline is underground, no visual impacts are foreseen during the operation phase.

To mitigate these impacts, the Contractor should ensure proper housekeeping measures, removal of unused machinery in a timely manner and to the extent possible and ensure proper storage and disposal of generated waste. Details on the mitigation measures and monitoring requirements can be found in the ESMP under section 8.

Land Use

Use of the project area for grazing by the local communities is unlikely to be affected. This is due to the fact that there is no key habitat for grazing that is restricted to the Project site only. Moreover, since there are similar habitats utilized for livestock grazing that can be found extensively throughout the area, the impact is considered of low magnitude.

As for the presence of farms along the route, the design of the pipeline does not pass directly through the farms but is rather adjacent to most of them. The design only passes through one land in which olive trees are planted, this plot or land has already been acquired by WAJ as the existing gravity main passes through it too. The Contractor during the construction works may re-route segments of the pipeline to avoid removal of any trees, otherwise, the contractor must re-plant or replace removed vegetation in coordination with Ministry of Agriculture or Landowner.

According to the detailed design of the project, an offset of two meters from the center of the pipeline for both sides was considered to compensate for the excavation of the pipeline trench. This results in a total area of approximately 54,240 m2 needed for the construction and operation of the pipeline, from which a total area of 13,614 m2 might need to be acquired (43 lands). The rest of the area is located entirely in the wadi which is government property. All the land takes will be associated with permanent land acquisition of the affected areas or overall property. If a land is not acquired fully, few constraints will limit the capacity of landowners to utilize the land at its full potential; the restriction will be imposed to an area of 4 meters on both sides of the pipeline. WAJ in coordination with DLS have overlayed the exact shares of the lands owned by WAJ over the entire list of 43 lands mentioned above; they have concluded that only 24 of these lands require acquisition as the pipeline will pass through WAJ owned property in the remaining lands. Out of the 24 lands, only 20 lands will actually be acquired as shown in table below:

Governorate	Village	Basin	Land Plot Number
Irbid	Hoor	Al Masyea Al Sharqya	91
Irbid	Hoor	Al Masyea Al Sharqya	88

Irbid	Hoor	Al Masyea Al Sharqya	119
Irbid	Hoor	Al Masyea Al Gharbya	23
Irbid	Hoor	Al Jora Al Gharbya	75
Irbid	Hoor	Al Jora Al Gharbya	85
Irbid	Hoor	Al Jora Al Gharbya	74
Irbid	Hoor	Al Masyea Al Sharqya	56
Irbid	Hoor	Al Jora Al Gharbya	33
Irbid	AlBareha	Iban	239
Irbid	AlBareha	Iban	153
Irbid	AlBareha	Iban	173
Irbid	Taqbal	Al Samouqa	72
Irbid	Soom	Al Maqttana	98
Irbid	Jijeen	El Oja	58
Irbid	Jijeen	El Oja	55
Irbid	Jijeen	El Oja	54
Irbid	Jijeen	El Oja	60
Irbid	Jijeen	El Oja	53
Irbid	Jijeen	El Oja	56

Taking the above into account, impacts on land ownership would be considered long-term, negative nature, and of medium magnitude. Given all of the above, the impact is considered of major significance. A land acquisition plan is developed by the Consultant and in coordination with WAJ to ensure fair compensation is provided for landowners rendering the significance of the residual impact as not significant.

Hydrology and Hydrogeology

As discussed earlier, the project is located on the route of an existing wadi and therefore there is a risk of local floods during the rainy season. This risk should be considered throughout the planning phase as to reduce damage to the project and its components. This impact is limited to seasonal floods and is considered a negative, temporary impact of medium magnitude.

Moreover, improper housekeeping practices during construction (such as illegal disposal of waste to land) could pollute groundwater resources. Such impacts can be easily controlled through applying general housekeeping practices. The potential impact of improper waste management could have a long-term effect on groundwater quality.

During operation, any bursts or blockages can pollute groundwater as well as surface water, these impacts can be properly mitigated by applying best practices and control measures.

More elaboration on the significance of risks and mitigation measures can be found in section 7.2 and section 8 respectively.

Geology and Soil

The nature of construction activities (land clearing, excavations, etc.) could disturb the soil leading to increased erosion during rainfall events. This in turn can result in siltation of surface water. Applying best practice as stated in section 7.2 can adequately control the situation making this temporary impact of low significance.

Additionally, improper housekeeping practices during construction including the improper disposal of solid waste as well as hazardous materials and wastes could contaminate and pollute soil. In order to easily mitigate this impact, the Contractor shall ensure proper storage of waste, ensure availability of waste containers and coordinate with Municipality for collection and disposal amongst others.

In the operation phase, rupture of the effluent pipeline and poor maintenance could result in leakages and contamination of soil and in turn groundwater.

Air Quality

Increased level of dust and particulate matter emissions, which in turn will directly and temporarily impact ambient air quality negatively impacting the health of construction workers and nearby receptors. The generation of dust (Particulate Matter), however, is highly dependent on weather conditions; excessive dust generation is caused mainly during dry weather and hight wind speeds.

In addition, the construction machinery and equipment might emit certain pollutants including (such as SO_2, NO_2, CO, etc.) as exhaust fumes from compressors, vehicles, etc.

However, these impacts are short term and are reversible as the ambient air quality will return to baseline conditions after construction activities are concluded.

Noise

The use of machinery and equipment such as compressors, etc. is expected to be a source of noise and vibration generation within the Project site and its surroundings causing nuisance on construction workers and nearby receptors especially at the beginning of the pipeline route as most of the right-of-way is not inhabited and receptors are quite far from the work area. The Contractor should adhere to the “Instructions for Reduction and Prevention of Noise for the year 2003” as a way to mitigate impacts. Details on the significance of the impact and monitoring requirements is stated in section 7.2 and section 8.

Archaeology and Cultural Heritage

Construction activities could damage or disturb potential archaeological remains on the surface or those buried in the ground that are discovered upon excavations. There is also a chance that archaeological remains buried under the ground can be discovered throughout construction activities. This risk is considered of medium magnitude and irreversible as construction activities can result in damages or disturbances to discovered sites.

The contractor shall develop and implement a chance find procedure which is a requirement of the Department of Antiquities (DoA). In case that remains are found during excavation, the construction activities are suspended while the area is fenced, the Contractor should then immediately notify the DoA. Construction works can only resume after clearance is granted from the DoA.

Biodiversity

Improper disposal of waste and poor housekeeping practices could indirectly affect flora/fauna while site preparation works might have a footprint and minimal disturbance on flora and fauna. However, the Project is located within an IBA and KBA, the site is not considered ecologically significant and the route through the wadi is described as arid with little vegetation and no threatened flora or fauna species or and sensitive habitats.

This means that if any flora or fauna species are impacted, a permanent change on the biodiversity is foreseen. Nonetheless the impact is considered of minor significance due to the low ecological importance.

Livelihood and Socio-Economic Conditions

The Project will create job opportunities including skilled job opportunities (to include engineers, technicians, consultants, surveyors, etc.) and unskilled job opportunities (mainly laborers but will also include a number of security personnel). The Contractor has not been selected yet so it is difficult to estimate the exact number of positions targeted at local communities, details on the types of jobs, duration of works, etc.

The presence of workers in the area will also have indirect impacts on the livelihood of local service providers (accommodation services, food, etc.)

Moreover, as stated earlier, some grazing activities take place along the pipeline route, nonetheless, since there are comparable natural environments in the vicinity of the site that are also used for grazing, the impact of the livelihood of cattle grazer is considered negligible.

Infrastructure and Utilities

The project is expected to generate construction waste including dirt, debris and rocks as well as general municipal wastes. The quantities generated are expected to be minimal and likely to be easily handled by the relevant municipalities.

Moreover, the project components will be transported by road to the project site, this will possibly involve many trucks. However, the transportation requirements will be temporarily and will increase traffic only intermittently. It is very unlikely that this short-term increase in traffic will impact traffic flows considerably and it is expected that this impact will be complementary with the capacity of the road network. In this regard, the Contractor shall develop a traffic plan before commencement of transportation as a method of minimizing the negative risks.

In addition, the project will impact the water resources in the area as it will require water for potable and non-potable usage during the Construction phase. The Contractor will be responsible for providing non potable and potable water for his workers for the entire project period. For non-potable usage, the water will be used as a way to supress dust and cleaning vehicles and machinery.

Lastly, during the construction phase it is expected that wastewater is generated (sewage water from toilets and sanitation facilities) but the quantities are expected to be minimal and not significant at all.

Occupational Health and Safety

Generic occupational health and safety risks to workers, as working onsite increases the risk of injury or death due to accidents, general risks associated with the project include moving machineries, working in confined spaces and excavations, exposure to high temperatures and sunny conditions, falling or tripping, etc. During Construction these impacts are considered temporary with medium sensitivity as it may cause permanent disabilities.

An Occupational Health and Safety Plan shall be developed by the contractor to ensure the safety all personnel and prevent any accidents or injuries.

During Operation, there could be related occupational health and safety issues for workers during maintenance works.

Gender Based Violence (GBV)

Often construction works bring male workers which can be a risk for women and lead to GBV. Given the scope of work covering a limited area of a few kilometers, the risk of GBV is however minor.

Community Health and Safety

Health and safety risks and nuisance during construction include possible dust, odour, and noise emissions from any excavations as well as the transportation of soil, waste, and other materials. Moreover, if any unauthorized people enter the construction site, potential negative impacts due to site specific risks and hazards is likely to take place this could include slips, trips and falls as well as cave-ins or collapses and being struck by moving machinery.

7.2 Summary of Environmental and Socio-Economic Impacts

No.	Resource Area	Assessment Rationale	Potential Impact(s)	Nature of Impact	Type of Effect	Likelihood	Magnitude	Consequence	Spatial Influence	Temporal Influence	Reversibility	Impact Significance
1	Landscape and Visual	• Due to construction machinery and activities, the local aesthetics will be affected. • Due to potential generation of waste and littering in the project area which will affect the landscape and visual components	Visual intrusion and aesthetic interference due to potential generation of waste as well as presence of construction machinery in the project area.	Negative	Direct	Likely	Low	Marginal	Local	Short term	Reversible	Minor
2	Land Use	• The informal land use (grazing) will be lost due to the project	Use of the project area for grazing by the local communities will be hindered	Negative	Direct	Likely	Low	Marginal	Local	Short term	Reversible	Minor
		• Acquisition of land	A number of lands through which the new pipeline passes will be acquired by WAJ	Negative	Direct	Certain	High	Critical	Local & Regional	Short term	Irreversible	Major
3	Hydrology and Hydrogeology	• Construction activities will result in the increase of runoff instances during rainfall events.	Increased surface water runoff leading to erosion and sedimentation during and after significant rainfall events.	Negative	Direct	Unlikely	Low	Marginal	Local & Regional	Long Term	Irreversible	Minor
		• Improper housekeeping and waste management can result in groundwater contamination	Contamination of groundwater resources due to improper housekeeping, waste storage and disposal	Negative	Indirect	Unlikely	Low	Marginal	Local	Long Term	Irreversible	Minor
		• Given that there are no surface water sources within the proximity of the site, there are no direct impacts on such sources.	Local degradation of surface water quality due to accidental spillage/leakage of oil, chemicals or liquid fuels.	Not Relevant								
			Surface water pollution due to disposal of construction wastes.	Not Relevant								
4	Air Quality and Dust	• Dust and emission from construction activities and equipment shall affect the work environment within the project site and nearby residents	Local degradation to air quality due to exhaust emissions	Negative	Direct	Very Likely	Low	Marginal	Local	Short term	Reversible	Moderate
		• Dust and emission from moving vehicles on surrounding roads shall affect surrounding residential area	Local degradation to air quality due to dust generation from construction activities.	Negative	Direct	Very Likely	Medium	Critical	Local	Short term	Reversible	Moderate
5	Noise	• Noise from construction activities and equipment shall affect the work environment within the project site and nearby residents • Noise from moving vehicles on surrounding roads shall affect surrounding residential area	Noise pollution due to construction activities such as excavation, etc. and use of heavy machineries, vehicle and equipment operation.	Negative	Direct	Certain	Medium	Critical	Local & regional	Short term	Reversible	Moderate
6	Geology and Soil	• Soil disturbance due to excavation and construction works	Removal of soil due to construction activities, thus causing erosion.	Negative	Indirect	Likely	Low	Marginal	Local	Long Term	Irreversible	Minor
		• Soil pollution from construction equipment and construction vehicles within the site	Contamination of soil due to improper waste management or accidental spillage/leakage of chemicals or oils stored on site or used during construction or rupture of fuel storage tanks in construction site.	Negative	Direct	Likely	Medium	Critical	Local	Long Term	Irreversible	Moderate
7	Archaeology and Cultural Heritage	• Disturbances to archaeological remains and heritage sites during excavations and construction activities	Construction activities could damage/disturb potential archaeological remains with might be buried under ground if any.	Negative	Direct	Likely	Medium	Critical	Local	Long Term	Irreversible	Moderate

No.	Resource Area	Assessment Rationale	Potential Impact(s)	Nature of Impact	Type of Effect	Likelihood	Magnitude	Consequence	Spatial Influence	Temporal Influence	Reversibility	Impact Significance
8	Biodiversity	• Construction activities are expected to disturb the existing ecosystem, in addition to the possible impacts due to improper management of generated waste and its disposal.	Loss of (protected) terrestrial species and some trees	Negative	Direct	Likely	Medium	Marginal	Local & Regional	Short term	Reversible	Minor
9	Socio-economic Issues	• The Project is expected to result in short term disturbance to the local conditions of the communities • The Project is expected to contribute to enhancing the livelihood of the small business as well as providing job opportunities.	Emission of dust from construction works which may cause stress to local community and businesses in the area	Negative	Indirect	Likely	High	Critical	Local & Regional	Short term	Reversible	Moderate
			Disturbance of women's wellbeing and social life.	Negative	Direct	Unlikely	Medium	Marginal	Local & Regional	Short term	Reversible	Moderate
			Small scale business activities to increase with higher income generation.	Positive	Direct	Certain	Medium	Marginal	Local & Regional	Short term	Irreversible	Moderate
			Workforce employment	Positive	Direct	Certain	High	Critical	Local & Regional	Short term	Irreversible	Major
10	Infrastructure and Utilities	• Water demands during construction phase are expected to increase to meet the demands of the additional activities and the demands of workers on site. • Construction activities will result in the increase generation of hazardous & non-hazardous waste. • Construction activities are expected to disturb the existing traffic conditions	Increased water demand during construction phase, which might lead to constraints on local users.	Negative	Indirect	Likely	Medium	Marginal	Local	Short term	Reversible	Minor
			Improper management of hazardous and non-hazardous waste generated at site leading to impacts on soil, water and visual environment and health and safety of construction workers and public	Negative	Direct	Likely	High	Critical	Local & Regional	Short/Medium term	Reversible	Moderate
			Traffic and road accessibility will be disrupted with the possibility of creating congestions at peak hours and temporary disruption or disturbance to local road networks and services provided within the closed area of the first part of the effluent pipeline such as the electricity network, water supply, and telecommunication services.	Negative	Direct	Likely	High	Critical	Local & Regional	Short term	Reversible	Moderate
11	Occupational Health and Safety (H&S)	• The construction activities may increase the risks on workers' H&S to some extent due to the possibility of injuries and accidents.	Potential accidents due to obstructed pedestrian and vehicular access, lack of sufficient signage barricades, warning, lights and other safety precautions that are required by the contractor.	Negative	Direct	Likely	High	Critical	Local	Short term	Reversible	Moderate
			Risk to occupational health and safety from construction activities such as excavation, confined space entry, handling of hazardous materials and chemicals, manoeuvring of construction equipment and machinery, risk of exposure to injuries.	Negative	Direct	Likely	High	Critical	Local	Short term	Reversible	Moderate
			Impact to workers health due to dust generation, noise generation, spread of COVID-19, etc.	Negative	Direct	Likely	High	Critical	Local	Short term	Reversible	Moderate
12	Labour conditions	• Risk of poor conditions and absence of contracts for workers	Impact to labour conditions due to poor working conditions and disregard to worker's rights	Negative	Direct	Unlikely	High	Critical	Local	Short term	Reversible	Moderate
13	Gender Based Violence (GBV)	• The Project is expected to result in short term disturbance to the local conditions of the communities	Physical and psychological strain to women and children due to presence of (foreign) workers.	Negative	Direct	Likely	Medium	Marginal	Local & Regional	Short term	Reversible	Minor
14	Community Health and Safety	• The construction activities may have a temporary impact on the community H&S due to the presence of the machinery and trenches.	Impact to public due to dust generation, noise generation, traffic accidents due to roadblocks, etc.	Negative	Direct	Likely	High	Critical	Local	Short term	Reversible	Moderate
			Impact on construction workers as well as the public due to the spread of COVID-19	Negative	Indirect	Likely	High	Critical	Local	Short term	Reversible	Moderate

No.	Resource Area	Assessment Rationale	Potential Impact(s)	Nature of Impact	Type of Effect	Likelihood	Magnitude	Consequence	Spatial Influence	Temporal Influence	Reversibility	Impact Significance
		• Spread of COVID-19 amongst construction workers										

Table 20: Summary of environmental and socio-economic impacts during construction phase

No.	Resource Area	Assessment Rationale	Potential Impact(s)	Nature of Impact	Type of Effect	Likelihood	Magnitude	Consequence	Spatial Influence	Temporal Influence	Reversibility	Impact Significance
1	Hydrology and Hydrogeology	• Improper operation and maintenance can result in surface water and groundwater contamination	• Contamination of groundwater resources due to improper operation and leakages	Negative	Indirect	Unlikely	Medium	Marginal	Local	Long Term	Irreversible	Moderate
2	Geology and Soil	• Improper operation and maintenance can result in contamination of soil	• Contamination of soil due to improper maintenance and leakage of wastewater	Negative	Direct	Likely	Medium	Critical	Local	Long Term	Irreversible	Moderate
3	Community Health and Safety	• The presence of the pipeline may have an impact on the community H&S due to bursting and leakage of pipeline which in turn contaminate groundwater sources	• Health hazard if there is poor maintenance leading to groundwater contamination	Negative	Direct	Likely	High	Critical	Local	Long Term	Reversible	Major
4	Occupational Health and Safety	• During the operational phase there might be some adverse impacts on workers' H&S	• Risk to occupational health and safety from maintenance activities	Negative	Direct	Likely	Medium	Critical	Local	Short term	Reversible	Moderate

Table 21: Summary of environmental and socio-economic impacts during Operation phase

7.3 Assessment of Cumulative Impacts

As a reflection of the Water Policy that encourages the reuse of reclaimed wastewater in agriculture, the water reuse system in the Northern Governorates is undergoing several enhancements as part of several capital investments initiated by WAJ. These projects include:

1. **CCMM**: Expansion and rehabilitation of Wadi Al-Arab (Doaqarah) WWTP from (18,000 m3/d) to (27,000 m3/d) and rehabilitation of Central Irbid WWTP to be able to treat up to the design capacity of (13,000 m3/d).
2. **CCMM**: Installation of a new pressurized effluent pipeline between Central Irbid and Wadi Al-Arab (Doaqarah) WWTPs, with a diameter of 800 mm to replace the existing Gravity Pipeline L (13,560 m), DN ranging from (500 to 600 mm)- this ESIA covers this component.
3. **USAID Jordan Water Infrastructure** – Expansion of Ramtha WWTP from (5,400 m3/d) to (22,000 m3/d) and connection to the reuse system by constructing new Pipeline L (8,000 m), DN (600 mm) between Ramtha WWTP and Wadi Ash-Sallalah WWTP
4. **CCMM**: In-pipe hydropower turbines along the system to utilize significant head difference for energy recovery at Wadi Al-Arab WWTP.
5. **Sanitation Programme – Nexus and Resource Protection C4**: In-pipe hydropower turbines along the system to utilize significant head difference for energy recovery at the toe of Wadi Arab Dam (Shouneh).

Currently, the expansion and rehabilitation works as part of CCMM for both Wadi Al-Arab and Irbid Central WWTP is on-going (1). As for the USAID Jordan Water Infrastructure Project, phase I of the Ramtha WWTP expansion is underway while the new pipeline has not started yet (3). Both hydropower plants under CCMM and Sanitation Programme (4&5), are in the design phase and will tendered in parallel to the proposed pipeline (2), meaning that the construction of the hydropower plants will overlap with the construction of the pressurized pipeline.

In the general, there are no negative cumulative impacts because the project will not affect the same receptors negatively. Nonetheless, there is a major positive accumulative impact of the aforementioned projects on the entire water reuse system as well as the climate and environment. These cover:

- Reducing air emissions and GHG through the integration of renewable energy and energy efficiency processes in the wastewater treatment plants as well as the hydropower plants
- Improving water effluent quality and the availability of treated wastewater for reuse as the treated effluent will comply with the Jordanian Standards for irrigation and will be regularly used for irrigation
- Improving wastewater treatment infrastructure
- Contribute to conserving natural resources
- Contributing to combating climate change through reducing GHG, providing additional water sources for irrigation, and achieving food security.

8 Environmental and Social Management Plan

The Environmental and Social Management Plan (ESMP) identifies measures to address any potential environmental and socio-economic impacts that might occur during the implementation of the New Pressurized Effluent Pipeline. The main pillars of a successful ESMP are the proper definition of roles and responsibilities for the implementation of management actions, and effective process control including training and capacity building.

The objective of this ESMP is to ensure the integration of environmental and social requirements and proposed mitigation and monitoring measures into the construction contractor's obligations. Detailed mitigation measures are identified and evaluated based on the environmental and socio-economic impacts in order to avoid, reduce or remedy the impacts during the construction and operation phase.

The ESMP shall be fully integrated in the construction activities, hereby addressing the responsibilities of the construction contractor (the Contractor), the Engineer and the Employer; as well as the operation activities where mitigation measures are identified for impacts resulting from the operational phase.

Consequently, the ESMP will refer to certain issues as mentioned below:

- The environmental component (e.g. air quality) that is likely to be impacted,
- Identified potential impacts and risks,
- Environmental and Social Mitigation Measures to eliminate or reduce impacts during Construction and Operation,
- Environmental and Social Quality Monitoring to ensure mitigation measures are implemented during both Construction and Operation,
- Frequency of monitoring actions,
- Obligations, roles and responsibilities amongst concerned parties in ESMP implementation.

8.1 Contractors, Engineers and Employer Roles and Responsibilities

Employer's Arrangements (Project Owner)

The Employer has the overall responsibility for environmental and social management during the construction phase of the Project. This includes the following responsibilities:

- Ensuring compliance with all relevant national legislation, relevant KfW Sustainability Guideline provisions as well as with the environmental controls and mitigation measures contained in this ESMP.
- Ensure that the design and planning is in compliance with national requirements and aligned with international best practice.
- Monitoring the performance of contractors and sub-contractors used for providing workforce, supplies and services.
- Acting as point of contact for consultation and feedback to stakeholders and the public (stakeholder engagement).
- Where possible, the Employer shall facilitate the issuing of the relevant permits, approvals etc. from the relevant authorities. Such assistance shall not, however, relieve the Contractor of his responsibilities under the contract to obtain such approvals.

Contractor's obligations

The Contractor shall comply with the environmental and social requirements contained in the construction contract. In particular, the Contractor shall:

- Ensure compliance with relevant KfW Sustainability Guideline provisions.
- Ensure environmental awareness among his personnel, suppliers and sub-contractors so that they are fully aware of and understand these environmental and social requirements.
- Strictly adhere to the provisions of the KfW 'Standard Bidding Document for Procurement of Works' issued in its latest version (currently January 2019), especially provisions with regard to Environmental, Social, Health and Safety (ESHS) related instructions.
- Prior to the commencement of works the Contractor shall submit an Environmental and Social Management Plan (CESMP) for the Engineer's approval indicating how the Contractor will comply with the contract requirements for execution of the works. The CESMP shall be properly implemented by the Contractor during the contract. The CESMP shall include an OHS plan and shall be properly implemented by the Contractor during the contract.

- Prior to the commencement of works the Contractor has to nominate the following staff:
  - ESHS Engineer
  - Health and Safety (HS) Engineer
- The Contractor has to pro-actively contribute to the implementation of Stakeholder Engagement Activities. For his workers and all workers of assigned sub-contractors the Contractor has to implement a worker's grievance mechanism.
- Notify the Engineer immediately in the event of any accidental infringements of these environmental requirements to enable appropriate remedial action to be taken immediately by the Contractor.
- Notify the Engineer, at least 7 working days in advance, of any activity it has reason to believe may have significant negative impacts, so that mitigation measures may be implemented in a timely manner.
- The Contractor shall maintain close liaison with utility companies and contractors employed by the other organizations who are carrying out works on or adjacent to the site. The Contractor shall ensure that the progress of the works is not adversely affected by the activities of such other parties and vice versa. The Contractor shall inform the Engineer when the potential disruptions due to the other parties are anticipated.
- The Contractor shall assess the COVID measures required, if any, as part of the C-ESMP subject to the approval of the Consultant.
- Strictly adhere to health and safety instructions and guidelines related to COVID-19 pandemic including Guide 12 set by the Government of Jordan and KfW guidelines.

The Contractor shall comply with ESHS requirements in accordance with sub-clauses 4.4, 4.8, 4.18, 4.21, 6.7 and 8.1 in the specific provisions in the Condition of Contract, as well as "Appendix 1 to Particular Conditions of Contract KfW Policy– Social and Environmental Responsibility".

Engineer's Role and Duties (Consultant)

The Engineer will designate all working areas and monitor and enforce the Contractor's compliance with these environmental and social requirements. In particular, the Engineer will:

- Ensure compliance with relevant KfW Sustainability Guideline provision.
- Strictly adhere to the provisions of the KfW 'Standard Bidding Document for Procurement of Works' issued in its latest version (currently January 2019), especially provisions with regard to ESHS related instructions.
- Strictly adhere to ESHS provisions imposed by the national legal and regulatory framework.
- Enforce and adhere to all health and safety instructions and guidelines related to COVID-19 pandemic issued by the government of Jordan as well as those issued by KfW and ensure proper ESHS monitoring.
- Pro-actively manage the implementation of the provisions of the ESMP.
- Review and approve the CESMP from the Contractor.
- Communicate to the Employer, at least 7 working days in advance, any proposed actions which may have negative impacts on the environment.
- Maintain a record of complaints from the public, and communicate these complaints to the Contractor and Employer (grievance mechanism).
- Facilitate communication between all role players in the interest of effective environmental management.

8.2 Environmental and Social Mitigation during Construction & Operation

The mainly short-term negative environmental impacts, which inevitably occur during the construction works, will be minimized by propped planning and application of preventative measures as listed in **Table 22** and Table 23 along with any monitoring requirements.

In practice, proper planning means that environmental and social requirements become an integrative part of the construction contractor's obligations and have to be approved by the

supervision engineer and competent authority/ies prior to any construction works. Consequently, the provisions listed hereafter shall apply to and be binding upon the Contractor for any part of the works on the site and the subcontractors. The main contractor is responsible to instruct sub-contractors accordingly and to supervise compliance. The Contractor shall ensure that proper and adequate provisions to this end are included in all subcontracts.

The Contractor shall also employ appropriate construction methods and carry out the works in a manner as to minimize any adverse impacts on environmental and social component listed hereafter within or outside any construction sites during the contract implementation.

Additionally, the Contractor shall submit an Environmental and Social Management Plan (CESMP) for the Engineer's approval indicating how the Contractor will comply with the contract requirements for execution of the works. The CESMP shall be properly implemented by the Contractor during the contract. The CESMP shall include as a minimum:

- A spill prevention and response plan
- A traffic Management Plan
- A dedicated waste management plan
- An OHS Plan
- A chance find procedures
- A grievance mechanism for concerned community and individuals
- A grievance mechanism for workers
- An O&M plan

No.	Environmental Attribute	Potential Impact	Management Action/ Mitigation measures	Monitoring Actions	Frequency	Responsibility of Implementation	Responsibility of Oversight	Performance Indicator
1	Visual and Aesthetic	• Visual intrusion and aesthetic interference due to potential generation of waste as well as presence of construction machinery in the project area.	• The Contractor shall ensure general cleanliness and good housekeeping practices at construction sites at all times. • Littering in the project area and surrounding areas shall be prohibited consequently the contractor shall provide trash bins within each construction site so as to prevent littering in the project area and surrounding areas. • The Contractor shall progressively rehabilitate disturbed areas; repave streets to the full width after relevant works have been completed. Contractors shall stabilize and plant any disturbed areas. All these activities shall be conducted at the Contractor's own expense. • The contractor shall make sure the excavated land for trench is returned to original conditions.	Visual inspections should be carried out at all times	Daily	Contractor	Engineer	• Construction areas are properly restored to original conditions. • No construction materials or wastes are present after construction is completed.
2	Land Use	• Use of the project area for grazing by the local communities will be hindered • Acquisition of land	• Tenants (formal or informal) shall be notified of proposed construction works prior to construction to avoid using the land and subsequent delay of the project. • Adequate compensation shall be provided to landowners according to national procedures and best practices.	Formal notification of land users and owners through newspaper articles, consultations, etc.	• Once, before operation commences	Contractor	Engineer	• All tenants have received notice of works • A Land Acquisition plan is developed, approved, and implemented to ensure proper compensation
3	Hydrology and Hydrogeology	• Increased surface water runoff leading to erosion and sedimentation during and after significant rainfall events. • Contamination of groundwater resources due to improper housekeeping, waste storage and disposal	• The contractor shall use barriers or other measures to ensure that sediments and any other contaminant do not come into contact with, or are transported off-site in surface water run-off, especially while laying the pipeline. Work shall be stopped in the event of heavy rains and subsequent runoff periods. • If groundwater is encountered, the contractor shall inform the Engineer, and all trenches shall be dewatered prior to installation of pipe. • All chemicals shall be stored in dedicated areas in tightly closed containers and shall be protected from adverse weather condition. • A spill prevention and response plan shall be prepared by the Contractor as part of the CESMP in order to control any inadvertent leakage or spillage. Spill response measures shall be implemented (as necessary) to contain and clean up any contamination. • Ensure that general purpose spill absorbent is available at project site. • Any spilled chemical shall be immediately collected and disposed of in accordance with Spill Prevention and Response Plan.	• Inspection for erosion and runoff control to include inspections for implementation of mitigation measures. • Inspection of waste management practices	• On Demand • Daily	Contractor	Engineer	• Runoff from constructions site should be clear of heavy particulates, oils/chemicals, or trash. • Up-to-date and complete records as required by spill prevention and response procedures. • Training records of personnel trained in emergency response/spill prevention and response procedures. • Environmental reports on implementation of the waste management practices onsite

No.	Environmental Attribute	Potential Impact	Management Action/ Mitigation measures	Monitoring Actions	Frequency	Responsibility of Implementation	Responsibility of Oversight	Performance Indicator
			• Regular maintenance of all equipment and machinery used onsite. Maintenance activities and other activities that pose a risk for hazardous material spillage (such as refuelling) must take place at a suitable location (hard surface) with appropriate measures for trapping spilled material. • The Contractor shall distribute a sufficient number of properly contained containers clearly marked as "Construction Waste" for the dumping and disposal of construction waste • Contractor shall direct contaminated wastewater from washing/maintenance to a drain pit in the construction workshop, collected by a vacuum truck and transported to the nearest approved municipal waste facility. • Contractor shall provide workers with and inform them of nearby available sanitation facilities to avoid contamination from any human wastes.					
4	Geology	• Removal of soil due to construction activities, thus causing erosion. • Contamination of soil due to improper waste management or accidental spillage/leakage of chemicals or oils stored on site or used during construction or rupture of fuel storage tanks in construction site.	• The Contractor shall adopt soil conservation methods during the entire length of the project to reduce the area of destruction during trenching/excavation works. • Upon completion of trenching/excavation works, the Contractor shall restore disturbed areas to their original condition. • Machineries and equipment shall be checked by the Contractor on daily basis to ensure that there is no leak of oil, fuel, greases or other liquids. If leaks are detected, machineries and equipment shall not be operated until repaired. • Contractors shall use impervious drip trays under portable equipment such as mobile generators and pumps to contain any spills or leaks. Contractor shall carry out all re-fuelling in designated areas with impervious surface. Contractor shall ensure no spills of fuel. • All chemicals shall be stored in dedicated areas in tightly closed containers and shall be protected from adverse weather condition. • A spill prevention and response plan shall be prepared by the contractor as part of the CESMP in order to control any inadvertent leakage or spillage. Spill response measures shall be implemented (as necessary) to contain and clean up any contaminated soil. • Ensure that general purpose spill absorbent is available at project site.	• Visual inspection of disturbed area in and around construction site for erosion. • Visual inspection of waste storage area, chemical storage area and fuel storage area for spills and leaks. • Visual inspection of vehicles, machinery and equipment for leaks of oils, grease, etc. • Inspection of waste management practices	Daily	Contractor	Engineer	• Up-to-date and complete records as required by spill prevention and response procedures. • Training records of personnel on spill prevention and response procedures. • Environmental reports on implementation of the waste management practices onsite

No.	Environmental Attribute	Potential Impact	Management Action/ Mitigation measures	Monitoring Actions	Frequency	Responsibility of Implementation	Responsibility of Oversight	Performance Indicator
			• Any spilled chemical shall be immediately collected and disposed of in accordance with Spill Prevention and Response Plan.					
5	Air Quality	• Local degradation to air quality due to exhaust emissions • Local degradation to air quality due to dust generation from construction activities.	• The Contractor shall use heavy equipment, machinery, and fuels in compliance with national regulations. The Contractor shall perform regular maintenance on all equipment, vehicles and machinery to prevent air emissions. • The Contractor shall limit idling of engines when not in use. • The Contractor shall make sure that any vehicle or equipment leaving the project area is cleaned of loose debris. Additionally, vehicles and equipment shall be covered to avoid dust generation. • The Contractor shall use dust suppression measures on unpaved roads, excavations, stockpiles, and for transport of excavated material to reduce airborne particulates areas and/or sensitive receptors during windy conditions and when needed. • The Contractor shall store cement, sand, or other such fine-grained material in manner to prevent wind erosion and dust. • Construction vehicles shall comply with speed limits. Speed limits for heavy vehicles within construction site shall be restricted to 20 km/hr. • Vehicle and machinery movements during construction shall be restricted to designated routes at all times where practicable. • No stockpiling of fine material is allowed within the construction sites. • Spillage of materials on roads or pathways shall be cleaned up promptly in accordance with the spill prevention and response plan that shall be developed by the Contractor as part of the CESMP.	• Source emission monitoring from vehicles and equipment • Odour spot monitoring during connection of new pipeline • Visual monitoring of dust generated from construction activities, construction vehicle movement, stockpiles, storage of construction materials, etc. • Conduct, at construction site, one day of air quality for particulate matter and total suspended particulates	• Daily • Daily (only during tie-in works) • Daily • Every 6 months	Contractor	Engineer	• Compliance with Jordanian ambient air quality Standards JS 1140/2006. • Complete records of monitoring activities. • Regular vehicle maintenance records. • No visible dust plumes originating from construction site. • No obvious bad odour originating from construction site. • No irregular exhaust (heavy black or white smoke) from equipment and vehicles. • Availability of track records of carried measurement that show comparison to Jordanian ambient air quality Standards JS 1140/2006.
6	Noise and Vibration	• Noise pollution due to construction activities such as excavation, etc. and use of heavy machineries, vehicle and equipment operation.	• The Contractor shall use heavy equipment, machinery, and fuels in compliance with national regulations. The contractor shall perform regular maintenance on all equipment, vehicle and machinery to prevent noise emissions. • The Contractor shall limit idling of engines when not in use to reduce its contribution to noise emissions. • Contractor shall take reasonable measures, such as installing acoustic screens or close barricades, to maintain noise levels within the national requirements at all construction	Noise monitoring at 1.5 m above ground. (A third person or entity can perform noise monitoring in the case of non-availability of noise meter with the contractor.)	Daily	Contractor	Engineer	• Compliance with Instruction for Reduction and Prevention of Noise for 2003 • Complete records of monitoring activities.

No.	Environmental Attribute	Potential Impact	Management Action/ Mitigation measures	Monitoring Actions	Frequency	Responsibility of Implementation	Responsibility of Oversight	Performance Indicator
			sites. If such measures are not reasonable, the contractor shall try to minimize disruption through other means such as scheduling noisy activity during less sensitive times in consultation with the sensitive receptors or using alternative techniques that create less noise. • Construction activities are prohibited between 8:00pm and 6:00am, according to the 2003 Instruction for Reduction and Prevention of Noise. Moreover, construction activities shall be avoided on Fridays (weekend in residential areas.) • Level of noise must not be higher than 55 dB during daytime or 45 dB during night activities (if any). • The Contractor shall provide 24 hours advance notification of construction schedule and activities with potential disturbance to nearest residences and public facilities which are abutting to the proposed alignment. • The Contractor shall take responsibility for rectifying damages caused by vibration generated from or by the use of any equipment, machinery, and haulage vehicles.					
7	Archaeology	• Construction activities could damage/disturb potential archaeological remains with might be buried under ground if any.	• Implement chance find procedures for potential unearthing of any archaeological sites during construction. This includes that construction activities be halted and the area fenced, while immediately notifying the DoA.	Inspection/ report Submission to DOA	On Demand	Contractor	Engineer	• Compliance with - Antiquities Law No. 21 of 1988 and its amendments No. 23 for 2004
8	Biodiversity	• Disturbance/Loss of (protected) terrestrial species	• Implement proper management measures to prevent damage to the biodiversity of the site. This could include establishing a proper code of conduct and awareness raising / training of personnel (e.g. with respect to prohibiting hunting) and good housekeeping (e.g. keeping the site orderly and clean). • If relevant, clearing of vegetation shall be confined to that necessary for the establishment of required infrastructure and lay down areas. • If relevant, trees, shrubs, or other flora on pathways and/or access roads are to be protected by appropriate means. • If relevant, removed vegetation shall be replaced at Contractor's own expense by re-planting indigenous species.	Inspection	Daily	Contractor	Engineer	• Revegetation completed
9	Socio-economic and Social Disturbance	• Physical and psychological strain to women and children due to presence of (foreign) workers.	• The Contractor shall maintain open communications with the local municipality and concerned residents (erect notification boards at construction site providing	Public consultation and community integration	Continuous	Contractor	Engineer	• Information meetings are well attended by women, elderly, and other vulnerable groups.

No.	Environmental Attribute	Potential Impact	Management Action/ Mitigation measures	Monitoring Actions	Frequency	Responsibility of Implementation	Responsibility of Oversight	Performance Indicator
		• Emission of dust from construction works which may cause stress to local community and businesses in the area • Disturbance of women's wellbeing and social life. • Workforce employment	information about the project and contact numbers). • Local residents are to be informed about construction and work schedules, interruption of services and demolition with a 7 days notification in advance. • A grievance mechanism for concerned community and individuals has to be in place. • Once the construction plan is issued, the Contractor shall hold public meetings to announce construction plan details (time and duration, stages, etc.). • The Contractor shall obtain work permit from the local authorities to remove or disturb any existing survey markers or other street or roadway markers and are to be restored after work completion. • Contractor shall confirm notification of tenant-one year prior to construction activities to avoid impact on livelihoods and delay of the project. • The Contractor shall ensure employment of a certain percentage from the local community.					• Regulation for Obligatory Employment of Jordanian Workforce from Surrounding Communities in Development Projects No.(131) for the year 2016
10	Infrastructure	• Increased water demand during construction phase, which might lead to constraints on local users.	• Coordinate with relevant authorities for securing additional water requirements of the Project. • Document water consumption of the Project	• Submit proof for coordination with authorities • Submit annual report	• Once; before construction commences • Continuous	Contractor	Engineer	• Availability of adequate water supply to workers and proper disposal and management of generated wastewater
10.1	Traffic Control	• Traffic and road accessibility will be disrupted with the possibility of creating congestions at peak hours.	• The Contractor shall submit a Traffic Management Plan (TMP) taking into consideration current traffic profiles. • The Contractor shall comply with all the applicable laws with regard to road safety and transport. The Contractor shall instruct its drivers and equipment operators that vehicles will be expected to comply with all road ordinances, such as speed limits, roadworthiness, load securing and covering. • The Contractor's vehicles shall be permitted only within the designated work sites or on existing roads, as would be required to complete their specific tasks. Vehicles are not permitted on re-vegetated areas, and site traffic shall be limited to prevent unnecessary damage to the natural environment. • Existing public access roads used by the Contractor in connection with the execution of the contract shall also be maintained by the Contractor.	• Visual spot checks and monitoring of road conditions, signage and traffic calming needs.	Daily	Contractor	Engineer	• All signage maintained and available at all times. • All accidents between construction vehicles and private vehicles are reported and investigated promptly and in compliance with health and safety procedures. • Accidents and incidents are reported and investigated promptly.

No.	Environmental Attribute	Potential Impact	Management Action/ Mitigation measures	Monitoring Actions	Frequency	Responsibility of Implementation	Responsibility of Oversight	Performance Indicator
10.2	Waste Generation and Disposal	• Improper management of hazardous and non-hazardous waste generated at site leading to impacts on soil, water and visual environment and health and safety of construction workers and public	• A dedicated waste management plan shall be developed and implemented based on a minimization approach and high-quality housekeeping practices. • The Contractor shall segregate storage for different types of wastes, such as hazardous, non-hazardous recyclable construction material to facilitate proper disposal as per waste management plan. • If applicable, the Contractor shall provide a separate storage area for hazardous materials. The hazardous materials/products must be labelled with proper identification of its hazardous properties. • Chemical waste shall be stored in accordance with the provisions of Material Safety Data Sheets (MSDS). The Contractor shall keep MSDS onsite. • The Contractor shall provide trash bins within each construction site so as to prevent littering in the project area and surrounding areas. • The Contractor shall establish regular intervals for waste collection and disposal as per waste management plan. • Inert waste generated from excavation activities shall be recycled to the extent possible, sold to contractors or disposed of to a designated landfill. • Keep records proving the safe disposal of all types of waste in approved landfills. • Coordinate with the MoEnv on the safe disposal of hazardous wastes in dedicated landfills (Swqa Landfill). • Keep records proving the safe disposal of wastewater in its designated areas. • Ensure that all generated wastewaters are disposed off in a safe manner through tanks equipped with electronic tracking devices.	• Visual monitoring of site cleanliness and waste storage	Daily	Contractor	Engineer	• Compliance with waste management plan. • Current and complete records of regular waste collection and disposal. • Compliance with applicable regulations including ○ Waste Management Framework Law No 16 of 2020 ○ Regulation for the management of hazardous materials and waste no.68 for the year 2020 ○ Solid waste management regulation no. 27 for the year 2005 ○ Instructions for hazardous waste management and handling for the year 2019 ○ Solid Waste Instructions 2019
11	Occupational Health and Safety	• Potential accidents due to obstructed pedestrian and vehicular access, lack of sufficient signage barricades, warning, lights and other safety precautions that are required by the contractor. • Risk to occupational health and safety from construction activities such as excavation, confined space entry, handling of hazardous materials and chemicals, manoeuvring of	• The Contractor has to ensure that all workers have access to protective measures and Personal Protective Equipment (PPE). • The Contractor shall comply with the KfW Specifications for Project Area Environmental, Social, Health and Safety Management (ESHS). • The Contractor shall nominate a qualified H&S Engineer dedicated for the site. The H&S Engineer and the Contractor shall be responsible for ensuring that a safety plan is prepared and adhered to and shall coordinate with the sub-contractors and or other persons	• Visual inspection of compliance with health and safety procedures • Regular controls and testing by the competent health authorities	• Daily • Random Inspection	Contractor Contractor through Ministry of Health	Engineer	• No identified non-compliances of health and safety procedures. • Regular training records of personnel on health & safety procedures on site. • Injuries or accidents to workers/personnel on site are reported and investigated promptly and in compliance with the health and safety procedures. • H&S training provided

No.	Environmental Attribute	Potential Impact	Management Action/ Mitigation measures	Monitoring Actions	Frequency	Responsibility of Implementation	Responsibility of Oversight	Performance Indicator
		construction equipment and machinery, risk of exposure to injuries. • Impact to workers health due to dust generation, noise generation, spread of COVID-19, etc.	working on or near the site for proper implementation during the execution of the works. • Workers shall be briefed regularly on occupational health and safety regulations including induction training. • A grievance mechanism for workers (contractor and sub-contractor) has to be in place. • The Contractor shall provide sufficient drinking water for workers as well as locations where protection against sun is provided during breaks. • Traffic control measures, including road signs and flag persons to warn of dangerous conditions shall be implemented. The Construction vehicles shall comply with speed limits. Speed limits for heavy vehicles within construction site shall be restricted to 20 km/hr. • The Contractor shall install fences, barriers, dangerous warning/prohibition signs around the construction area in order to protect the workers. • Ground movement shall be controlled and collapsing prevented by systematically shoring, sloping, benching, etc. • The Contractor shall develop and implement appropriate fire precautionary measures as per the H&S Plan in accordance with the requirements of the appropriate Local Standards for Construction. • Contractor must comply with Guide 12 issued by the Ministry of Labour to reduce the risks of COVID-19 spread amongst workers; contractor must also ensure that KfW Info-Sheet on COVID-19 is taken into consideration, especially during the construction phase.					• PPE used on site by workers • Review of grievance register • No COVID-19 cases
12	Labor conditions	• Risk of poor conditions and absence of contracts for workers	• The Contractor shall ensure continuous compliance to all Labour obligations outlined in the local legislative framework, IFC Performance Standards, and ILO stipulations. • The Contractor shall ensure the implementation of a just Human Resource Policy and related procedures and ensure it is communicated clearly to its workforce. • The Contractor shall comply and respect workers' rights as per local legislations and other relevant international requirements to cover topics such as wages, compensation, benefits, workers' organization, clear	• Periodic audits, inspections, and/or spot checks of project locations or work sites • Follow-up on workers grievance mechanism	• Random	Contractor	Engineer and Employer	• Grievance mechanism is implemented and grievance closure reports are prepared

No.	Environmental Attribute	Potential Impact	Management Action/ Mitigation measures	Monitoring Actions	Frequency	Responsibility of Implementation	Responsibility of Oversight	Performance Indicator
			grievance mechanisms, retrenchment, accommodation, etc. • The Contractor shall commit to non-discrimination employment procedures with equal opportunities, and prohibit forced and child labour as well as protecting workers including vulnerable groups such as women and migrant workers					
13	Gender Based Violence	• Potential risk of GBV including sexual harassment amongst female workers and women of neighbouring communities	• Necessary measures shall be taken to ensure that the presence and demeanour of construction workers is not sexually or physically threatening women and children under any circumstance. This shall include sensitization of the workers and the community on appropriate behaviours, expectations, and disciplinary actions against workers who do not follow the established protocol.	• Orientation and awareness raising for workers on proper behaviour and code of conduct	• Continuous	Contractor	Engineer	• Establishing a proper code of conduct and ensuring workers are aware of its provisions
14	Community Health and Safety	• Impact to public due to dust generation, noise generation, traffic accidents due to roadblocks, and the presence of trenches etc. • Impact on construction workers as well as the public due to the spread of COVID-19	• The Contractor shall be responsible for the protection of the public health from any dangers associated with construction activities. • The Construction vehicles shall comply with speed limits. Speed limits for heavy vehicles within construction site shall be restricted to 20 km/hr. • Ensure that the consultations involve poor households, women, persons with disabilities, the elderly and illiterate persons to ensure the information reaches them and they are aware of the project's specifics before the onset of the project. • If relevant, the Contractor shall install fences, barriers, dangerous warning/prohibition signs around the construction area and trenches. • The Contractor shall ensure that no children are allowed to be around construction activities in particular during excavation and the installation of structures. • Any excavations, material dumps, or other obstructions likely to cause injury to any person or thing shall be suitably fenced off and at night marked by red warning lights. • Workers should abide by the health and safety instructions and guidelines set by the government of Jordan as well as the guidelines issued by KfW to reduce the risk of COVID-19 outbreak. • Inform the Engineer and Project owner of any incidents or accidents.	• On-site visits and communications with communities • Monitoring of COVID-19 Symptoms and Ad hoc intervention in case any of the workers show symptoms	• Monthly • When necessary	Contractor Contractor through Ministry of Health	Engineer	• No identified non compliances of health and safety procedures. • Regular training records of personnel on health & safety procedures on site. • Review of grievance register • Incident and accident reports • Minimal rate of infection with COVID-19

Table 22: ESMP for Construction Phase

No.	Environmental Attribute	Potential Impact	Management Action/ Mitigation measures	Monitoring Actions	Frequency	Responsibility of Implementation	Responsibility of Oversight	Performance Indicator
1	Geology and Soil	• Soil pollution during operation in case of a breach in the pipe or leakage	• Development of an Operations and Maintenance Plan • The Consultant shall, during the Construction phase, conduct proper quality control to ensure that all the vulnerable points (joints, connections, valves, etc) are installed properly	• Visual Inspection • Soil Quality testing	• In case of rupture or breakage • Twice per year	Operator	Employer	• Up-to-date and complete records as required by spill prevention and response procedures. • Training records of personnel on spill prevention and response procedures
2	Hydrology and Hydrogeology	• Improper operation and maintenance can result in surface water and groundwater contamination	• Development of an Operations and Maintenance Plan • The Consultant shall, during the Construction phase, conduct proper quality control to ensure that all the vulnerable points (joints, connections, valves, etc) are installed properly • Constant cleaning of bar screens, etc.	• Visual Inspection • Water Quality testing	• In case of rupture or breakage • Twice per year	Operator	Employer	• No identified leakages • Compliance with Operation and Maintenance Plan • No contamination detected in water resources
3	Community Health and Safety	• The presence of the pipeline may have an impact on the community H&S due to bursting of pipeline which in turn contaminate groundwater sources	• Development of an Operations and Maintenance Plan • The Consultant shall, during the Construction phase, conduct proper quality control to ensure that all the vulnerable points (joints, connections, valves, etc) are installed properly	• Visual Inspection • Water Quality testing	• Random Inspections • Twice per year	Operator	Employer	• No identified leakages • Compliance with Operation and Maintenance Plan • No contamination detected in water resources
4	Occupational Health and Safety	• Occupational health and safety issues for workers during maintenance works.	• Inspection of Personal Protective Equipment (PPE) for operation and maintenance workers • Ensure that an emergency plan and a rescue plan are in place and ready to be implemented, if needed	• Visual inspection of compliance with health and safety procedures	• Monthly	Operator	Employer	• Up-to-date and complete records of PPEs and records of any incidences and appropriate responses

Table 23: ESMP for Operation Phase

9 Stakeholder Consultation and Engagement

One of the essential steps of a successful ESIA procedure is stakeholder engagement; a statutory requirement of the national EIA regulation, and the KfW guidelines.

Stakeholders are individuals or groups who might affect or be affected by the project either directly or indirectly. As part of this project the Stakeholder consultations will be undertaken in an inclusive and culturally appropriate manner to ensure the engagement of all stakeholders in addition to sharing relevant information that helps stakeholders in understanding the risks and benefits of the project, as well as giving them the opportunity to voice in their views and concerns.

9.1 Objectives

The objective of stakeholder consultation is to ensure that a participatory approach takes place through which the concerns of the stakeholders are considered, responded to, and incorporated into the decision-making process.

In general, the consultations should take place on a two-way communication basis to ensure that information is communicated to stakeholders and at the same time the needed data and on-ground information is collected from stakeholders.

This section presents a summary of national and international requirements for stakeholder engagement as well as identify the main stakeholders and provide the main consultation activities.

9.2 Requirements for Stakeholder Engagement

The Jordanian legal requirements for consultation and engagement are mainly included within the “Environmental Classification & Licensing Regulation No. 69 of 2020". The requirements of the Regulation are summarized below.

The Regulation requires that for projects requiring a comprehensive EIA study, a scoping session must be held in order to provide stakeholders with all available information on the Project and its impacts.

In this regard, the main stakeholder groups that are generally required to attend the scoping session are as follows:

- Governmental entities and ministries
- Local governmental agencies
- Non-Governmental Organizations
- Academic and research institutions
- Local community representatives

The regulation also requires that the EIA outlines the stakeholder engagement activities undertaken through scoping sessions, surveys, interviews, etc.

In addition, the KfW Sustainability guidelines (2019) require that the public and the affected communities are involved and informed through meaningful participation and consultation. The stakeholder affected by the project should be able to express their thoughts and concerns on the proposed project. The guidelines also states that a public hearing is held as part of the scoping phase and that the results of the ESIA report should be shared and disclosed through suitable channels in a timely and culturally appropriate manner.

9.3 Stakeholder Identification and Analysis

The stakeholder groups that are expected to affect or be affected by the project are divided into two main categories: local communities impacted by the project, and governmental and non-governmental entities who are interested in the project or who can influence it.

Affected Communities

The affected communities have been identified based on the geographic location and administrative setup of the project site. As mentioned previously, the project is located within Irbid governorate and specifically within Qasabet Irbid district.

The communities who will be impacted by the project reside in Soom, Fo'arah, Doaqarah, Jijjien, Teqbel, Irbid (Al Bareha), and Hoor.

Governmental and Non-governmental organisations

These stakeholders have been identified based on the project location, nature, and its potential social and environmental impacts. Governmental stakeholders include Ministries, Directorates, and other agencies while non-governmental stakeholders include NGOs and academic institutions.

The following table provides a list of key national and local stakeholders along with their influence on the project.

Stakeholder Group/Entity	Interest and Influence on the Project
National Governmental Agencies	
Ministry of Environment	The protection of the environment is the main mandate for the MoEnv. The ministry is also the official governmental responsible for approval of the ESIA and making sure it complies with the "Environmental Classification & Licensing Regulation No. 69 of 2020" and granting the environmental clearance.
Ministry of Water and Irrigation (MWI) / Water Authority of Jordan (WAJ)	The official body responsible for the overall monitoring of the water sector and water supply. For this Project WAJ is the Project Owner.
Yarmouk Water Company (YWC)	Is owned by WAJ and is responsible for the operation and maintenance of drinking water production and distribution systems, as well as collection and treatment of wastewater in Northern Governorates of Jordan (Irbid, Jerash, Ajloun and Mafraq). For this Project YWC is the project operator.
Ministry of Agriculture (MoA)	Protecting wildlife and managing forests, rangelands, grassland and vegetation is the main responsibility of the MoA. The main role of MoA in this project is related to land use issues (especially if the project site is within agricultural land, grazing land, etc.).
Ministry of Local Administration (MoLA)	The land uses in Jordan are designated by MoLA which in turn identifies the projects and activities that are allowed for each location. For this project, this mainly includes issues related to designated land use of the Project site.
Ministry of Health (MoH)	The Ministry of health is the main official body responsible for the entire health sector including public health and safety. For this Project the ministry of Health's main interest is the public health of nearby communities and nuisance prevention from project activities.
Ministry of Labour (MoL)	The ministry of labour is the main entity responsible for labour issues and affairs, regulating the labour market, supervising labour unions, providing vocational training and enhancing labour education, employment of Jordanians and non-Jordanians, etc.
Ministry of Tourism and Antiquities (MoTA) / Department of Antiquities (DoA)	MoTA and DoA are mainly responsible for tourism development and protection of antiquities in Jordan. Their interest in this project is primarily the potential impacts relate to archaeology and cultural heritage related to the Project.

Stakeholder Group/Entity	Interest and Influence on the Project
Ministry of Digital Economy and Entrepreneurship	Ministry of Digital Economy and Entrepreneurship are responsible for granting approvals for laying of communication lines including fibre optics.
Local Governmental Agencies	
Irbid Governorate	The governorate is officially responsible for providing the main services (health, education, security, etc.) as well as coordination for the development of the area.
Irbid sub-district	The sub-district oversees all administration matters within its jurisdiction.
Non-governmental Organisations	
Environmental Societies Association	The Association forms the umbrella for all environmental NGOs in Jordan.
Community Based Organisations (CBOs)	Such entities could be interested in updates on environmental and social implementation of the Project.
The Royal Society for the Conservation of Nature (RSCN)	The RSCN is responsible for protecting the biodiversity and natural resources in Jordan. Moreover, this environmental NGO sets up protected areas to safeguard the wildlife and birds. As part of this project, RSCN's role involved issues related to land use in the case of the site being in environmental reserves and important bird areas as well as potential impacts from the project on biodiversity.

Table 24: Stakeholder Mapping

9.4 Stakeholder Consultation and Engagement to Date

The Consultant held a public scoping session to facilitate maximum public participation in the development of an Environmental and Social Impact Assessment (ESIA). The purpose of this scoping session was to provide public entities and official organizations with the opportunity to raise concerns about the environmental and social impacts of the proposed project.

The scoping session was held in Amman on October 18th, 2022 at the Intercontinental Hotel, Amman. More than 20 stakeholders were invited to participate representing most relevant sections with the government.

Figure 10: Photos Documenting the Scoping Session

The Consultant presented the project introducing its elements, phases and components as well as an overview of the ESIA study and the expected impacts. The session was concluded with a questionnaire on the environmental and social impacts to measure their importance in the view of the stakeholders.

The planned agenda for this session left sufficient time for discussion. The table below shows the synthesis of the different comments made throughout the session directly related to the pipeline construction and operation:

No.	Questions and Answers
1	Q: Is the pipeline closed off and if there will be protection barriers around it. Requested that this is covered in the EIA to ensure the safety of local communities. A: Safety considerations are taken into account and the hydropower turbines are in closed and fenced buildings. It was also stated that the safety of local communities will be covered in the study as well as in the Environmental and Social Management Plan (ESMP).
2	Q: Inquiry on the point in the presentation with regards to reinstating the land as well as about land acquisition. A: explained that reinstating the land in this case means returning the land to its original conditions before the start of construction. The operation phase will last 25 years. It was also stated that the acquisition process started five months ago and within two months the acquisition process will be concluded. It was also stated that a land acquisition plan has been developed in accordance with WAJ procedures.
3	Q: Land acquisition and whether any of the lands are agricultural lands.

	A: It was explained that the lands are all in the wadi or inside existing infrastructures and that the acquisition is underway and following WAJ's normal procedures as covered also in the Land Acquisition Plan.
4	Q: about the safety consideration and requirements throughout the Project implementation A: The team ensured that occupational health and safety, and environmental and social health and safety requirements are a priority in this project and are taken into consideration in the design and will be covered in the ESIA and ESMP. It was also stated that there will be a supervision team on site ensuring that the contractor abides by all health and safety measures.
5	Q: Inquiry about the possibility of transportation of soil outside the project sites and stated that coordination is needed with specific entities based on the soil type. Asked about surface run off causing soil erosion and transport. A: It was stated that the ESMP will cover soil conditions and erosion and the need to stop working during heavy rains to reduce the impact. It was also stated that the soils will be used to reinstate the land after excavation, however in the case where soils needs to be transported outside the project boundary it will be arranged with the municipalities.
6	Q: How far is the Project from the Jordanian boundaries with Syria. What is the distance between the project and natural reserves. A: It was explained that the project is not close to the Jordan-Syrian borders. It was stated that the location of the project's components was identified with regards to natural reserves and important bird areas. The environmental and social impact assessment study will cover the potential impacts and mitigation measures with this regard.

More details on the scoping session including the list of invitees, attendees, agenda and results of the questionnare are found in the scoping report in Annex 5.

The Consultant also held three local consultation sessions on the 4th and 5th of December with representatives of eight local communities located within Irbid district in three different municipalities (Greater Irbid Municipality, West Irbid Municipality, and Khalid Bin Al Waleed Municipality), these areas include: Al Bareha, Taqbal Soom, Foarah, Hoor, Jijeen, Doaqara and Um Qais.

The main purpose of this session is to inform the local communities of the project and take into consideration their concerns and opinions, especially those related to the ESIA study.

9.5 Future Stakeholder Engagement and Consultation

This Section identifies the future stakeholder consultation and engagement plans which are to take place by WAJ throughout the lifetime of the Project.

9.5.1 Future Stakeholder Engagement and Consultations during different phases

The most important engagement activities during construction and operation of the project are outline below:

- Revise list of stakeholders most likely to be affected by and interested in construction and/or operation.
- Review and update stakeholder information when needed
- Notify local stakeholders of planning, decision making, construction, and operation activities and changes to schedules.
- Manage the transition from construction to operations as well as parallel undertaking of both phases.
- Get community liaison staff on the ground quickly.
- Aim for rapid response times in resolving grievances.
- Continue to disclose, consult, and report to stakeholders as needed.
- Choose contractors/service providers with the capacity to engage effectively with stakeholders.
- Communicate emergency preparedness and response plans on a regular basis.
- Keep WAJ grievance mechanism operational.
- Inform the stakeholders of the existence of a Community Liaison Officer (CLO), providing their Contact Details and mechanisms to contact them.
- Regularly engage and inform stakeholders, including municipalities and local communities (with special focus on vulnerable groups and women) of planning, decision making, construction, and operation activities and schedule of the activities.
- Continue Regular Engagements and information distribution.
- Receive, track and respond to grievances.
- Continue documenting engagements and responding to grievances.

9.5.2 Roles and Responsibilities

WAJ will be the main responsible entity for the implementation of stakeholder engagement activities and shall ensure compliance and satisfactory delivery of the services by the contractor. Where needed, the Contractor will collaborate with WAJ for undertaking specific engagement activities.

- Contractor in close coordination with WAJ shall assign CLO for the project. Feedback from Yarmouk Water Company, as the operator, will be considered in the decision.
- WAJ will provide adequate and timely information to the stakeholders about project progress and development.
- The main contractor will be responsible for providing accurate and up to date information to WAJ regarding project activities and timeframes,
- CLO will obtain, organise and document feedback from the project stakeholders regarding concerns and requests.
- Contractor shall be ready and available to participate in WAJ's public consultation and disclosure activities, if required by WAJ. The team will also attend all coordination meetings requested by WAJ as required.

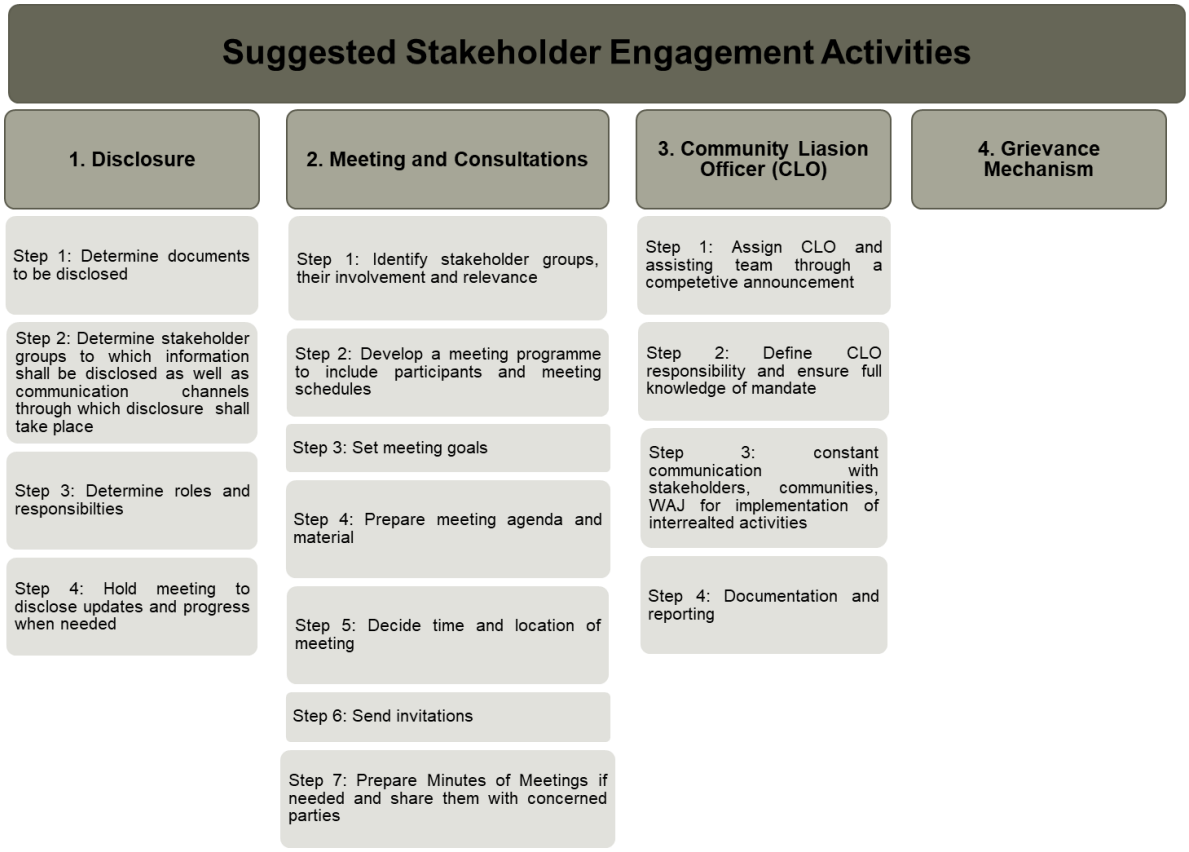
- Contractor will provide information to WAJ related to actions and activities that involve WAJ stakeholders and influence areas, specifically those that involve potential social and environmental impacts. The Contractor will also inform in regards to social incidents and community relations issues and grievances. The main contractors' Project Managers will be responsible for incorporating summaries of grievance reporting into monthly and quarterly reports
- WAJ will coordinate meetings and liaise with different governmental departments and other stakeholders to ensure smooth implementation of the project. The table below provides a list of the relevant entities outside WAJ that will most probably be involved and consulted.

Involved Parties		**Purpose and Topics**	**Frequency**
Main Lead	**Participants**		
Stakeholders who may be directly or indirectly affected by the Project			
WAJ, YWC	Community stakeholder groups(include residents,landowners, Sensitive and vulnerable groups: Poor communities Women Migrant workers), NGOs, CBOs, Academia	• Provide updates on project activities of interest to stakeholder and which could affect them • Community integration and follow up on any enquiries and comments	Once during construction (due to short project duration)
Stakeholders who have a regulatory role in ensuring the implementation and compliance of projects (Secondary Interested Parties/Stakeholders)			
WAJ	Ministry of Environment	• Environmental monitoring • Related permits or licenses and any additional ESIA requirements •	As needed
	Ministry of Interior	• Related permits and permissions	
	Jordan Electric Power Company Energy and Minerals Regulatory Commission	• Electric power connection and generation	
	Civil defence	• Review and discuss Emergency Response Plan	
	Public Security Directorate	• Coordination in the case of overlapping services and utilities	
	Royal Jordanian Air Force	• Coordination in the case of overlapping services and utilities	
	Municipalities	• Discuss types of waste, waste transportation, traffic and wind-blown litter	
Contractor	Municipalities	• Coordination on reinstatement • Other related permits	As needed

WAJ also has several departments that may be involved directly or indirectly in the implementation of stakeholder engagement, for example, the social media department which supervises the different social media platforms will be responsible for the disclosure of information such as project updates.

9.5.3 Planned Stakeholder Engagement Programme

Based on the above and all the findings of this ESIA, the Contractor in close coordination with WAJ shall implement several stakeholder engagement activities are elaborated below.



Disclosure of Documents and Information (Pre-Construction and during Construction)

To ensure that project stakeholders are continually being updated on project progress and related EHSS issues, information will be accessible to the public, key stakeholders, and local communities through dissemination of related documents. The disclosure package will be publicly available in Arabic language (as well as English if available) to relevant stakeholder groups through various communication channels agreed by GAM. At this stage, the following documents will be disclosed for effective stakeholder communication:

- Non-Technical summary
- Roll ups and leaflets to include a summary of project activities and key associated risks (distributed at the affected municipalities)

There are different communication channels through which information can be disclosed, including:

- WAJ website
- Social Media
- YWC website

Community Liaison Officer (During Construction)

The CLO will be assigned by the Contractor in close coordination with WAJ through a competitive announcement. The main responsibility and the scope of the CLO is provided in the table below. In the case that the CLO wants to meet with female groups, a female engineer either from the Contractor's side, or from WAJ shall attend.

Entity	Scope	Responsibilities
Community Liaison Officer (CLO)	• Main point of contact for the project with local communities and stakeholders on all project-related issues • Builds and maintains relationships with community members to better understand community concerns and perceptions	• Ensure timely disclosure of project information in Arabic to the key stakeholders • Undertake informed participation and meaningful two-way consultation with the affected stakeholders • Ensure implementation of a grievance mechanism to ensure that the affected stakeholders' concerns and issues are addressed. • Keep a log of all grievances • Develop, update, and follow up on implementation for project specific plans and procedures, training plans and programmes, and labour management plan • Preparation of bi-weekly, monthly, quarterly and annual reports including documentation for the above items.

The CLO contact information must be disclosed to the local community members ideally on the project billboard.

9.6 Grievance Mechanism for the Concerned Public (During Construction)

One of the most vital components of stakeholder engagement is grievance mechanisms. Grievances are a clear reflection of any growing concerns that might escalate if they weren't addressed properly.

The Project owner will identify and respond to all grievances and complaints in a timely and effective manner in order to ensure that positive relationships are developed and any recurrent issues are identified. In general, the grievance mechanism shall be at no cost and without retribution to the party that originated the issue or concern, it should also allow anonymous submissions.

The following mechanism describes the steps to be undertaken to address, respond, and close complaints:

1. Grievances are submitted through different communication channels:

- The existing joint governmental platform (بخدمتكم) / Bekhedmetkom or 'at your service' to submit any complaints and/or suggestions, given that it is a neutral interactive portal to communicate with different governmental entities and follow up on the different questions, suggestions, and complaints.
- WAJ Complaint Direct line: 117116 (this is generally used for technical complaints only i.e. water cuts, pipe breakages, leakages, sewer flooding, and water quality)
- CLO

2. The public can submit grievances on ongoing project on Bekhedmetkom and WAJ offices. Grievances submitted will be recorded and for each grievance The complaints will have a specific number, date, data on the complainant, and the classification of the complaint.
3. The grievance will then be investigated and the reason behind the complaint will be analysed. Accordingly, the measures to be undertaken to solve the grievance are identified along with the needed timeline.
4. After resolution, the complainant is contacted to ensure that everything is sorted and resolved.
5. In the case that there are proposed actions and measures to solve the grievance, monitoring and follow up is required to ensure their implementation in the specified timeline
6. The grievance is considered closed if it was resolved withing the specified timeline. If the problem was not solved within the estimated time, it is raised to the secretary general. If the problem is still not solved after 2 days, it is raised in a direct email to the minister of water and irrigation

9.7 Grievance Mechanism to the Workers

To avoid workplace disputes and ensure maximum productivity, all workers on the project shall be treated fairly and shall have access to an effective system to voice in their problems and concerns. Therefore, a clear and transparent grievance mechanism shall be developed and made clear to all workers. This is the responsibility of the awarded Contractor; the prepared workers grievance mechanism will be reviewed by the Consultant. Some of the difficulties that may arise as part of their work on this project might include:

- Improper working conditions such as an unsafe working environment, poor relationships with managers, etc.,
- Inadequate management policies such as overtime, transfers, demotions, inappropriate salary structure, etc., and/or
- Violation of organizational rules and practices.
- Sexual harassment and gender-based violence.

Therefore, the grievance procedure should ensure any issues are dealt with equally, reasonably and in a timely manner.

Project grievance mechanisms for workers are not set-in-stone but should at least follow the main guiding principles, as explained below:

1. Quick action: As soon as the grievance arises, it should be identified and resolved. Training must be given to responsible staff to effectively and timely manage a grievance. This will lower the detrimental effects of grievance on the employees and their performance.
2. Acknowledging grievance: The managing staff must acknowledge the grievance put forward by the worker as manifestation of true and real feelings of the employees. Acknowledgement by the manager implies that the manager is eager to look into the complaint impartially and without any bias. This will create a conducive work environment with instances of grievance reduced.
3. Gathering facts: The managing staff should gather appropriate and sufficient facts explaining the grievance's nature. A record of such facts must be maintained so that these can be used in later stage of grievance redressal.
4. Examining the causes of grievance: The actual cause of grievance should be identified. Accordingly, remedial actions should be taken to prevent repetition of the grievance.
5. Decision Making: After identifying the causes of grievance, alternative course of actions should be thought of to manage the grievance. The effect of each course of action on the existing and future management policies and procedure should be analysed and accordingly decision should be taken by the managing staff.

6. Execution and review: The managing staff should execute the decision quickly, ignoring the fact, that it may or may not hurt the employees concerned. After implementing the decision, a follow-up must be there to ensure that the grievance has been resolved completely and adequately
7. Reporting of worker complaints.

In order to guarantee a quick and effective way of submitting grievances, a phone number should be provided to workers allowing them the provision of their cases during both construction and operation.

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Annex 1: MoEnv Categorization Letter

Annex 2: JS 2006 Class A Effluent Standards

Parameter	Unit	2021 Class A	2021 WAJ WWTP
BOD_5	mg/L	<30	<30
COD		<100	<100
DO		>2	-
TSS		<50	<30
pH		6 – 9	-
NO_3N	mg/L	<16	< 11.3
NH_4^+		-	< 1
Total – N		<70	< 30
FOG		<8	-
E.Coli	MPN per 100 mL	<100	<100
Nematodes	Eggs/L	$\leq$ 1	-
Turbidity	NTU	<10	-
P as PO_4	mg/L	<10	-

WWTP Effluent Quality Standards

JS 2021 Class A, for irrigation of Parks, Playgrounds and beside roads inside cities.
WAJ Decree 2021 WWTP Effluent Standards

Annex 3: ToR Approval Letter

Annex 4: DoA Letter

Annex 5: Scoping Report and Local Consultations

Annex 6: Coordinates along the Effluent Pipeline Route


Point 12
Point 11
Point 10
Point 9
Point 8
Point 7
Point 6
Point 5
Point 4
Point 3
Point 2
Point 1
Sum سوم

Point Number	Easting	Northing
1	766350.00	3608091.00
2	765134.00	3608639.00
3	764200.00	3609292.00
4	763195.00	3609597.00
5	762232.00	3609995.00
6	761119.00	3609720.00
7	759924.00	3610107.00
8	759141.00	3610328.00
9	758424.00	3610716.00
10	757665.00	3611029.00
11	756994.00	3611619.00
12	756490.00	3612327.00

Points above are taken directly from Google Earth and coordinates of points is in UTM 36S.

Annex 7: Curriculum Vitae of ESIA Team