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Al Ghabawi Septic Tank Facility Project

Environmental and Social Impact Assessment / Non-Technical Summary



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Table of Contents

1 Introduction	1
2 Project Rationale and Description	1
Project Rationale	1
Project Description	1
Wastewater to be Treated	2
Wastewater Treatment Process	2
Odour Control System at the WWTP.....	6
Effluent Wastewater Quality and Potential Reuse	6
Treated Sludge Disposal	6
Project Implementation and Workforce	7
Alternatives	7
(i) Wastewater treatment technology alternatives.....	7
(ii) Treated Effluent Reuse Options	8
(iii) Sludge Disposal and Reuse Options	8
(iv) "Project" versus "No Project"	9
3 Background.....	10
Project Ownership	10
Legal Aspects and Compliance.....	10
Existing Environmental and Social Conditions.....	13
Environmental Conditions.....	14
Social Conditions	16
Project Stakeholders.....	18
Public Consultation.....	19
4 Environmental and Social Impacts and Management Measures	21
What are the Project's expected Effects on Natural Environment?	21
Air Quality and Noise	21
Greenhouse Gas Emissions.....	21
Climate Change Risks	21
Soil	22
Biological Environment.....	22
Water Resources.....	22
Sludge Handling.....	23

What are the Management Measures for the Natural Environment during the Project's Construction and Operation?	23
What are the Project's expected Effects on Social Conditions?	25
Local Community Perceptions	25
Employment Opportunities	25
Potential Implications on Local Community Groups	26
Community Health and Safety	26
Affordability of Communities Potentially to-be-Served	26
Labour and Working Conditions	27
Occupational Health and Safety	27
Infrastructure Improvement	27
Transfer of Skills	27
Transportation	27
Archaeological and Cultural Heritage Impacts	28
What are the Management Measures for the Social Conditions during the Project's Construction and Operation?	28
What are the Project's Impacts due to Unplanned Events and Emergencies?	30
What are the Management Measures for the Unplanned Events and Emergencies during the Project's Construction and Operation?	31
Are there any Cumulative Impacts?	32
Are there any Residual Impacts?	33
5 Communications	33
What will be the process for Stakeholder Engagement?	33
What will be the process for addressing any arising issues/complaints (Grievances)?	33
Contact Details	33

List of Tables

Table 1. Summary of the proposed wastewater treatment process at Al Ghabawi	2
Table 2. Legislative Register relevant to the Project.....	10
Table 3. Management measures during Project implementation.....	23
Table 4. Management measures during Project implementation.....	28
Table 5. Management measures for unplanned emergency events	31

List of Figures

Figure 1. Location of Al Ghabawi Site and the facilities surrounding it	2
Figure 2. Illustration of Al Ghabawi Septage Treatment Plant Process Flow Diagram	4
Figure 3. Wastewater treatment process units' layout	5
Figure 4. Wadi for discharge of treated effluent.....	6
Figure 5. Illustration of the Project's buffer areas delineated to determine the study area	14
Figure 6. GAM Land Use Classification of East Amman Area	18

Abbreviations

AGTP	Ain Ghazal Treatment Plant
CLO	Community Liaison Officer
CSO	Civil Society Organisation
DoA	Department of Antiquities
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESP	Environmental and Social Policy
GAM	Greater Amman Municipality
GHG	greenhouse gases
H ₂ S	Hydrogen Sulphide
IBA	Important Bird Areas
JISM	Jordanian Institute for Standardization and Metrology
JS	Jordanian Standard
MEMR	Ministry of Energy and Mineral Resources
MoA	Ministry of Agriculture
MoEnv	Ministry of Environment
MoH	Ministry of Health
MoL	Ministry of Labour
MoT	Ministry of Transport
MSDS	Material Safety Data Sheet
MWI	Ministry of Water and Irrigation
NGO	Non-Governmental Organisation
NH ₃	Ammonia
NTS	Non-Technical Summary
O&M	Operation and Maintenance
OHS	Occupational Health and Safety
PIU	Project Implementation Unit
PM2.5	Particulate Matter
PMU	Performance/Project Monitoring Unit
PR	Performance Requirement
THMs	TriHaloMethanes
TN	Total Nitrogen
TSS	Total Suspended Solids
VOCs	Volatile Organic Carbons
WAJ	Water Authority of Jordan
WWTP	Waste Water Treatment Plant

1 INTRODUCTION

The Ministry of Water and Irrigation (MWI) and the Water Authority Jordan (WAJ) have approached the European Bank for Reconstruction and Development (EBRD) to support the preparation and financing of the construction of a new septic tank facility to replace and relocate the existing facility at Ain Ghazal Treatment Plant (AGTP). The proposed new septic tank facility will be located at Al Ghabawi and will serve Amman and the surrounding area.

As such, the EBRD has engaged the services of the Ankura Consulting Europe Limited (Ankura) and Engicon to prepare a feasibility study that the Bank can use to appraise the Project and take a decision on the prospective financing including the preparation of a comprehensive Environmental and Social Impact Assessment (ESIA) study for the Project.

This report represents a Non-Technical Summary (NTS) for the Environmental and Social Impact Assessment (ESIA) study carried for the Project in line with EBRD's Environmental and Social Policy (ESP) and Performance Requirements (PRs) as well as Jordan's local regulations including Environmental Impact Assessment Regulation No. 37 for year 2005.

2 PROJECT RATIONALE AND DESCRIPTION

Project Rationale

The Tanker Discharge Facility at AGTP has been causing odour, local noise pollution and increased traffic problems especially for the surrounding communities. This necessitated the need to find an appropriate solution to resolve its issues; and be able to cater for growing demand, especially with an influx of Syrian refugees to Jordan and the impact of climate change on scarce water resources applying additional demand on municipal infrastructure. In addition, high biological loading coming from septage has been affecting the design capacity of As-Samra WWTP creating problems for its operator. Accordingly, GoJ engaged Engicon in 2009 and Fichtner in 2017 to investigate different alternatives to solve these issues. Both Engicon and Fichtner studies recommended the relocation of the Tanker Discharge Facility at AGTP. This Project involves the closure and decommissioning of the Tanker Discharge Facility at Ain Ghazal and the development of a new septic tank receiving facility and wastewater treatment to be located at Al Ghabawi to serve Amman and the surrounding area.

Project Description

This project involves the development of a completely new septage receiving facility and wastewater treatment plant (WWTP) on the land plot No. 63, basin No.1 at Al Ghabawi/ Al Madouneh Area. This project area is 300 dunums and is located approximately 20 km to the east of Amman in Al Ghabawi area next to AlGhabawi solid waste landfill site. The Project's location between Amman and Zarqa governorates and the proximity to most districts facilitates the movement of septage tankers from most localities. Moreover, the roads leading to the plant are considered to be easily accessible for tankers. There are no residential areas within at least 5 km radius of the proposed site. The topography of the site is featured by gentle to moderate ground slopes with a small storm-water drainage line running from the north-west to the south-east corner of the site. The surrounding facilities within a close proximity to the proposed Project site include Al Ghabawi solid waste landfill

site, Amman Strategic Reserve Terminal for Petroleum Products, a cow farm, Amman Asia Electric Power. The Project location is presented in Figure 1.

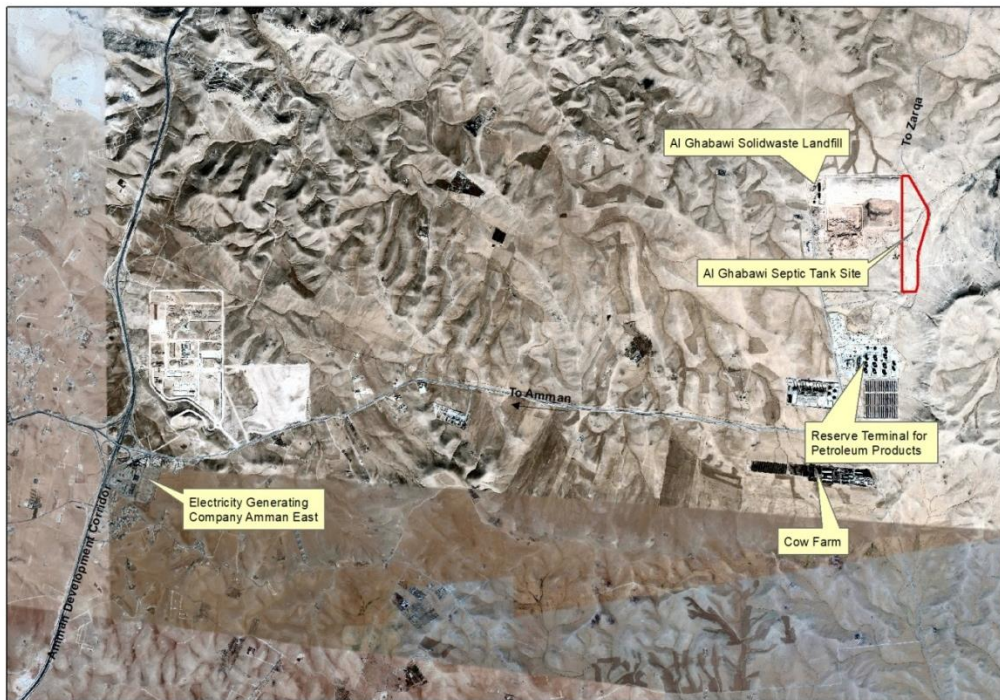


Figure 1. Location of Al Ghabawi Site and the facilities surrounding it

Wastewater to be Treated

The influent wastewater into the WWTP will be from tankers transferring septage from the unsewered areas of Amman and Zarqa Governorates, in addition to liquid sludge transported from the treatment plants of Salt, Fuheis, and Baqa'a. The WWTP will be designed to treat a future inflow of approximately 22,500 m³/day, serving the catchment area up to the year 2045.

Wastewater Treatment Process

The proposed wastewater treatment process for Al Ghabawi WWTP is a Conventional Activated Sludge process followed by sludge treatment using aerobic digestion. This treatment process is summarized in Table 1 and the process and layout are illustrated in Figure 2 and Figure 3, respectively.

Table 1. Summary of the proposed wastewater treatment process at Al Ghabawi

Treatment Level	Objective	Processes
Preliminary Treatment	-To protect equipment at the plant and improve wastewater treatability	-Sand and rock traps to protect equipment and ensure a continuous flow to downstream treatment units. -Screening. -Aerated grit and fats, oil, and grease (FOG) removal to prevent accumulation in treatment units downstream.

Treatment Level	Objective	Processes
		<ul style="list-style-type: none"> –Odour Control Units involving installation of biological filters and collecting the gases from the head works, the sludge digesters/thickeners and the dewatering building.
Primary Treatment	<ul style="list-style-type: none"> –To remove the majority of suspended solids in the wastewater 	<ul style="list-style-type: none"> –Online equalization tank to absorb fluctuations in the incoming wastewater loads and flows and allows the downstream treatment units to operate under the preferable steady conditions. –Primary settling tanks to achieve ~60% removal of suspended solids and 30% removal of BOD via settling.
Secondary Treatment	<ul style="list-style-type: none"> –A biological treatment system that oxidizes both suspended and soluble organic materials providing greatest improvement in the effluent quality. 	<ul style="list-style-type: none"> –Conventional activated sludge process consisting of an aeration tank that achieves organic material oxidation as well as ammonia nitrification, an anoxic tank that achieves denitrification for nitrogen removal, and a secondary settling tank to separate the treated effluent from the activated sludge.
Tertiary Treatment	<ul style="list-style-type: none"> –processes after secondary treatment to provide high quality effluent. 	<ul style="list-style-type: none"> –Slow Sand Filters as rectangular sand beds for removal of suspended solids, turbidity as well as viruses and bacteria removal. –Chlorination to reduce pathogen by use of the bactericide hypochlorite. To achieve disinfection, a contact time of 30 minutes must be provided at a residual chlorine concentration of 0.5 mg/l. this chlorine disinfection will provide at least 10 mg/L dose and will have a standby chlorinator. The system will have chlorine gas cylinders for 1-month use. –Effluent Reuse Tank with an effluent storage capacity of one-day.
Sludge Treatment	<ul style="list-style-type: none"> –To become well stabilized so as to prevent odour emission and to reduce pathogens and volume 	<ul style="list-style-type: none"> –Gravity thickened aerobic digester to provide both, aerobic sludge digestion of the primary and secondary sludge as well as gravity thickening. –Sludge Dewatering using centrifuges to reduce the sludge volume and increase its dryness to ~22% dry matter content. –Greenhouse Sludge Drying Beds will be utilised to dry the dewatered sludge up to 50% dry matter content. –Onsite stockpiling where dried sludge will be collected and stored in the stockpiling area with a capacity to stockpile up to 7 years.

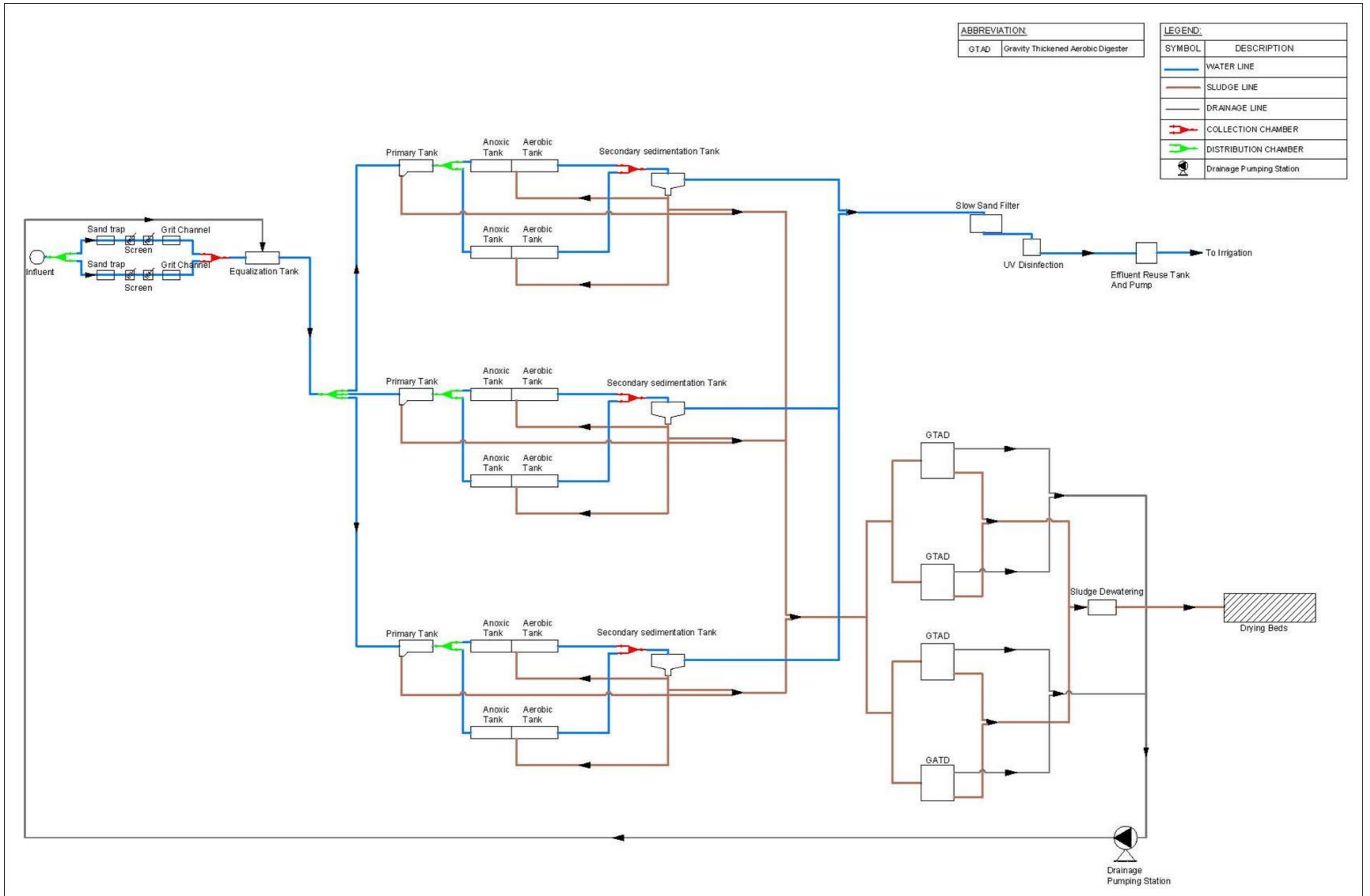
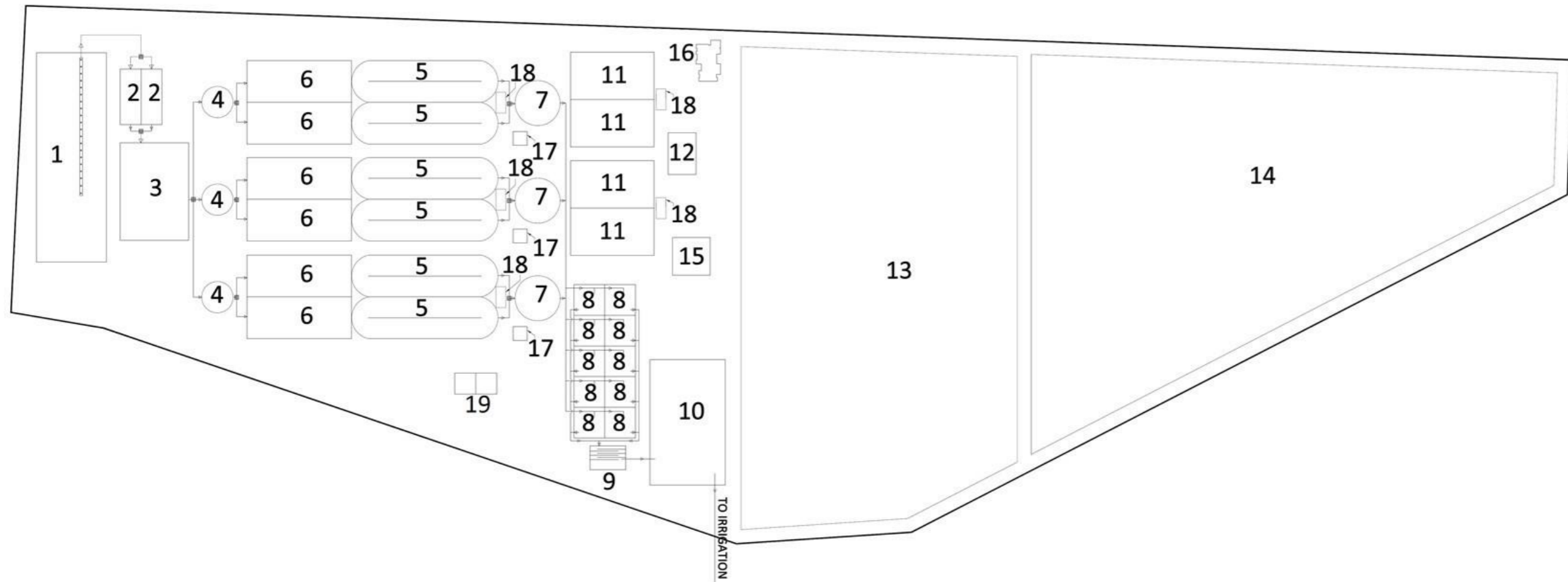


Figure 2. Illustration of Al Ghabawi Septage Treatment Plant Process Flow Diagram



NO	Unit Description	NO	Unit Description	NO	Unit Description	NO	Unit Description
1	Tanker discharge area	5	Aeration tank - Aerobic	10	Effluent reuse tank	15	Drainage pumping station
2	Headworks	6	Aeration tank - Anoxic	11	Aerobic digester (GTAD)	16	Admin building
3	Equalization tank	7	Secondary settling tank	12	Sludge dewatering building	17	RAS/WAS Building
4	Primary settling tank	8	Slow Sand filter	13	Drying beds	18	Blower Room (If aeration is by air diffusion)
		9	Chlorination System	14	Stockpiling area	19	Standby Generator And Electrical Room

AL-GHABAWI SEPTAGE TREATMENT PLANT
PROCESS UNITS LAYOUT

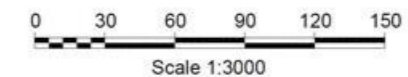


Figure 3. Wastewater treatment process units' layout

Odour Control System at the WWTP

The WWTP will have an odour control system to achieve air suction and treatment from the headworks building, sludge dewatering building, sludge handling facilities, sludge tanks, and any additional structures that might emit offensive smells and harmful gases. This odour control system will be sized to achieve a minimum air change of 6 air changes per hour and is to be a biological one.

Effluent Wastewater Quality and Potential Reuse

In line with Jordan's water strategy all wastewater needs to be treated and used as a replacement of fresh water and utilized by the agricultural sector. The effluent wastewater will be treated to comply with JS 893/2006 on the reuse of treated wastewater and the EU Directive (91/271/EEC) on urban wastewater treatment – a requirement of the EBRD. The project is in line with WHO guidelines on wastewater use in the agriculture.

At this stage of the Project development, the treated effluent reuse option is discharge into the nearby wadi. This wadi discharge stream is part of Al-Zarqa River basin which flows into King Talal Dam. Water from this dam is used for irrigation purposes and also receives treated wastewater from other WWTPs, including As-Samra WWTP. The option for reuse locally for irrigation will be agreed at a later stage. These options may require some infrastructure, such as a pipeline and pump station to direct treated wastewater to irrigation areas.



Figure 4. Wadi for discharge of treated effluent

Treated Sludge Disposal

The WWTP is expected to generate 285 m³/day of dried sludge with a Moisture Content >50% and Dry Matter of 62-tonnes per day. Based on the analysis of the various management alternatives, stockpiling on site was the recommended temporary (short-term) solution until a sludge management national strategy is created. The onsite stockpiling will involve mechanical dewatering to reduce the sludge volume and increase its dryness to around 22% dry matter content. This will be followed by greenhouse drying technology to further dry the dewatered sludge up to 50% dry matter content. This will allow WAJ to stockpile onsite with a capacity of 5-7 years while also maintaining flexibility to move to a long-term solution once a national strategy is in place.

The reuse of treated sludge for land application as soil conditioner is not currently practiced due to social considerations. Therefore, this reuse option is considered as long-term reuse option which requires further investigation in terms of its technical viability, financial feasibility, and social acceptance.

Project Implementation and Workforce

The Project construction phase is expected to last for around 24 months. Moreover, a one-year operation and maintenance (O&M) support period will be added to the contractor's scope of work in order to ensure a suitable capacity building and proper O&M of the WWTP. The workforce during the construction phase will have a peak of 300 persons (for a 4-month peak period) and will involve the use of around 25 heavy construction equipment and 25 light vehicles.

The Project lifetime is 50 years and during operation phase, the WWTP will operate for 24-hours with 12 hours for tankers discharge. The anticipated workforce required during the WWTP operation phase are around 30 employees.

Alternatives

The analysis of certain alternatives to the Project development were carried in relation to: (i) the selected wastewater treatment technology, (ii) treated effluent reuse options, (iii) the sludge disposal and management, and (iv) the "No Project" alternative which assumes that the Project development does not take place.

(i) Wastewater treatment technology alternatives

Three treatment alternatives were evaluated for a range of flows between 16,000 m³/day and 22,500 m³/day:

- Alternative 1: Conventional Activated Sludge Process (CAS);
- Alternative 2: Aerated lagoons system followed by constructed wetland or slow sand filters; and
- Alternative 3: Mixed Bed Bio-reactor Process.

The Advanced Integrated Aerated Lagoons was not selected because it requires a larger land area than that available for the project. CAS and MBBR; both utilising Slow Sand Filter for the Tertiary Treatment and Mechanical Dewatering with Emergency Drying Beds for the Sludge Treatment. The MBBR was less optimal than CAS as MBBR is costly, its media require special care, and MBBR requires more energy for mixing and aeration than CAS. The optimum recommended solution was the CAS with Slow Sand Filters for the Tertiary Treatment and Mechanical Dewatering with Emergency Drying Beds for the Sludge Treatment. This option was recommended since:

- It has the lowest capital and operation cost;
- It has the highest process reliability and flexibility;
- It includes unit processes that meet the required treatment criteria; and
- It includes low technical equipment that can be easily operated and maintained.

(ii) Treated Effluent Reuse Options

The treated wastewater effluent from Al Ghabawi WWTP will meet the JS 893/2006 for Class A Irrigation and the EU Council Directive 91/271/EEC of 21 May 1991 concerning urban wastewater treatment. Accordingly, the treated effluent will be suitable for discharge into wadis and for reuse in irrigation. Though the effluent will meet the standard for class A irrigation, its reuse will be restricted to fodder crops due to the potential for the formation of trihalomethanes (THMs) in treated wastewater under certain conditions as a result of the chlorination used for final disinfection. Based on this, the following three options were identified for the treated effluent reuse:

- Discharge to nearby wadi which eventually leads to Zarqa River or infiltration into groundwater resources;
- Provide the treated effluent to water users from the local community for restricted irrigation purposes; and
- Provide the treated effluent to GAM for irrigation of the green belt areas and agricultural investment areas designated in East Amman land use master plan. For this purpose, a pipeline can be installed along the road corridor to the agricultural area and another pipeline can be installed adjacent to Al Ghabawi landfill sidewall.

The environmental and social evaluation of these options shows that:

- No environmental or social impacts have been identified with the release of the treated effluent into the nearby wadis.
- Providing the treated effluent to the local community will result in positive impacts on socio-economic conditions and land value. Based on the household survey conducted as part of this Project, 48% of the respondents indicated that they would use the treated effluent if provided to them, 46% said they would not, and 7% were not sure. However, the treated wastewater should be used for restricted irrigation (mainly fodder crops) in order to avoid health implications associated with THMs that may be present under certain conditions in the treated effluent due to disinfection by chlorination. Raising awareness on the safe use of treated effluent in case the Septic Tank Facility were to provide it to the local community is important.
- Providing the treated effluent to GAM for irrigation of the green belt areas and agricultural investment areas will enhance land value in the agricultural investment area. It will also enhance general aesthetics due to availability of irrigation water to cultivate those areas. At the agricultural investment area, the treated effluent should be designated for restricted irrigation

At this stage of the Project, and based on the above discussion, it was agreed that the default management option for the treated effluent will be the discharge to wadi. The options for reuse of the treated wastewater will be investigated in more detail at a later stage in discussion with various stakeholders.

(iii) Sludge Disposal and Reuse Options

Viable disposal options for the treated sludge include:

- Stockpile on site or off site
- Construct new landfill

- Incinerate on site or off site

Given the constraints around GAM landfill, land allocation as well as budget, stockpiling on site is a recommended temporary solution until a sludge management national strategy is created. This will involve mechanical dewatering to reduce the sludge volume and increase its dryness to around 22% dry matter content. This will be followed by greenhouse drying technology to further dry the dewatered sludge up to 50% dry matter content. This will allow WAJ to stockpile onsite with a capacity of 5-7 years while also maintaining flexibility to move to a long-term solution once a national strategy is in place.

With respect to treated sludge reuse, the options include:

- Reuse of treated sludge as agricultural Fertilizer
- Sludge reuse as incineration/clinker fuel

Since the dried sludge from the WWTP is expected to meet Class #2 in terms of the moisture content (> 40%), the dried sludge theoretically speaking, treated sludge can be reused as soil conditioner in rangelands within the project area taking into consideration the conditions and limitations of the Jordanian Standard JS 1145/2016 and availability of land. However, the reuse of treated sludge in land application, including the use as soil conditioner, is not currently practiced due to social considerations. Therefore, this reuse option is considered as long-term reuse option, which requires further investigation in terms of its technical viability, financial feasibility, and social acceptance.

(iv) "Project" versus "No Project"

The analysis of alternatives considered two options: "Project" versus "No Project" alternative. The "No Project" alternative was evaluated for two locations: the proposed Project site and the Ain Ghazal Septage Receiving Facility.

At Ain Ghazal Septage Receiving Facility, the "No Project" means the continued operation of the facility and consequently the continuation of odour, local noise pollution and increased traffic problems especially for the surrounding communities. At the proposed Project site, the "No Project" alternative implies that the environmental and social aspects will not vary from prevailing conditions. However, not going ahead with the Project is also associated with the loss of opportunity of having treated wastewater that may be reused for irrigation purposes within the green belt areas and agricultural investment areas indicated by East Amman land use master plan.

With respect to the "Project" alternative, the construction phase of the proposed project will include disruptions to air quality, noise levels, health and safety within the proposed Project site. However, these impacts are manageable, temporary and limited to the construction phase of the project. During operation phase, the social concern associated with air quality and odour nuisance is also considered to be manageable especially that the closest community is at around 7.5 km away from the Project site. On the contrary, there are some socio-economic benefits in terms of potential for job opportunities, availability of treated wastewater for irrigation, and that the WWTP operator will implement initiatives related to maintaining social responsibility with the local community based on WAJ Social Responsibility Strategy and give back some positive social impact to the local communities

nearby. This will be later determined between WAJ and the operator. In addition, the operation of the Project will eliminate the odour, social and traffic nuisance at the Ain Ghazal location.

3 BACKGROUND

Project Ownership

The Water Authority of Jordan, operating under the MWI, is responsible for the operational management of water resources and the organization of water supply and wastewater treatment. The Ghabawi WWTP's operational activities as well as physical facilities will be owned by the Government of Jordan through MWI. It is expected that the project components will be operated by WAJ, either directly or through an agreement with a third party, including private sector contractors, or any other form that WAJ deems suitable.

Legal Aspects and Compliance

The national legislative register applicable during both the construction and operational phases of the wastewater treatment plant at Ghabawi is presented in Table 2.

Table 2. Legislative Register relevant to the Project

Legislation	Responsible Authority
Cross-Sectoral Legislation	
Law of Organization of Cities, Villages and Buildings No. 79 of 1966	Ministry of Municipal and Rural Affairs
Environmental Protection Law No. 6 of 2017	Ministry of Environment
Environmental Impact Assessment Regulation No. 37 of 2005	Ministry of Environment
Agriculture Law No. 13 of 2015	Ministry of Agriculture
Public Health Law No. 47 of 2008	Ministry of Health
Management and Administration of Government Properties Law No. 17 of 1974	Ministry of Finance
Land Acquisition Law (LAL) No. 12 of 1987	Cabinet/Ministry of Finance
Water Resources Legislation	
Sanitary Wastewater System Code, and the Water Supply Code of 1988	Ministry of Public Works and Housing
Water Authority Law No. 18 of 1988	Water Authority of Jordan
Drinking Water Instructions of 1981	Water Authority of Jordan
Wastewater Management Legislation	
Solid Waste Management Regulation No. 27 of 2005	Ministry of Environment
Sanitary Wastewater System Code, and the Water Supply Code of 1988	Ministry of Public Works and Housing
Jordanian Standards for Industrial Wastewater - JS 202/1991	Water Authority
Jordanian Standard for Reclaimed Domestic Wastewater - JS 893/2006	Water Authority

Legislation	Responsible Authority
Jordanian Standard for Reclaimed Industrial Wastewater - JS 202/2007	Water Authority
The Regulations of the Sewage System No. 66 of 1994	Water Authority
Prevention of Repulsive Waste and Fees for Solid Waste Collection within Municipality's Boundaries No. 1.	Municipalities
Jordanian Standard on General Precautionary Requirements for Storage of Hazardous Materials – JS 432/1985	Ministry of Health
Air Quality, Noise, Soil Protection, Traffic Legislation	
Soil Protection Regulation No. 25 of 2005	Ministry of Environment
Environmental Law No 6 of 2017	Ministry of Environment
Traffic Law No. 49 of 2008	General Security Department
Regulation for the Protection of Air No. 28 of 2005	Ministry of Environment
Ambient Air Quality Standards (JS 1140/2006)	Jordanian Institute for Standardization and Metrology (JISM)
Maximum Allowable Limits of Air Pollutants Emitted from Stationary (JS 1189/2006)	Jordanian Institute for Standardization and Metrology (JISM)
Instruction for Reduction and Prevention of Noise for 2003	Ministry of Environment
Water – Sludge – Uses of Treated Sludge and Sludge Disposal (JS 1145:2006)	Jordanian Institute for Standardization and Metrology (JISM)
Solid Waste Handling	
Regulation on the Management of Solid Waste No. 27 of 2005	Ministry of Environment
Management, Transportation and Handling of Harmful and Hazardous Substances Regulation No. 24 of 2005	Ministry of Environment
Instructions on Solid Waste Management of 2019	Ministry of Environment
Instructions on Hazardous Waste Management and Handling for 2019	Ministry of Environment
Nature Conservation Legislation	
Civil Defense Order No. 1: The Protection of Forestry in Jordan of 1993	Civil Defense Department
Protection of Birds and Wildlife Bylaw No. 113 of 1973	RSCN
Natural Reserves and National Parks Bylaw of 2005	Ministry of Environment
Environmental Law No. 6 of 2017	Ministry of Environment
Regulation of Management of Environmental Protection No. 37 of 2018	Ministry of Environment
Cultural and Archaeological Heritage Legislation	
Law of Antiquities No. 20 of 2004	Ministry of Tourism and Antiquities
Quarries Bylaw No. 8 of 1971	Natural Resources Authority
Labour Conditions, Health and Safety	
Regulation of Forming Committees and Supervisors of Occupational Safety and Health No. 7 of 1998	Ministry of Labour

Legislation	Responsible Authority
Labour Law No. 8 of 1996 and its amendments	Ministry of Labour
Labour Law Amendment No. 26 of 2010 related to rights and protection of non-Jordanian workers	Ministry of Labour
Social Security Law No. 1 of 2014.	Social Security Corporation/Ministry of Labour
Social Security Corporation (SSC) Law - Work Injuries Instructions	Social Security Corporation/Ministry of Labour
Civil Service Regulation No. 82 of 2013	Civil Service Bureau
GAM Human Resources Regulation No. 71 of 2012	Greater Amman Municipality
Regulation No. 42 of 1998 on Preventive Medical Care and Treatment for Institutional Workers	Ministry of Labour
Regulation No. 43 of 1988 on Protection and Safety from Industrial Machinery and Equipment on Worksites	Ministry of Labour
Instruction for Initial Medical Examination of Workers in Institutions of 1999	Ministry of labour
Instruction for the Protection of Workers against the Risks of the Work Environment No. 8 of 1996	Ministry of labour
Jordanian Standard on Heat Levels in the Work Environment - JS 525/1987	Jordanian Institute for Standardization and Metrology (JISM)
Jordanian Standard on Lighting Levels in the Work Environment - JS 524/1987	Jordanian Institute for Standardization and Metrology (JISM)

In addition to national legislation and international agreements ratified by Jordan, EBRD's ESP and Performance Requirements (PRs) and relevant EU Directives that are referred to within EBRD's ESP are considered applicable to this Project. These EU Directives include the following:

- Directive 85/337/EEC - Directive on EIA (Environmental Impact Assessment)
- Directives related to Labour and Working Conditions
 - Directive 2006/54/EC – Equal opportunities
 - Directive 2002/14/EC – Informing and consulting employees
 - Directive 2000/78/EC – Equal treatment
 - Directive 89/391/EEC – OHS- Framework & Directive
 - Directive 2009/104/EC – Use of work equipment
 - Directive 92/58/EEC – Safety and/or health signs
 - Directive 89/656/EEC – Use of personal protective equipment
 - Directive 89/654/EEC – Workplace requirements
 - Directive 2009/161/EU – Occupational exposure limit values
 - Directive 2012/18/EU – Major-accident hazards
 - Directive 90/269/EC – Manual handling of loads
- Directive 96/62/EC - Air quality framework directive, which describes the basic principles for assessing and managing air quality in Member States.

- Directive 2002/49/EC - Assessment and Management of Environmental Noise, which relates to the assessment and management of environmental noise.
- Directive 2008/98/EC - Waste Framework, which sets the general framework of waste management requirements and the basic waste management definitions for the EU.
- EU Council Directive 91/271/EEC - Directive on Urban Wastewater Treatment, which requires that urban wastewater be treated to minimum levels before its discharge into surface waters.
- Directives relating to Public Participation which are the Directive 2003/04/EC (Access to Environmental Information) and Directive 2003/35/EC (Providing for Public Participation).
- Council Directive 86/278/EEC of 12 June 1986 on the Protection of the Environment, and in particular of the Soil, when Sewage Sludge is used in Agriculture.
- Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the Conservation of Wild Birds.
- Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora.

Based on EBRD Environmental and Social Policy (ESP), the proposed WWTP at Al Ghabawi will serve a population significantly above the 150,000 PE threshold defined by EBRD's E&S Policy of 2014 and the EU EIA Directive for Category A/Annex1 projects. Accordingly, the Project was categorised as "A" and thus required a full ESIA.

With respect to national environmental requirements, specifically the Jordanian EIA Regulation (No. 37 of Year 2005) and the filed an environmental permit application with MoEnv, the Project has been classified to require a full EIA study which corresponds to EBRD's category A classification.

Existing Environmental and Social Conditions

The study area for this ESIA is the area affected by the Project implementation and which is beyond the Project's footprint. The following boundaries were used to delineate the study area (illustrated in Figure 2) for the purpose of evaluating the Project's impacts:

- **For physical, biological, archaeological and cultural heritage receptors**, a buffer of 1.5 km around the Project site was adopted as the area within which impacts are assessed. This area is considered to cover the extent of impacts to be caused by the construction and operation of the Project on the parameters of physical and biological environments as well on cultural/archaeological resources.
- **For the socio-economic receptors (i.e., local community, economic activities, land use, etc.)**, an area with a radius of 10 km around the Project boundary was adopted as the area of study. Usually, the direct impact from the construction and operation of the WWTP is not expected to influence local communities available within 10 km or further distance. However, this ESIA study extended the description of baseline conditions and impacts to communities available within 7.5 to 13 km from the Project site boundary since no local communities are available at less than 7.5 km from the site.
- **For transportation and wastewater reuse**, a study area was not delineated. For transportation, tankers will be coming from within Amman and Zarqa governorates to the Project site. For treated wastewater, the reuse may extend to areas that are cultivated by

members of local communities identified to be available at distances of greater than 12 km from the Project boundary. The same applies to discharge to the wadi.

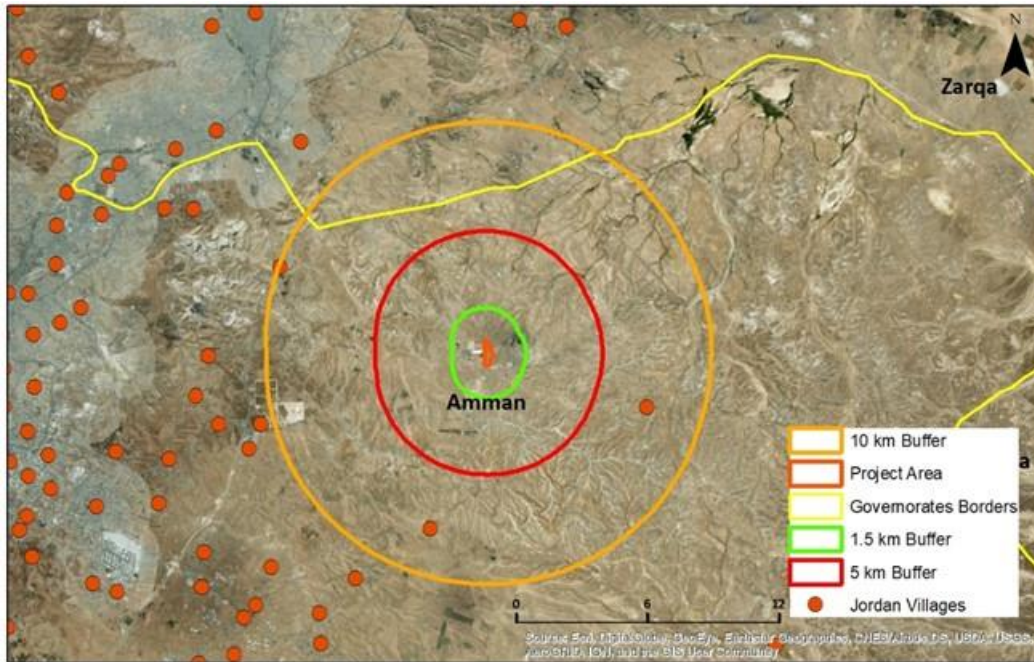


Figure 5. Illustration of the Project's buffer areas delineated to determine the study area

Environmental Conditions

The existing environmental baseline conditions for the selected area of influence for the Project were found to be as follows:

- Climate:** The project area belongs to the Arid Mediterranean cool climatic zone dry. The average minimum temperature is 3.5°C recorded during January and maximum temperature was 34.3°C during August. Annual average precipitation is around 84 mm and the majority of the rain (more than 80% of the total average precipitation) occurs during the period from December to March. Westerly winds prevail within the Project area.
- Air Quality:** Air quality measurements for H₂S, NH₃, VOCs, and PM_{2.5} were carried within the Project site over 7 days extending from 1st to 8th of December 2019. The results showed that all parameters are below permissible levels with the exception of H₂S which showed exceedance of allowable limits over the 7 days of measurement. This elevated level of H₂S is attributed to operations at the neighbouring Al Ghabawi solid waste landfill.
- Noise Levels:** Noise level measurements carried at the Project site over 7 days extending from 1st to 8th of December 2019 did not reveal any exceedance of noise levels indicated by the Jordanian Guidelines for Prevention of Noise (2003) for residential areas.
- Topography, Geology and Geomorphology:** The Project site is semi-flat with a gentle slope towards the north-east with elevations ranging between 775 to 795 m above mean sea level. The surface is a soft, thick bedded chalky marl and chalky limestone, which acts as an

impermeable barrier to water flow. The site lies in a chalk marl unit called Muwaqqar formation consisting of soft, thick-bedded chalky marl, marl and chalky limestone with bedded nodules of microcrystalline limestone and chert.

- **Surface Water:** the site does not contain and is not close to any surface water resource. In terms of surface water runoff, the catchment area contributing storm water runoff towards Al Ghabawi WWTP site is limited to the project site itself, as there are no external catchment conveying runoff towards the site. The computed runoff from Al Ghabawi WWTP for various storm return periods showed that the peak flow rates are relatively small and can be discharged without flooding the receiving adjacent water courses.
- **Groundwater:** The project site is considered to be located within the Zarqa groundwater basin. However, there is no shallow groundwater present in the project area rendering the chances for groundwater pollutions as very low. This is confirmed by the Ground water Vulnerability Map of Jordan issued as per the Amended Guideline of the Water Resources Protection for the year of 2019 (Official Gazette No. 5224) which indicates that the Project area is located within a very low vulnerability zone.
- **Landscape and Aesthetics:** The area and its surroundings are characterized as barren land with no vegetative cover. Due to its proximity to the existing solid waste landfill site and the prevalent wind direction in the area, trash bags can be found scattered within the site and mostly to the southern side.
- **Climate Change:** For Jordan, climate change studies anticipate an increased incidence of droughts and an increasingly warmer, drier future. These climate change impacts have critical implications on the quantity and quality of Jordan's freshwater resources in general. With respect to the Project, the potential climate change impacts on Al Ghabawi WWTP process due to rising temperature were found to be mostly negligible. The only major concern is the likelihood of future intensification of energy price shocks on international energy markets will have implications on the operating cost of the WWTP.
- **Biodiversity:**
 - The proposed project site is located in Irano-Turanian biogeographic zone. Dwarf shrubs are characteristic of this zone. The proposed project area ecosystem is represented by the Scrap and Highland Ecosystem. This ecosystem consists of escarpments and mountains, hills and undulating plateaus.
 - Flora of the Project area is characterized by the vegetation type Steppe Vegetation. The soil in the region is poor with low annual rainfall resulting in poor vegetative cover. The vegetation is mostly composed of fleshy and drought tolerant plants that can resist the conditions of hot and dry climate. Vegetation is restricted to the places close to the wadi system where enough soil moisture exists. The Project site is very degraded and only two species of natural plant (*Anabasis syriaca* and *Malva spp*) are found at site of this project and they are considered common vegetation of no conservation importance.
 - No herpetofaunal, mammal, or significant bird species were recorded within the site. Absence of herpetofaunal species can be explained by the degraded vegetation cover and the cold weather during the site survey carried during the month of November which limits herpetofaunal activities. Despite the timing of the site survey, the degraded nature of the site and its proximity to an existing landfill operation does not present an ideal habitat for fauna species.

- The site is not located within or close to sensitive habitats (i.e., protected areas, Important Bird Areas, and rangeland reserves).
- No priority biodiversity features or critical habitat, as per EBRD PR6, has been identified on site or in the immediate surrounding area.

Social Conditions

With respect to social conditions, there are no residential areas or communities within the direct vicinity of the project location nor within the 5 km radius of the Project site. The closest community is located at a distance of around 8 km from the Project boundary Qafour village. At 11 to 13 km from the Project site, there are the villages of Al Madouneh, Al Manakher, Mghayer Muhanna, Khashafieh South, Khashafieh North and Al Baidah. These seven population clusters fall mostly within Uhod area under Sahab district, except for Mghayer Muhanna village which falls under Muwaqqar district. According to the Department of Statistics (DoS) projections for 2018, these communities are inhabited by 30,662 individuals.

The illiteracy rate is 16% in the targeted communities, higher than the illiteracy rate on the national level (11%). However, according to DoS (2015c), it is aligned with the illiteracy rate in rural areas (16%). Illiteracy is exceptionally high in Qa'four (42%), Al Madouneh (42%) and Khashafieh South (33%). The community with the most educated population beyond primary schooling is Mghayer Muhanna with 58% educated beyond primary school. On the other hand, the community with the lowest educational level is Qa'four with only 9% educated beyond primary schooling.

Based on the household survey conducted for this Project, 9 in 10 families reported relying on one source of income and 1 in 10 families (9%) reported income generated from two different sources. There is a high reliance on salaries from employment or pensions (39% and 27% of families, respectively). Unemployment among men was reported at 18%, closely aligned with the 16.8% reported by DoS in 2019. The unemployment rate among women was reported at 39.1%, almost 67% higher than women's unemployment rate on the national level which is 24.2%.

The local community has high reliance on the public sector (including law enforcement and the Armed Forces) for employment. 37% of surveyed individuals were employed in the public sector and the armed forces, similar to the ratio of 40% reported on the national level.

The monthly household income reported by the household survey sample was JOD415.12 on average, with a standard deviation of JOD233. 69% of respondents said their household income is usually or always insufficient in meeting the household needs.

Breeding livestock is considered by the local community as part of the local lifestyle and culture, a secondary occupation by a member of the household. However, cultivating crops for sustenance and income by members of households beyond a home garden was reported by only 3% of the sample.

Based on the household survey conducted in the target communities, 38% and 31% of the surveyed families reported frequent headaches and allergies, respectively, for at least one family member. Respiratory diseases were reported by 20% of households and gastrointestinal diseases by 14% of households. Moreover, environmental nuisances were reported by a proportion of the households

where noise and smoke were reported by 45% of the households, bad odors by 75%, and high levels of dust by 86%.

The project area is considered to be barren land that is unsuitable for agriculture. GAM classifies the Project location under the “strategic services” area as shown in Figure 6. This area is suitable for industrial and infrastructural facilities as it is relatively far away from residential areas. The project site is located directly to the east of Al Ghabawi solid waste land fill site operated by Greater Amman Municipality (GAM). The surrounding facilities found to be within a close proximity to the proposed Project site include:

- Al Ghabawi solid waste landfill site located directly next to the project site.
- Amman Strategic Reserve Terminal for Petroleum Products that belongs to the Ministry of Energy and Minerals, is located 1.5 Km to the south of the site.
- There is a cow farm around 3 km south from the Project site.
- Amman Asia Electric Power, which is around 12 km south-west of the Project site.

According to the household survey, half of the local communities seem to be aware of the designation of Al Ghabawi as a Strategic Services Zone and expected further developments to take place in the area.

Existing power lines (medium voltage) are also available on the main road. In addition, the project site already has communication/mobile network coverage.

The Project site can be reached by existing access roads from Zarqa and Amman (12 Km from Amman Development Corridor Road). The road leading directly to the project site is accessible through the main road that also leads to the adjacent Al Ghabawi landfill. However, necessary improvements to road infrastructure will take place during the construction phase to accommodate the project activities and needs. With respect to background traffic, no data is available except for that from Al Ghabawi landfill site, showing that the landfill receives around 200 daily outgoing loads from 80 operating transfer trailers of different sizes.

With respect to archaeology and cultural heritage, no potential archaeological sites were found in close proximity or within the 1.5 km buffer zone for the Project area.

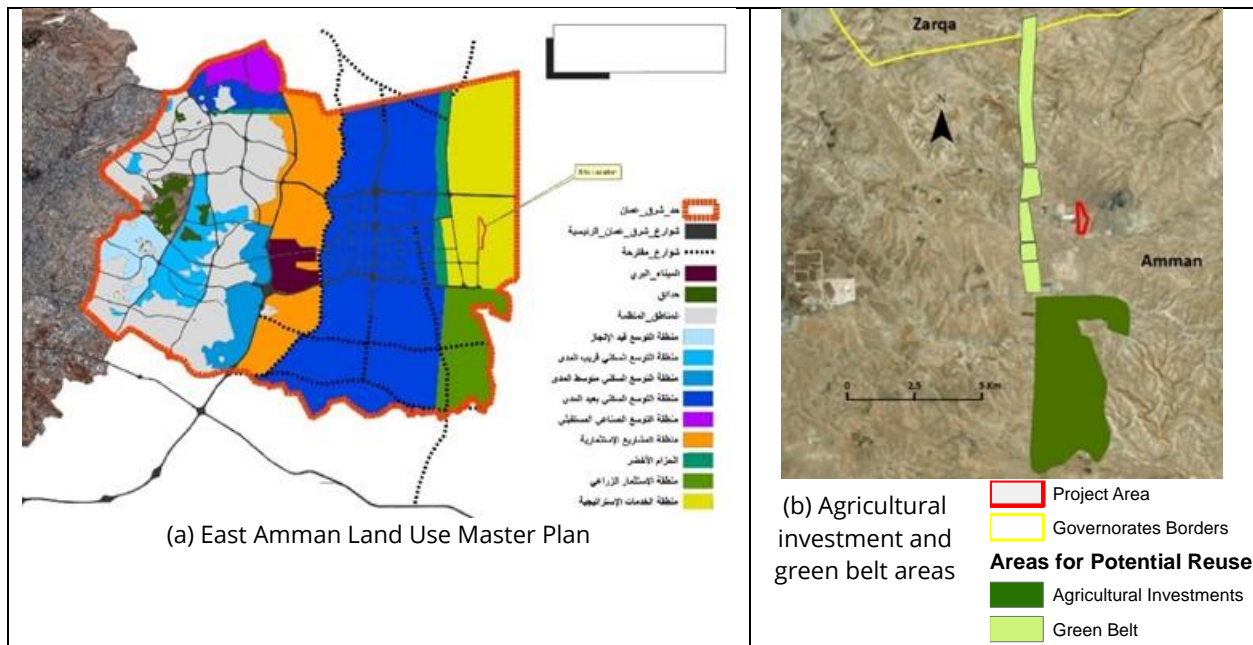


Figure 6. GAM Land Use Classification of East Amman Area

Project Stakeholders

The Project’s stakeholder groups, were identified to include the following:

Internal Stakeholders

- Project Owner: Ministry of Water and Irrigation (MWI) / Water Authority of Jordan (WAJ).
- Direct Workers/ employees: This includes WAJ male and female employees involved in this project. This includes temporary and part-time workers.
- Contractors/ Sub-contractor workers: Contracted Workers and those employed by third parties such as the Contractor and/or sub-contractor. This includes temporary and part-time workers.
- Operator’s O&M Team: Personnel responsible for the operation and maintenance of the septic tank facility during the operation phase of the project.
- Tanker operators/ owners: Tanker operators will be responsible to collect and transfer the septage from the unsewered areas of Amman and Zarqa Governorates, in addition to sludge from the treatment plants of Salt, Fuheis, and Baqa’a and will transport them to the septic tank facility at Al Ghabawi.

External Stakeholders

- Local Authorities: including Ministry of Environment (MoEnv), Ministry of Labor (MoL), Ministry of Transport (MoT), Ministry of Health (MoH), Ministry of Energy and Mineral Resources (MEMR), Ministry of Tourism and Antiquities (MoTA), Greater Amman Municipality (GAM) and relevant municipalities, Civil Defence Authority, and Miyahuna.
- Members of the local community and villages living within the project surroundings.

- Vulnerable Groups including women, youth, and Syrian refugees.
- Local communities within the areas to be served which are households residing in areas that are un-sewered within Amman and Zarqa Governorates. These households are currently served by the existing septic tank facility at Ain Ghazal Treatment Plant, and will eventually be served by the proposed project.
- Non-Governmental Organizations (NGOs)/ Civil Society Organisations (CSOs): The main identified CSOs within the project area and its surroundings are:
 - East Amman Society for Environmental protection
 - Roboua Al Manakher Society
 - Al-Bayida' Society (charity)
 - Maghayer Muhanna Society
 - Khashafiyeh Dabaybeh Society
- Neighbouring facilities: The closest facilities surrounding Al Ghabawi septic tank facility project which are Al Ghabawi landfill, Electricity generating company Amman East, Reserve terminal for petroleum products, Cattle farm, and other facilities under construction.
- International Financing Agencies/ Donors and International NGOs working in the infrastructure sector in Jordan.

Public Consultation

A public consultation session was held as part of the ESIA study and stakeholders were invited by MoEnv. The overall aim of the session was to take into consideration issues of concern raised by stakeholders throughout different phases of the project, and take their feedback into account in the ESIA study after further discussing them with the project owner (WAJ), EBRD and MoEnv. The scoping session introduced the Project to the attendees and after the presentation, the floor was open for discussions of potential impacts and the issues of concern along with a questionnaire was distributed to get the feedback from the participating stakeholders on what they perceive as the most and least significant E&S issues during the Project's construction and operation phases. The identified E&S issues of concern included:

- **Significant E&S issues during construction:**
 - Occupational health and safety concerns.
 - Air quality concern due to dust and emissions from vehicles and equipment. Establish the air quality baseline to allow for a comparison during the operation phase.
 - Impact of high noise levels and vibrations on occupational health.
 - Soil pollution due to accidental leakage of oil and fuel.
 - Traffic accidents. Greater Amman Municipality has declared that it has assigned a budget of 30 Million JODs for the rehabilitation of Al Ghabawi highway over a period of three years.
 - Impact on land value for surrounding areas.
 - Work conditions for the labour force in terms of number of work hours and salary pay.
 - Positive impact of creating job opportunities to youth from surrounding communities.

- **Least significant E&S issues during construction:**
 - Aesthetics is not perceived as a significant aspect during project construction.
 - Odour and noise levels.
 - Potential chance finds of archaeological artefacts.
- **Significant E&S issues during operation:**
 - Odour generation.
 - Occupational health and safety concerns due to exposure to biological and mechanical hazards as well as physical hazards such as noise levels and heat.
 - Impact on groundwater.
 - Impact on air quality and their impact on health especially with respect to surrounding communities.
 - How will the sludge be handled after the storage period of 7 years?
 - Increase in traffic accidents and potential impacts on traffic due to movement of vehicles from Amman and Zarqa towards Al Ghabawi especially that the movement of septage tankers will coincide with the movement of garbage trucks to and from Al Ghabawi landfill.
 - Potential change in the fees paid for transporting the septage to the new Al Ghabawi WWTP instead of Ain Ghazal receiving station.
 - Monitoring of the septic tankers so they do not empty the septage illegally.
 - Concern for potential of odour generation from the stored dried sludge.
 - Cumulative impacts on air quality, odours and traffic due to availability of other infrastructure services within the area especially the future land port and slaughterhouse.
 - Potential effect on land prices within the surrounding area.
 - Work conditions for the labour force.
 - Contribution of Al Ghabawi WWTP to greenhouse gas emissions.
 - Cumulative impacts due to Al Ghabawi WWTP in relation to odour generation, air quality, soil and water quality.
 - Potential to use Al Ghabawi WWTP to treat the leachate coming from Al Ghabawi landfill.
- **Least significant E&S issues during operation:**
 - No potential impact on agricultural lands as the surrounding land plots are not suitable for agricultural purposes/use.
 - Dust and noise levels.

Additional stakeholder consultation meetings were carried out with local community stakeholders to engage them early on during the project and understand their concerns together with managing their expectations. Also, focus group meetings were held as part of the household survey. These meetings outcomes are documented as part of the Project's Stakeholder Engagement Plan (SEP).

4 ENVIRONMENTAL AND SOCIAL IMPACTS AND MANAGEMENT MEASURES

What are the Project's expected Effects on Natural Environment?

Air Quality and Noise

During construction, the negative impact of increased levels of dust, exhaust gases and noise due to construction works is anticipated to affect the construction workers as well as the neighbouring workers at Al Ghabawi landfill. This impact is considered to be of minor significance since it is site-specific, manageable and limited to construction phase.

During operation, the odour nuisance to be caused by the WWTP is of minor significance since the closest local community is around 7.5 km from the Project site. However, odour nuisance is likely for the WWTP and Al Ghabawi landfill employees, which necessitates the need for adoption of odour control mitigation and monitoring measures.

Greenhouse Gas Emissions

An estimation of greenhouse gas (GHG) emission during the Project operation was carried based on European Investment Bank Project Carbon Footprint Methodologies (2018). The results estimated that the emissions will be around 99,889 CO₂e tonnes/year in 2020. The majority of the emissions (around 84%) is attributed to the treatment process and a smaller percentage (around 14%) is attributed to energy consumption from the grid. Comparing these GHG emissions of Al Ghabawi WWTP and those of the septage receiving at AGTP and subsequent treatment at As-Samra WWTP show an increase of around 42,567 CO₂e tonnes/year. This increase implies that the treatment of the septage at Al Ghabawi WWTP will increase GHG emissions by 74% compared to the current practice of receiving it at AGTP and its subsequent treatment at As-Samra WWTP. Moreover, since the estimation exceeds the 25K CO₂e tonnes/year limit indicated by EBRD's PR3, the WWTP operator will have to conduct an annual quantification of these emissions in accordance with EBRD Methodology for Assessment of Greenhouse Gas Emissions.

Climate Change Risks

A vulnerability analysis of the Project was carried out to determine any needed climate change adaptation needs. The potential impacts posed by climate change on the planned WWTP are either positive or of negligible significance. Only two issues were considered of minor to major significance and these include:

- Minor significance challenge of potential increase in odour caused by enhanced generation of hydrogen sulphide at the headworks and hydrogen sulphide at the sludge dewatering due to increased temperatures.
- Minor significance challenge of increase in WWTP operating cost due to energy price shocks.
- Major significance challenge of potential increase in illegal dumping of transported septage due to the increase in fuel price and consequently increase in transportation cost.

Accordingly, the adaptation measures were identified for the potential increase in illegal dumping of transported septage. The adaptation measure required monitoring of the movement of wastewater tankers. However, the transportation of wastewater by tankers is already being monitored as part of

the Ministry of Environment's (MoEnv) Online Tracking System for Wastewater Tankers. Any illegal dumping of septage by the wastewater tankers will be detected by MoEnv and, hence, the challenge is considered to be under control.

Soil

Soil pollution may arise during construction due to improper handling of the generated solid and liquid wastes, fuel and chemicals especially in case of accidental spill of chemicals/oils/fuels. Since the Project site has no surface water resources and groundwater resources occur at very deep levels, the impact is considered to be of minor significance. Still, it is required to include mitigation measures for handling of solid and liquid wastes as well as chemicals and fuels during construction phase as part of the Contractor's construction environmental and social management plan (CESMP).

Biological Environment

During construction, no impacts are anticipated on biological environment arise due to the following:

- The vegetation cover within and around the site is already degraded and high disturbance have been found due to proximity to Al Ghabawi landfill.
- Construction activities will be in a limited area and there are no sensitive faunal species.
- The site is not close to any sensitive habitats and no priority biodiversity features or critical habitat, as per EBRD PR6, has been identified on site or in the immediate surrounding area.

During operation phase, the concern of exposure of birds and mammals to harmful pathogens and pollutants is of minor significance since the area has a low prevalence of bird species and mammals. Moreover, this impact can be mitigated by fencing the site and using proper means to prevent waterfowls from landing on open influent wastewater tanks.

Moreover, since Jordan is a passage for many types of migratory birds, in addition to the mentioned resident birds, it is possible that these birds would be exposed to the risk of hunting by workers on the project, especially during the migration period. Therefore, it is important to prevent project workers from fishing during all phases of Project implementation.

Water Resources

During operation of the WWTP, there are two impacts to consider with respect to water resources: 1) potential negative impact of pollution to groundwater resources in case of accidental leakage of wastewater, and 2) positive impact of reuse of treated wastewater effluent.

The risk to groundwater resources within the Project area is considered to be low as there is no shallow groundwater present and groundwater resources within the Project area occur within aquifers at very deep levels. Still, during the operation phase, it is required to have groundwater quality monitoring from the nearest well to the Project with the aim of ensuring the protection of groundwater sources.

On the other hand, the treated effluent will have the positive impact of enhancing irrigation water supply within the Project study area. The default option for this stage of the Project is discharge into

the nearby wadi. This discharge has not been related to potential environmental or social impacts because the treated effluent will meet the required standards for discharge into wadis (less stringent than Class A irrigation water to which the influent will be treated) and most of the water is expected to evaporate before eventually reaching the Zarqa river or infiltrating into groundwater resources.

Sludge Handling

During operation, the dried and stabilized sludge will be stored onsite over a period of 7 years. This stabilized sludge does not cause odours, insect breeding, or act as source of pathogens. But since the current approach of onsite stockpiling is temporary, a long-term national strategy is required. This may require investing in new incineration facilities, new landfills or even changes in legislations so that the generated sludge can be used as fertilizers.

What are the Management Measures for the Natural Environment during the Project's Construction and Operation?

The management measures required for the Project's implementation in order to eliminate or minimize environmental risks are presented in Table 3. The implementation of these measures is the responsibility of the Project's contractor and WAJ. Regular and frequent site inspections will be required to ensure compliance with the required measures.

Table 3. Management measures during Project implementation

Area of Risk	Mitigation Measures	Monitoring Measures
Construction/Decommissioning Phase		
Air Quality	<ul style="list-style-type: none"> - Conduct 24-hour of air quality monitoring for PM_{2.5}, H₂S, and NH₃ each month. - Carry out proper management of vehicles and equipment. They should be switched off when not in use and kept in good technical condition. - Suppress dust scattering by sprinkling of water on a as needed basis. - Properly stockpile (friable materials) and cover truck loads to minimize dust generation. 	<ul style="list-style-type: none"> - Observe and carry out site inspection for dust. - Review the results of the one day of air quality monitoring for PM_{2.5}, H₂S, NH₃ and report instances of exceeding the limits set by JS 1140/2006 and by EU Directive 96/62/EC - Air quality framework directive. - Review complaints records for number of complaints recorded.
Noise and Vibrations	<ul style="list-style-type: none"> - Conduct spot noise measurements to ensure to ensure that noise levels do not exceed the day-time limit of 70 dBA and night-time limit of 65 dBA as an industrial area. - Ensure vehicles and equipment are switched off when not in use. 	<ul style="list-style-type: none"> - Review the results of the one day of noise level measurements. - Review complaints records for number of recorded complaints.
Topography, Geology and Soil	<ul style="list-style-type: none"> - Maintain the machinery and vehicles. 	<ul style="list-style-type: none"> - Carry out site inspection and observations such as checking for oil leakage from construction machinery

Area of Risk	Mitigation Measures	Monitoring Measures
	<ul style="list-style-type: none"> - Have a spill response plan to control any leakage or spill. - Maintain proper housekeeping site. - Properly collect and dispose of solid and liquid wastes in line with legal requirements. - In case of having temporary fuel tanks onsite, use secondary containment tanks to control accidental leakages. 	<p>and vehicles, review waste manifests and the permit of approved disposal sites, etc.</p>
Biodiversity	<ul style="list-style-type: none"> - Prohibit workers from hunting. 	<ul style="list-style-type: none"> - Carry out field visits to ensure that there are no hunting accidents by Project workers.
Operation Phase		
Air Quality including Odour	<ul style="list-style-type: none"> - Ensure availability of an odour control system. - Once per month, carry 24 hours of air quality measurements for PM_{2.5}, H₂S, and NH₃ and report on instances of exceeding the limits set by JS 1140/2006 and by EU Directive 96/62/EC - Air quality framework directive - Reduce the work hours for workers in exposed areas. - Develop an Odour Committee to check on odour within the WWTP. - Have a green barrier around the Project to assist in reducing odours and emissions. 	<ul style="list-style-type: none"> - Review results of air quality monitoring measurements within the WWTP site. - Ensure that the Odour Committee meet and document the odour at the WWTP. - Review the records on odour complaints.
Greenhouse Gas Emissions	<ul style="list-style-type: none"> - Consider energy efficiency in Project design to reduce energy demand (already considered but to be refined). 	<ul style="list-style-type: none"> - Prepare an annual estimation of GHG emissions by the WWTP.
Water Resources	<ul style="list-style-type: none"> - 	<ul style="list-style-type: none"> - Ensure that the plan to develop the infrastructure needed to deliver the treated wastewater has been prepared. - Ensure that a record proving the safe disposal of waste in approved landfills and hazardous waste in the Swaqa hazardous waste landfill is maintained. - Ensure the implementation of a groundwater quality program.
Sludge Handling	<ul style="list-style-type: none"> - Ensure proper stabilization of the treated sludge. - Review records of odour and/or insect complaints. 	<ul style="list-style-type: none"> - Check that the long-term plan for sludge handling has been prepared.

Area of Risk	Mitigation Measures	Monitoring Measures
	- WAJ and Operator to develop a long-term strategy for handling the treated sludge.	
Biodiversity	- Ensure the site is fenced and proper means are used to prevent birds and/or mammals from landing on open influent wastewater. - Prohibit workers from hunting.	- Observe availability of fencing and control measures. - Carry out field visits to ensure that there are no hunting accidents by Project workers.
Treated effluent not meeting the standards	- Have WWTP Design controls. - Prevent discharge (operating procedures) unless quality standards achieved.	- Have a monitoring program for the treated effluent to ensure that it is in line with Jordanian Standard JS 893/2006 for reuse of treated wastewater and the EU Urban Waste Water Directive.
Risk of untreated wastewater overflow under emergency operation conditions at the WWTP	- Maintain a record of occurrence of such emergency situations.	- Review the records on documented such incidences and evaluate the extent of exceedance of the equalization tanks capacity.

What are the Project's expected Effects on Social Conditions?

Local Community Perceptions

Throughout the stakeholder engagement process, local stakeholders (primarily those residing within East Amman area) expressed some concerns from the operation of this Project. These included:

- Concerns that previous projects / facilities in the East Amman area did not sufficiently integrate the local community into their projects; and
- Concerns from the potential escalation of public health issues in the area due to potential pollution from several project facilities.

These concerns necessitate that during the Project operation phase, appropriate management measures are implemented to allow the local community to voice their concerns through a formalized grievance mechanism, in addition to enforcing the mitigation measures set-out in the ESIA as well as taking into account during project implementation WAJ Social Responsibility Strategy. Local community proposed measures that include greening the area, establishing parks, maintaining roads and extending a wastewater network in the area.

Employment Opportunities

During construction, positive benefits of the Project may arise from short-term (around 24 months) job opportunities. During the 4-month peak period during construction, an approximate 300 persons will be employed. The benefits of this impact can be maximized by selecting staff from surrounding local communities as much as possible or sourcing goods and services from locals.

In terms of gender issues, the job opportunities during construction are mainly limited to men due to required physical efforts and other cultural considerations. Women can be hired for office-related activities such as engineering design, project management or administrative coordinators. Moreover, jobs available to local men can benefit women directly through services such as renting homes and selling goods, and indirectly through income from the job provided for the spouse or household head.

During operation, the potential for employment is assessed as a positive impact. However, the employment opportunities are limited in number (a total of up to 30 people) and require people with certain technical qualifications. Therefore, to manage local community expectations and to maximize this benefit, the operator should ensure that any needed qualifications available within the local community will be hired in the project.

Potential Implications on Local Community Groups

The Project implementation will not trigger physical or economic displacement the land plot is already assigned to WAJ and it considered a barren land that is unsuitable for cultivation or agriculture. Therefore, there are no impacts associated with land acquisition, involuntary resettlement and/or economic displacement.

Community Health and Safety

Potential negative impacts to community, health and safety is expected to be of minor significance given that the project area is currently vacant of any activities, in addition no residential communities are present within at least a 5 km buffer. Moreover, the adjacent Al Ghabawi landfill is accessed through a separate entrance and exit that is designated only to permitted personnel. Still, the local community will be able to file a grievance or compliant via the project's formalised public grievance mechanism set out in the project-specific SEP.

During the operation phase, the site will be fenced, appropriate security measures applied, and entry exit of any personnel in addition to the tanker drivers to the WWTP will be controlled, and health and safety procedures enforced on site to avoid safety hazards during the septage discharge into the septic tank facility. This makes the health and safety concerns of low significance.

Affordability of Communities Potentially to-be-Served

To assess the impact during the operation phase, the affordability of households within Amman and Zarqa governorates was assessed as part of the feasibility for this Project. Affordability ratios were calculated by dividing household utility expenditure by the total household expenditure (or by total income where data is unavailable). Utility bills are considered "unaffordable" when they exceed the pre-set threshold, which in the context of this project is 5% for water and wastewater. The affordability analysis found that combined water and sewer bills in Amman and Zarqa account for 4.7% and 4.4%, respectively, of the total annual household expenditure. Both of which are below the affordability threshold of 5%, which indicates that utility bills are affordable. Since utility bills were found to be affordable within both Amman and Zarqa governorates, the concern for ability to pay will not arise implying no impact with respect to affordability.

Labour and Working Conditions

During construction, common activities such as excavations, lifting, movement of heavy machinery, handling chemicals, etc. can introduce occupational health and safety risks to workers. Other risks are also associated with child labour and forced labour risks. Effective systems in line with EBRD “Performance Requirement 2: Labour and Working Conditions”, and good site practices in terms of site services and facilities shall be designed and implemented to manage such potential risks. The implementation of an effective system will reduce the risks of labour and working conditions throughout construction making the risk of minor significance.

Occupational Health and Safety

During construction, potential impacts on workers’ health and safety due to exposure to risks through construction activities that lead to accidents causing injuries and death. These risks include safety risks such as tripping; falling due to working at heights; working at confined spaces, etc. and Health risks and injuries such as lifting, lowering, pushing, pulling and carrying, etc. Given the health and safety system and precautions are expected to be applied by the contractor, the impact is considered to be of moderate impact significance.

The operation and maintenance of the wastewater treatment plant will involve a range of activities that are potentially unsafe for workers. The specific hazards associated with working at the WWTP can be categorized into physical, chemical, and biological hazards. The result of an encounter with these hazards can often be immediate, severe, and irreversible, even fatal. The prevention of occupational accidents on-site and the harmful health impacts in its vicinity require the operator to undertake compliance and monitoring measures in-line with the requirements of Jordanian and international health and safety laws and guidelines during the operation phase. If control measures are not correctly applied, the impacts can be severe. Therefore, it is essential to ensure that the operation and maintenance personnel operating the facility and carrying out the regular technical checks are made aware of potential health effects that could occur on site. Given that WAJ’s operator (Miyahuna) has an existing OHS policy, adherence to OHS policy and the health and safety procedures on-site during O&M activities will significantly reduce the potential for occupational health and safety impacts on workers rendering the impact to be of moderate significance.

Infrastructure Improvement

The operation of the proposed Project is expected to solve an existing infrastructure issue that has been present at AGTP, thereby minimizing the current load and operational burden, and improving wastewater services. Thus, it is considered to be a positive impact in terms of infrastructure services.

Transfer of Skills

This project is anticipated to have the positive impact of contributing to transfer of skills in wastewater treatment technologies to operator staff as well as project owner.

Transportation

During construction, traffic due to vehicle movement is expected to increase to a certain degree. This vehicle traffic can cause congestion on road networks around and within the site and thereby leading

to potential accidents. However, this is a short-term impact and not anticipated to cause any permanent effect on the receiving environment and, hence, considered to be of minor significance.

During operation, there is the potential risk for illegal dumping of transported septage. Moreover, potential increase in traffic loads especially from hauling trucks and septic tankers is expected. A traffic impact assessment was undertaken describing the trip generation and trip distribution of Al Ghabawi Wastewater Facility up to 2045. During operation of the facility, workers' light vehicles in addition to around 920 sludge hauling trucks trips are expected to travel daily between the site and both Amman and Zarqa. Yet, the projected number of trips is expected to increase gradually to reach 1250 daily trips in the year 2045. This number of daily trips generated by the Project is not considered a significant impact and is well within the acceptable range for level of service. No interventions are necessary in terms of increasing road capacity at Al Ghabawi Road or the access road. Thus, though the increased traffic load during the operation phase of the project is certain, it will be of low consequence yielding an overall moderate impact significance.

Archaeological and Cultural Heritage Impacts

During construction, no potential impacts are anticipated on archaeological and cultural heritage. Still, care should be taken during excavation and if any remains or relics are observed, the Department of Antiquities should be notified to get the relevant expert assigned for further guidance on handling such relics while excavation work is stopped and contractor awaits instructions.

What are the Management Measures for the Social Conditions during the Project's Construction and Operation?

The management measures required for the Project's implementation in order to eliminate or minimize social risks are Table 4. The implementation of these measures is the responsibility of the Project's contractor and WAJ. Regular and frequent site inspections will be required to ensure compliance with the required measures.

Table 4. Management measures during Project implementation

Area of Risk	Mitigation Measures	Monitoring Measures
Construction/Decommissioning Phase		
Community Health and Safety	<ul style="list-style-type: none"> - Appoint two Community Liaison Officers (CLOs) to manage community related matters for the project and the community grievance mechanism. 	<ul style="list-style-type: none"> - Monitor grievance log and ensure all complaints are addressed. - Ensure project area is secure and access is well monitored.
Labour & Working Conditions	<ul style="list-style-type: none"> - Ensure that labour, health and safety, and recruitment are all in line with Jordanian laws and the requirements of EBRD PR 2 are in place. - A Grievance Mechanism is available for all workers and employees. 	<ul style="list-style-type: none"> - Ensure that systems are in place to monitor compliance with labour and health and safety standards. - Appoint a manager on site to be responsible for ensuring that labour and health and safety legislation is complied with.

Area of Risk	Mitigation Measures	Monitoring Measures
	<ul style="list-style-type: none"> - Employing workers under the minimum age of 18 for employment is not allowed nor is the use of force or compulsory labour. 	<ul style="list-style-type: none"> - Review the employee's grievance log sheets.
Occupational Health and Safety Risks	<ul style="list-style-type: none"> - Develop an Occupational Health and Safety (OHS) Plan that complies with Jordanian and EBRD OHS related policies and procedures that is based on emergency plans prepared prior to commencement of work. 	<ul style="list-style-type: none"> - Daily site inspection and auditing to check for compliance with OHS procedures. - Monthly review of inspection records, records on reported injuries or accidents, trainings conducted, and records of mock up drills on site.
Transportation	<ul style="list-style-type: none"> - All trucks and vehicles accessing the facility are operated by licensed operators and comply with speed limits and signs. - Vehicles are adequately maintained and inspected. - Entry and exit points at the Project site are controlled. 	<ul style="list-style-type: none"> - Maintain open dialogue with Al Ghabawi landfill personnel as it is located adjacent to the project area. - Monitor vehicle movement to and from the Project area.
Archaeology and Cultural Heritage	<ul style="list-style-type: none"> - In case of coming across any artefacts during excavation works, follow chance procedure including stopping the work and informing Department of Antiquities (DoA). 	<ul style="list-style-type: none"> - Carry our observations on existence of any artefacts at construction site. - Review records of coordination with MoTA/DoA.
Operation Phase		
Local Community Perceptions	<ul style="list-style-type: none"> - Appoint one CLO to manage the grievance mechanism. - Have an odour control system and an odour monitoring committee. - Implement WAJ's existing Grievance Mechanism. - Implement initiatives related to maintaining social responsibility with the local community in line with WAJ's "Social Responsibility Strategy". - Allow only septage tankers that are tracked electronically by MoEnv. - Adopt strict monitoring system to ensure the quality and type of the septage received. 	<ul style="list-style-type: none"> - Ensure the implementation of the SEP throughout the project operation phase including maintaining of stakeholder consultation records and records of grievance logging and reporting.
Community Health, Safety and Security	<ul style="list-style-type: none"> - Control the entrance and exit into the facility as a safety procedure. 	<ul style="list-style-type: none"> - Ensure Project area is secure and access is well monitored.
Occupational Health and Safety	<ul style="list-style-type: none"> - Develop an Occupational Health and Safety (OHS) Plan that complies with OHS related policies and procedures complying to local Jordanian requirements, as well as EBRD requirements where applicable. - Enforce the use of PPEs, use of inspected equipment, proper handling of hazardous 	<ul style="list-style-type: none"> - Regularly inspect and test all safety features and hazard control measures. - Regularly audit for the compliance with OHS procedures. - Carry out surveillance of workers' health through periodic clinical and/or

Area of Risk	Mitigation Measures	Monitoring Measures
	<p>material, use of warning signs, availability of first aid kits, etc.</p> <ul style="list-style-type: none"> - Allocate specific personnel to be responsible for health and safety management on site. - Ensure adequate and appropriate training of all workers on the contractor's OHS policies and procedures. - Prepare emergency plans for the operation areas. - All workers should undergo periodic examinations by occupational physician to reveal early symptoms of possible chronic effects or allergies and provide worker immunization (e.g. for Hepatitis B and tetanus). 	<p>physiological assessment of individual workers.</p> <ul style="list-style-type: none"> - Review records on reported injuries or accidents and the corrective action taken, records of trainings conducted, and evidence and records of mock-up drills and emergency exercises on site.
Transportation	<ul style="list-style-type: none"> - Allow only septage tankers that are tracked electronically by MoEnv. - Ensure availability of warning signs for truck drivers and others using the road. - Use speed bumps or rumble strips. - Control entry and exit points at the WWTP. - Raise the driver's awareness. 	<ul style="list-style-type: none"> - Coordinate with MoEnv to add the location and route information of the tanker owners and drivers involved in the Project operation phase to the MoEnv's database to be tracked and undergo review for any violations done by the wastewater tankers using the WWTP. - Monitor access roads around the site. - Review the records on documented incident reports. - Monitor the records for any reporting of spillage from the septic tankers along the roads.

What are the Project's Impacts due to Unplanned Events and Emergencies?

During Project construction phase, unplanned events relate mainly to health and safety aspects due to construction activities and movement of heavy machinery. These may vary from injury to site workers, soil pollution due to accidental oil/chemical spills, traffic accidents during movement of vehicles and machinery, fire accidents, etc. However, measures relating to emergency response plans and preparedness to address such incidents are addressed as part of the construction environmental and social plan (CESMP).

During the Project's operation phase, unplanned events and emergencies and their related risks include:

- A process malfunction where treatment efficiency is reduced and the treated effluent discharged into the wadi does not meet the indicated Jordanian and EU standards. Though the sensitivity of the study area in terms of water resources pollution or biodiversity impacts is low, this risk is considered to be of moderate significance.
- Overflow of untreated wastewater into the adjacent wadi in case of malfunction at the WWTP.

However, the wastewater to be received at Al Ghabawi WWTP will be transported by tankers. Hence, in case of an operational emergency, the discharge of wastewater from the tankers can be stopped. In addition, the design for the WWTP has accounted for a large capacity equalization tanks that has the capacity to take additional wastewater inflow. Therefore, risk of overflow of untreated wastewater is unlikely and the impact is considered to be of negligible significance.

- Accidental chlorine gas release from the chlorination unit posing occupational health risk to workers at the facility. This risk is considered to be moderate significance.
- The risk that the septic tankers may bring industrial wastewater into the WWTP. However, this is unlikely since Al Ghabawi should be receiving licensed municipal septage transport tankers which have the standard orange colour. Accordingly, the operators would notice if a non-municipal septic taker entered the WWTP facility. Moreover, all the received septage is directed towards the equalization tank where the mixing of all received wastewater is expected to dilute any accidentally received industrial wastewater. However, if industrial wastewater concentrations were high, this will affect the efficiency of the treatment process resulting in an overall major risk significance.
- Fire hazards which can occur at WWTP especially in case of chlorine, ammonia, methane and hydrogen sulphide build up in confined spaces. Fire hazards would pose high risk to individuals available within the Project site and its impact is considered to be of moderate significance.
- Disruptions to the wastewater treatment process due to power supply failure. However, the WWTP receives its power requirements from the national electricity grid and incidences of power failure are extremely remote and are usually fixed within short time durations. Thus, no disruptions to the wastewater treatment process is anticipated due to power failure.

What are the Management Measures for the Unplanned Events and Emergencies during the Project's Construction and Operation?

Table 5 presents the management measures required for the unplanned emergencies.

Table 5. Management measures for unplanned emergency events

Area of Risk	Mitigation Measures	Monitoring Measures
Construction/Decommissioning Phase		
Health and safety accidents due to construction activities and movement of heavy machinery	- Have emergency response plans and preparedness as part of the construction environmental and social plan (CESMP).	- Daily site inspection and auditing to check for compliance with OHS procedures. - Monthly review of inspection records, records on reported injuries or accidents, trainings conducted, and records of mock up drills on site.
Operation Phase		
Treated effluent not meeting the standards	- Have WWTP Design controls. - Prevent discharge (operating procedures) unless quality standards achieved.	- Monitor the treated effluent to ensure that it is in line with Jordanian Standard JS 893/2006 for reuse of treated wastewater and the EU Urban Waste Water Directive.

Area of Risk	Mitigation Measures	Monitoring Measures
Risk of untreated wastewater overflow under emergency operation conditions at the WWTP	<ul style="list-style-type: none"> - Maintain a record of occurrence of such emergency situations. 	<ul style="list-style-type: none"> - Review the records on documented such incidences and evaluate the extent of exceedance of the equalization tanks capacity.
Risk of chlorine gas release at the chlorination unit	<ul style="list-style-type: none"> - Have leak detection sensor for chlorine gas at the chlorine gas storage room along with a system that treats the released gas. - Material Safety Data Sheet (MSDS) information on chlorine gas. - Place warning signs and develop safety protocols and staff training. 	<ul style="list-style-type: none"> - Check for availability of safety protocols and warning signs.
Risk of industrial wastewater at the WWTP	<ul style="list-style-type: none"> - Receive wastewater from licensed municipal septic tankers. - Have a separate tank to empty tankers suspected of carrying industrial wastewater. - Adopt an influent wastewater quality monitoring program. 	<ul style="list-style-type: none"> - Monitor the WWTP records for influent quality monitoring and to check that wastewater tankers are licensed as municipal wastewater septic tankers.
Risk of Fire incidents as unplanned events	<ul style="list-style-type: none"> - Have a firefighting plan and system including planned fire drills with evacuation procedures. - Have regular inspections and maintenance for the firefighting system. 	<ul style="list-style-type: none"> - Review available firefighting plan and a representative to attend the firefighting drills at least once annually.

Are there any Cumulative Impacts?

The Project area is overall planned as an area of strategic services such as Al Ghabawi municipal solid waste landfill and nearby petroleum reserve facility. Currently, there are some planned projects that are of medium to large scale that are likely to contribute to cumulative impacts within the area. Though the proposed Project is relatively small scale compared to the planned activities within this strategic services area, the household survey revealed a great concern by the local communities over the current environmental state driven by the current Landfill in the Strategic Services Zone and the other facilities in the area, and the cumulative impact of the upcoming Project and other planned developments in the area. These concerns stemmed from the local community perception of having a negative experience with existing facilities in the area in terms of environmental impacts, with the landfill considered as having the most negative impact due to odour and the garbage which flies off trucks. Other developments including Amman Strategic Reserve Terminal for Petroleum Products, a cow farm, and Amman Asia Electric Power, the East Amman livestock market and the current Septic tank facility Project are perceived as unwanted developments adding to an already vulnerable environmental situation.

However, the proposed Project is relatively a small scale one with its potential adverse cumulative impacts considered as negligible and confined to odour nuisance, increase in traffic, and potentially increased local community perception of risk overtime if the environmental and social commitments are not met. Still, it is important for the Project to engage stakeholders as needed and to communicate clearly the proposed measures that are feasible, applicable and in-line with project scope. Also, future developments should aim to employ the technicians and university-educated local community members who may qualify for such jobs and provide low-skill primary jobs to the local community.

Are there any Residual Impacts?

Given that the majority of the identified impacts on physical environment are of minor significance and manageable through adoption of proper environmental management measures, the only residual impact of concern is anticipated on labour and working conditions due to prevalence of odour nuisance from the neighbouring Al Ghabawi solid waste facility. As discussed, this impact requires adoption of mitigation measures for minimizing impact of the prevalent nuisance on the WWTP employees.

5 COMMUNICATIONS

What will be the process for Stakeholder Engagement?

A Stakeholder Engagement Plan (SEP) has been prepared as part of the environmental and social assessment. The SEP is designed to engage the stakeholders and manage community relations, expectation, and grievances (or complaints) through consultation and disclosure. WAJ has overall responsibility for consulting with the public and providing community support throughout the Project lifecycle.

What will be the process for addressing any arising issues/complaints (Grievances)?

Any member of the community or workforce will be able to submit a grievance to the Project if they believe an activity or action related to the project is having a detrimental impact on the community, workforce, environment, or on their quality of life. Such complaints can be initiated by using the contact details provided below.

Contact Details

Entity: Water Authority of Jordan
Attention. Eng. Ahmad Al-Awamleh

Address: Building No. 6, Jaber Ben Hayyan Street, Shmeisani
P.O. Box 5012, Amman-11181

Telephone: +962-06-5652261-Ext (1050)



Fax: +962-006-5687760

E-mail: ahmad_al-awamleh@mwi.gov.jo

Website: www.mwi.gov.jo