The Hashemite Kingdom of Jordan
Ministry of Water and Irrigation
Water Authority of Jordan

Wadi Arab Water System II

Environmental and Social Impact Assessment Study

Draft ESIA

Volume 1-Main Report

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INNOVATIVE SOLUTIONS...PROVEN EXCELLENCE

DESIGN MANAGEMENT SERVICES SPECIALIZED STUDIES

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1 INTRODUCTION

CDM International Inc. was retained by the United States Agency for International Development (USAID) to undertake the Water/Wastewater Infrastructure Project (WIP) for the purpose of improving the utilization of limited water resources in Jordan for the next 25 years and bringing about urgently needed enhancements to the water and wastewater systems. One of the tasks is to conduct Environmental and Social Impact Assessment (ESIA) to the Wadi Arab Water System II (a component of WIP Project) according to local, as well as European Investment Bank (EIB) guidelines. It worth mentioning that, the construction of this project is intending to be financed by EIB and AFD. However, financing remains subject to approval by their governing bodies and satisfactory legal documentation.

ESIA is a process where the future consequences of a proposed action or undertaking are identified and mitigated before irrevocable decisions are made. A well-constructed ESIA provides the basis for responsible corporate decision-making that is forward-looking and globally participatory. Potential issues are identified as early in the process as possible and solutions are developed to maximize project benefit while minimizing both front-end and downstream costs to development. CDM International Inc. commissioned Consolidated Consultants Engineering & Environment (CC) for the preparation of ESIA for the project of Wadi Arab Water System II. Accordingly, a team of experienced practitioners has been assembled to prepare the Scoping Statement Report/TOR and ESIA for the proposed project.

1.1 Literature Review and Background of the Project

The City of Irbid is located on a plateau at an elevation of around 500 m (1,640 ft) above sea level, while the sources of water associated with the study area are generally in the low lying valley areas as low as 200 m (656 ft) below sea level. More specifically, the sources of water relevant to the western region of the Irbid Governorate include:

- Groundwater from the Wadi Arab well field. This is the current major source of potable water for the City of Irbid and these wells are located in the Wadi Al Arab area at the Northern tip of Jordan near the Yarmouk River. The Wadi Arab supply is augmented by water supplied from the Manshyeh wells and the Tabaqat Fahel wells in the Jordan Valley.
- Groundwater from the Mukheiba wells located at the Northern boundary of Jordan near the Yarmouk River, at Al-Hamma town. These artesian wells have been in operation for more than 25 years and water production has varied from 15-30 MCM per year (10.85 to 21.71 mgd). This well field is considered by MWI/WAJ to be a secure and a reliable water source. Currently, flow from this source is discharged into the Mukheiba canal which joins into the King Abdullah Canal (KAC) which supplies irrigation water in the Jordan Valley and potable water to Amman (Zai Water Treatment Plant).
- Surface water from Lake Tiberius. This is a key water source for Jordan and it supplies water into the KAC through the Deganya pipeline. The treaty between Israel and Jordan specifies the quantities and seasonality of the transfers from Lake Tiberius into the KAC.
- Surface water from the Yarmouk River and the Al Wehdeh Dam. The Yarmouk River is the primary source of water for the KAC. Water enters the KAC at Adassiya weir on the Yarmouk River. Flows in the Yarmouk River and the amount that Jordan can abstract from the river are controlled by the Al Wehdeh Dam sited on the border between Syria and Jordan. The amounts that Jordan can abstract from the river and the dam are set out in the Yarmouk River water agreements between Syria and Jordan as well as Israel and Jordan.

- Treated Wastewater. The construction of a new MWI project includes rehabilitation of existing Central Irbid and Wadi Al Arab Wastewater Treatment Plant (WWTP) so that the effluent from these two plants in addition to the effluent from the newly built Al-Shallalah WWTP can be reused for irrigation purposes.

Additional Water supply is required for the region to cover the deficit. This is part of the current project and is addressed in section 2 of this report.

Water Resources Alternatives for the Project Area

For additional supplies to the region, two alternatives were put forth to MWI for meeting the goal of a new bulk water supply pipeline to transport water from the Wadi Al Arab area to the City of Irbid:

Alternative No. 1: taking groundwater directly from the Mukheiba well field and pumping this using a 34-km (21.13-mile) pipeline and four pump stations to Zabda reservoir in the City of Irbid:

Alternative No. 2: taking surface water from the KAC and pumping this using a 32-km (19.89-mile) pipeline and four pump stations to Zabda Reservoir in the City of Irbid.

The two alternative options were compared based on the following criteria: demand growth and the current deficit, resilience, water quality risk, pipeline route selection, construction complexity, and construction duration.

Although the Mukheiba Wells (Alternative No. 1) was the less expensive option, its cost advantage was insufficient to overcome the risks associated with the uncertainty of the sustainability of supply from this source in the quantities required over the life of the Project. For this reason, from a technical point of view, Alternative No.2 was recommended, the KAC water source option.

1.2 Alternatives to the Project

To deliver the water to Irbid, the project will comprise the following components:

- New raw water intake from the King Abdullah Canal (KAC) and Intake Pump Station;
- Four (4) pumping stations
- A 30 MCM/yr Water Treatment Plant (WTP); and
- Potable water transmission main

For the third and fourth bullets, alternatives were studied as presented below and recommendations were provided for the most feasible option technically and financially.

Water Treatment Plant (WTP) Options

WTP Option 1

The WTP Option 1 site is in the vacant Plots number 4, 80 and 82 of "Manshyeh Village (0749), Sahl Al Manshyeh Basin (003)"located south/south east of the existing PS-0 on the Wadi Arab Water System I. The site location is presented in **Figure 1**.

Figure 1: Proposed WTP Option 1 and 2 Site Plan

Advantages

Potentially large area of land is available which allows for implementation of a robust conventional treatment system (including both water treatment and sludge handling) which is expected to result in reduced O&M costs and a more operator friendly facility, while also allowing space for potential future capacity expansion, if needed. The site area is potentially sufficient to host the WTP components, the clear well and the new PS-0.

- The natural sloping of the site may allow for gravity flow between unit processes to be implemented at a lower construction cost.
- This site is adjacent to the recommended transmission pipeline route (refer to **Figure 3**).
- The site is currently vacant and does not appear to be used for any special purposes (e.g. farming); making property acquisition potentially easier.
- Site elevations are higher than the neighbouring areas, providing good opportunities for drainage and a low likelihood of flooding.
- Allows for easy access roads to and through site. More conducive for industrial deliveries.
- More conducive for septic waste disposal without contaminating water source or filtered water.
- Generally not near large residential areas.

Disadvantages

- Site is not directly adjacent to the KAC; therefore the intake pump station will be at a separate site requiring separate dedicated O&M staff.
- Two power sources (Transformers) will be required, one at the intake PS and one at the WTP site.
- Site potentially requires some retaining walls for grading

WTP Option 2

The WTP Option 2 site is adjacent to the KAC in Plot number 1 of "Manshyeh Village (0749), Sahl Al Manshyeh Basin (003)". The land area located south west at about 0.5 km distance from the existing PS-0. The site location is presented in **Figure 1**.

Advantages

- Site is directly adjacent to the KAC, therefore the intake pump station will be at the same site therefore would not require dedicated separate O&M staff.
- One power sources (Transformer) will be required for both the intake PS and the WTP site.
- Location near the KAC water source provides easy access for WTP staff to observe seasonal changes in water quality.
- This site is adjacent to the recommended transmission pipeline route (refer to **Figure 3**).

Disadvantages

- Land area is relatively small and may not be sufficient to host all of the WTP components, reservoir and proposed PS0. There is less ability to expand WTP capacity for future water flows.
- Site elevations are lower or of the same elevation of the neighbouring areas, potentially making site drainage more difficult. The site is in a relatively low-lying area, resulting in increased risks of flooding.
- The triangle shape of the site does not provide for smooth layout of the structures.
- This site may require higher construction costs due to deeper foundations for some structures to provide for gravity flow between the treatment processes.

  The site results in finished water structures located closer to the KAC than the WTPOption 1, resulting in an increase potential for cross-contamination.
- The site is near a residential area and located on a secondary road, making it less conducive to industrial deliveries.
- Current land is used for farming, potentially making site acquisition more difficult.
- No good area for septic disposal in relation to finished water quality and KAC.
- Less space available for sludge drying beds, this will likely require implementation of more expensive mechanical sludge dewatering.

Recommendation on Manshyeh WTP Site Options

Based on the analysis provided here-in-above for the two WTP site options, it is recommended to adopt WTP Option 1.

Pipeline Alternative Route Descriptions

Pipeline Option 1

The Pipeline Option 1 route is presented in **Figure 2** This route would be substantially located within the right-of-way (ROW) of the Mosul–Haifa oil pipeline (also known as Mediterranean pipeline), locally known as the "TAP" line. The "TAP" line, currently not in use, and was constructed between 1932 and 1935. The "TAP" consisted primarily of 300 mm diameter pipe that was reduced in parts to 250 mm and 200 mm sections.

The Pipeline Option 1 would terminate at the Zabda Reservoir and would be approximately 24.5 km in length.

A total of four pump stations will be required for this option. PS-0 will be at the location selected for the Manshyeh WTP; PS-1 will be located at about 2 km from PS-0 at about 10m ground elevation. PS-2 and PS-3 will be located in the same sites of the existing Wadi Arab Water System I PS-2 and PS-3. **Figure 4** presents a preliminary layout for the proposed PS-1**. Figure 5** and **Figure 6** present a preliminary layout of the proposed PS-2 and PS-3 respectively.

Advantages

The main advantage of Pipeline Option 1 over Pipeline Option 2 is the overall pipeline length. Option 2 is approximately 4.2 km longer than the Option 1 route. A shorter route will result in savings of time and money to the project. It also provides for less hydraulic losses (energy savings). With the shorter route, less pipe, excavation, and backfill is required. A shorter distance would also result in a shorter construction duration which would be beneficial to the overall Manshyeh-Zabda Water System construction schedule. Other advantages include ease of construction in the PS0-PS2 section away from residential areas where there is no traffic.

Disadvantages

There is a significant elevation change from the Jordan Valley heading easterly from the proposed Manshyeh WTP. One section of this option has an approximate 30% grade beginning about 2 km east of the KAC and continues for about 1 km.

A potential environmental concern exists with this option. An oil spill or leak may have occurred in the period when the oil pipeline was in operation. Oil content in the soil may have negative impact on the proposed pipeline. This can be addressed by conducting investigations and selecting the alignment within the ROW that avoids any observed oil spills.

Pipeline Option 2

As described in Pipeline Option 1, the proposed Manshyeh-Zabda water system transmission main will begin from a water pump station that will be adjacent to the proposed WTP site. The Pipeline Option 2 route is presented in **Figure 3**. A similar route was identified in the European Investment Bank pre-feasibility study on the Wadi Arab Water Supply project. The route follows the existing Wadi Arab transmission main between existing PS-0 and the existing PS-1 (at the

WTP) along the old Irbid road up to a point where the existing Wadi Arab transmission main turns to the north and continues to the existing Wadi Arab Water System I WTP (see **Figure 4**). From that point, this proposed pipeline route would continue along the old Irbid road and then the Irbid highway (Route 10) passing by a possible location for a new Manshyeh-Zabda Water System Pump Station 1 (PS-1) (next to the existing reservoir) and continues up to the existing Wadi Arab PS-2. From the existing PS-2, the Pipeline Option 2 route would follow the same route (TAP line) as Option 1 up to the Zabda reservoir. The total pipe length for this option is approximately 28.7 km.

A total of four pump stations will be required for this option. PS-0 will be at the location selected for the Manshyeh WTP, PS-1 will be located at about 6.5 km from PS-0 at about 10 m ground elevation next to existing distribution reservoir. PS-2 and PS-3 will be located in the same sites of the existing Wadi Arab Water System I PS-2 and PS-3. **Figure 7** presents a preliminary layout for the proposed PS-1. **Figure 5** and **Figure 6** present a preliminary layout of the proposed PS-2 and PS-3.

Advantages

One possible advantage of Option 2 is that it may be less steep in some sections as compared to Option 1.

Disadvantages

The main disadvantage of this Option is the overall pipe length. A longer pipe route means higher cost and a longer time to construct. Another disadvantage is working within or adjacent to highway rights-of-way which will require permits from the Ministry of Public Works and Housing and traffic control measures.

As in option 1, an oil spill or leak may have occurred in the period when the oil pipeline was in operation. Oil content in the soil may have negative impact on the proposed pipeline. This can be addressed by conducting investigations and selecting the alignment within the ROW that avoids any observed oil spills.

Pipeline Route Options Common Issue

A separate concern with constructing the new water transmission main close to the existing 800 mm diameter Wadi Arab transmission main would be the effect that heavy construction equipment could have on the existing pipeline.

Since both Options have overlap with the existing Wadi Arab transmission main, special consideration will need to be included in the final tender documents in order to protect the integrity of the existing pipeline.

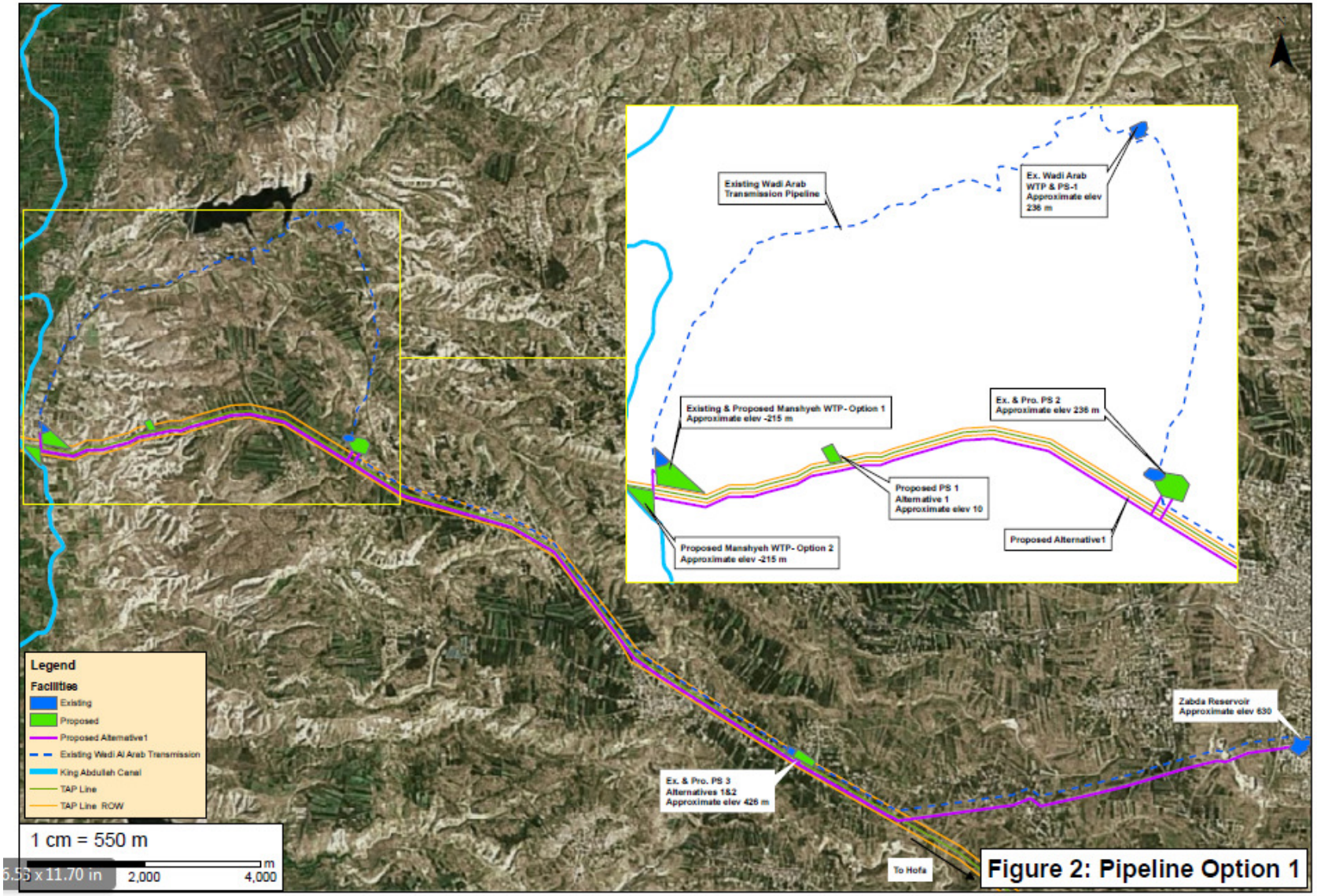


Figure 2: Pipeline Option 1

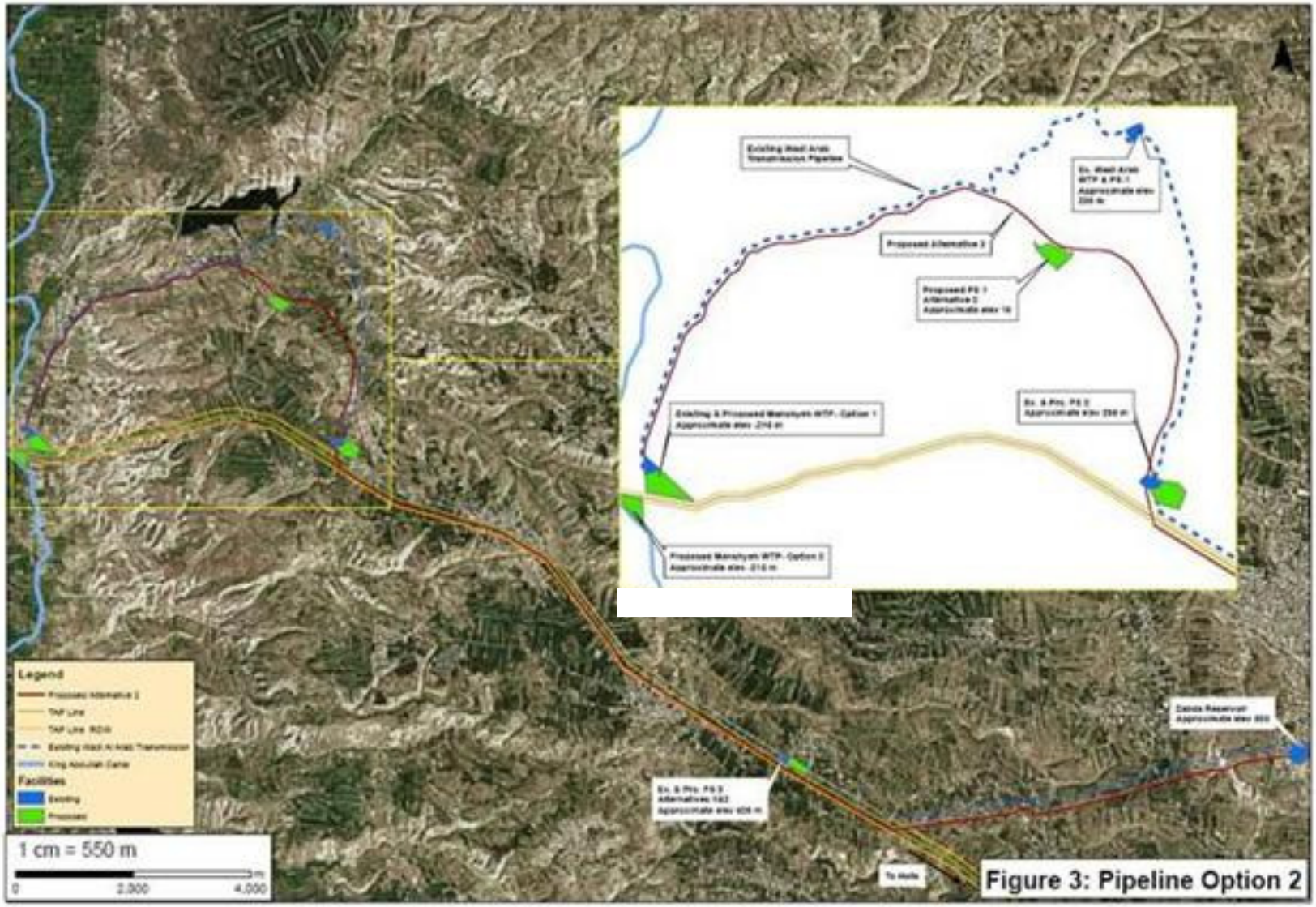


Figure 3: Pipeline Option 2

Recommendation Regarding Manshyeh-Zabda Pipeline Options

If permissions can be obtained promptly and there is not an unacceptable environmental concern, Pipeline Option 1 is recommended because it is a shorter route which will result in less cost and time to construct.

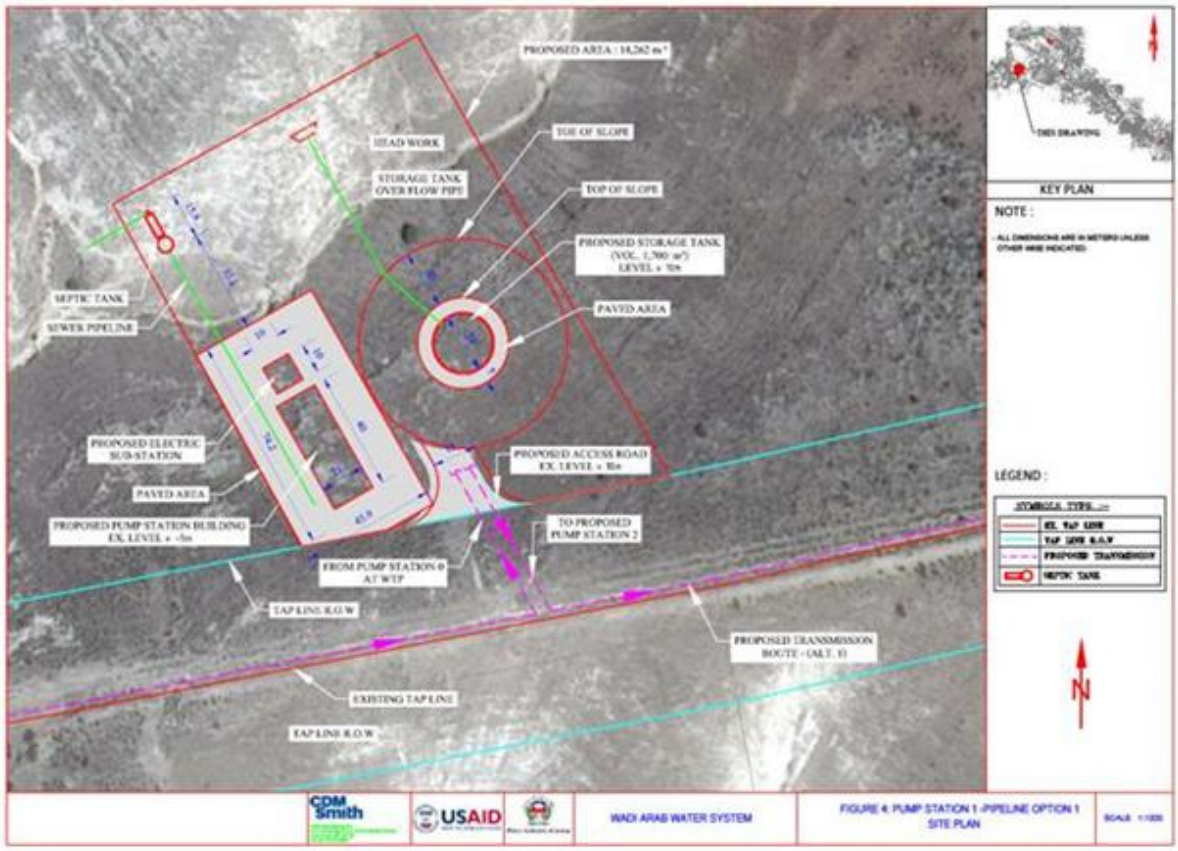


Figure 4: Pump Station 1 -Pipeline Option 1 Site Plan

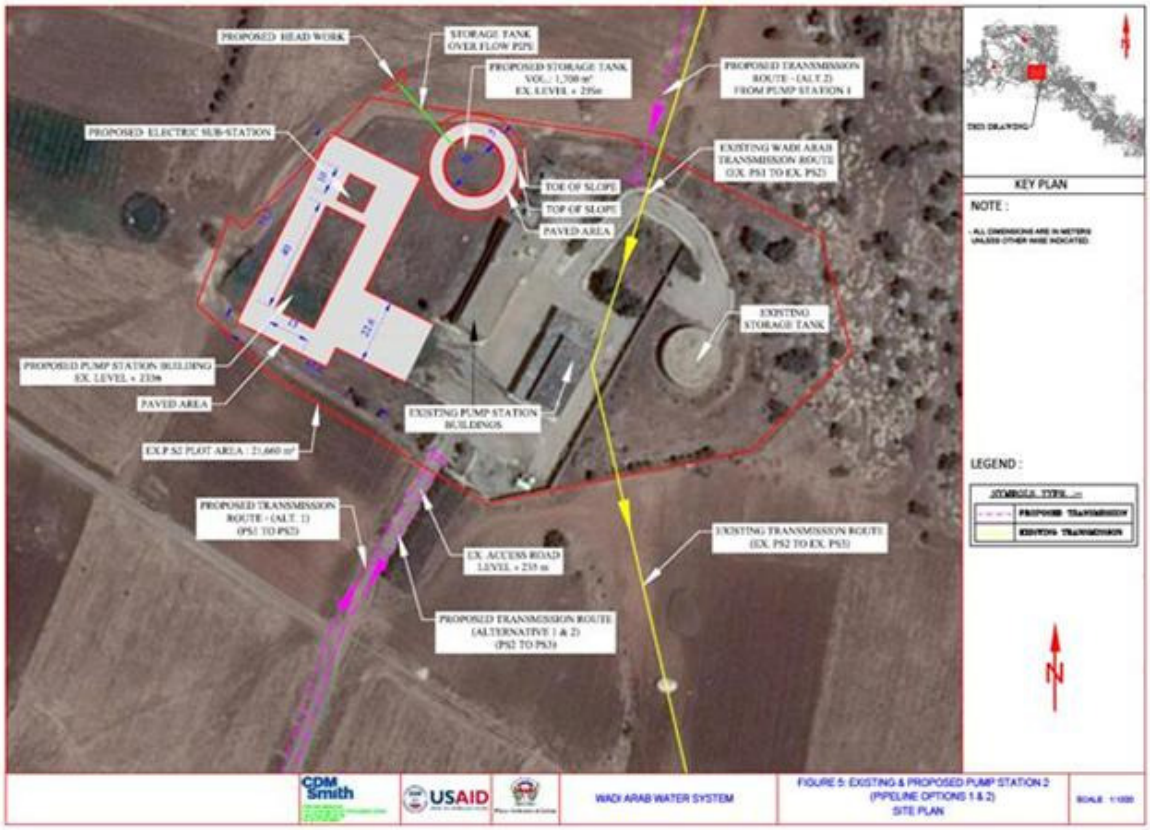


Figure 5: Existing & Proposed Pump Station 2 (Pipeline Options 1 & 2) Site Plan

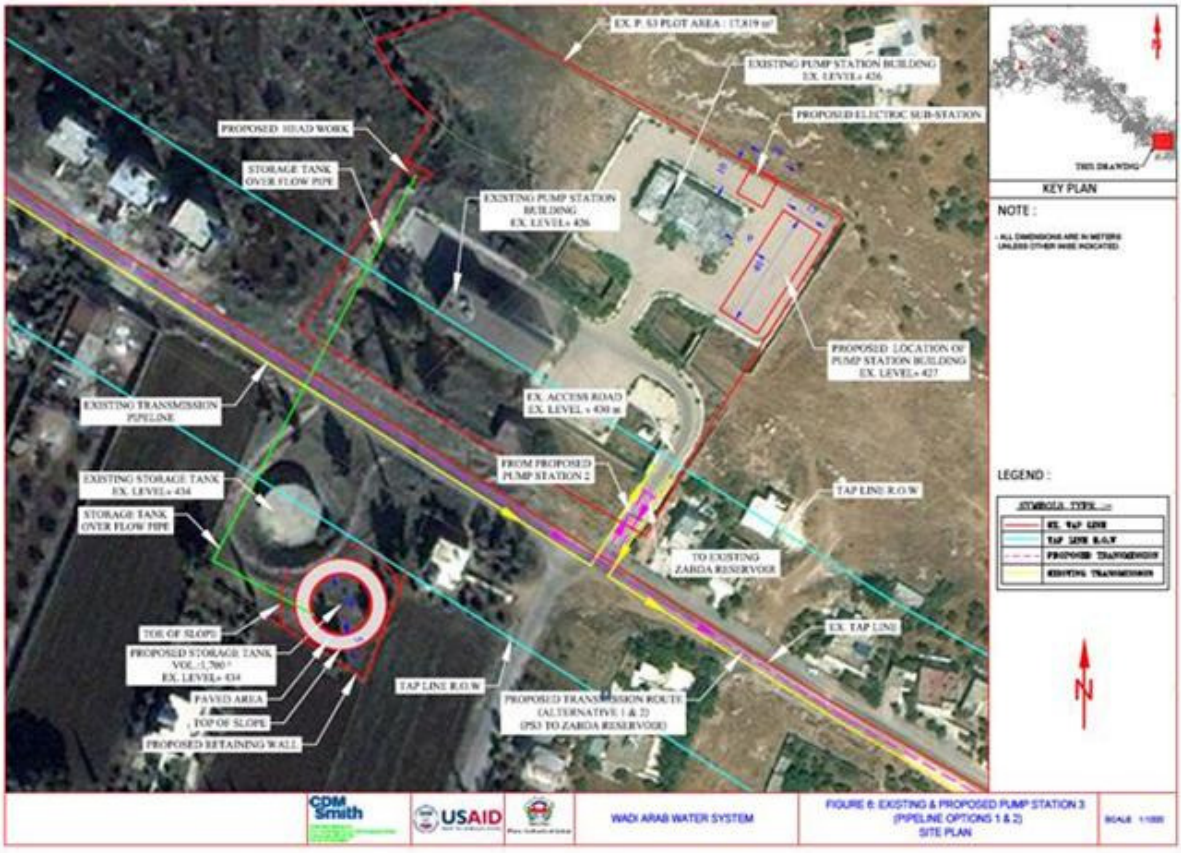


Figure 6: Existing & Proposed Pump Station 3 (Pipeline Options 1 & 2) Site Plan

Figure 7: Pump Station 1 for Pipeline Option 2 Site Plan

1.3 No Action/Without Project

The "no action/without project" alternative can be judged to possess no impacts, or in other words to cause no change to existing environmental and social settings neither within nor out of the proposed project corridor. This anticipation alternative is basic to all potential project-specific impacts except for the public health concern related to potential positive improvement of water quantity and quality supplied to citizens. Without the project it is understood that direct pumping of water through the existing system might be difficult to secure and people will keep suffering from shortage of water supply, and need storage in household tanks where contamination becomes a potential threat.

The inflation of the population in Irbid Governorate especially after the influx of Syrian refugees, will increase the demand on drinking water, and add more stress on the shortage of water supply to Irbid residents.

The study results showed that the major impacts will be temporary for the duration of construction such as dust, and disturbance to residents. These impacts can be minimized by applying effective mitigation measures suggested in this report.

2 PROJECT DESCRIPTION

The following section presents a detailed description of the proposed Wadi Arab Water System II. The description of the project, its components and activities has been developed based on the following:

- The Project Design, Description documents, provided by the designer (CDM)
- Meetings and discussions with the different stakeholders including the designer and representatives of WAJ in this regard; and
- The Rapid Field Diagnosis (RFD) done by the ESIA team.

2.1 Nature of Project

Project Name: Wadi Arab Water System II

Location: Shouneh/Manshyeh - Irbid Governorate, **Figure 9** shows the location of all facilities on Google maps. The City of Irbid is located approximately 70 km north of Amman and the Zabda Reservoir is located in Irbid at an elevation of 625 meters. The Village of Manshyeh is located in the Jordan Valley approximately 25 km to the west of Irbid at an elevation of -190 meters. The intake off the KAC and intake pump station is proposed to be located on the south side of the Village of Manshyeh while the WTP will be located to the east of the village.

The transmission pipeline will be routed in the Mosul-Haifa oil Pipeline, locally known as the TAP line (TAP) right-of way from the WTP to a location 2.25 km east of PS 3 where the pipeline changes direction to head northeast to the Zabda Reservoir following the existing Wadi Arab pipeline ROW acquired during the 1983 project.

Pump Station 0 (PS0) will be located adjacent to the reservoir within the WTP area. Pump Station 1 will be located on newly acquired land approximately 2 km east of the WTP at elevation 10 meters. Pump Station 2 will be located on land currently owned by WAJ and is approximately 3.8 km east of PS 1 at elevation 235 meters. Pump Station 3 will be located on land currently owned by WAJ and is approximately 8 km east of PS 2 at elevation 422 meters. The existing Zabda Reservoir is located on land currently owned by WAJ and is approximately 9.3 km northeast of PS 3.

Figure 8 below show schematic layout for the proposed project.

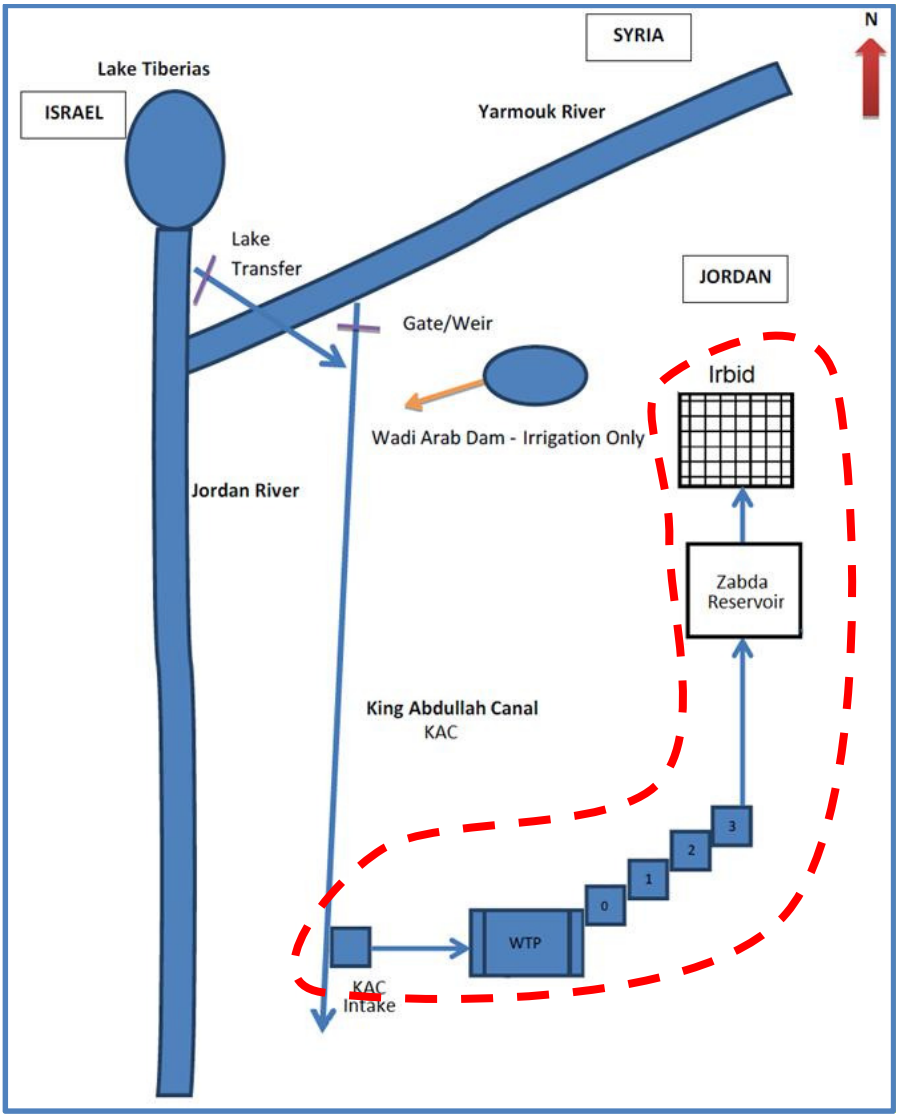


Figure 8: Schematic Layout of the Proposed Project

Scope of Project

The proposed Wadi Arab Water System II aims to provide an additional water source for the Yarmouk Water Company service area in the Northern Governorates of Jordan; water produced and supplied by this project is dedicated for Irbid Governorate; Manshyeh – Zabda Reservoir. The assessment will cover construction and operation and maintenance phases of the project.

The project as described earlier will consist of the following components:

- New raw water intake from the King Abdullah Canal (KAC) and Intake Pump Station;
- Four (4) pumping stations – the first pump station (PS0) is located on the WTP site
- A 30 MCM/yr Water Treatment Plant (WTP); and
- Potable water transmission main Diameter: 1000mm, Final Length is: 25.6 Km (Different approximate length were mentioned previously)

The proposed new WTP will be located in Shouneh/Manshyeh in the Jordan Valley; the water transmission main (1000 mm) will pass through several villages namely Samma, Mekhraba,

Zabda Al Wasteyeh, Al Taybeh, Kufr Youba, Deir Al Se'neh, Zabda Farkouh and Beit Yafa. **Figure 10** presents the villages along the water transmission main.

Key Stakeholders:

- **Client:** Government of Jordan (GoJ) represented by Water Authority of Jordan (WAJ)
- **Funding Agency/ Design:** U.S. Agency for International Development design services.
- **Funding Agency/ Construction:** European Investment Bank (EIB) and Agence Française de Développement (AFD) joint financing of construction. However, financing remains subject to approval by their governing bodies and satisfactory legal documentation.

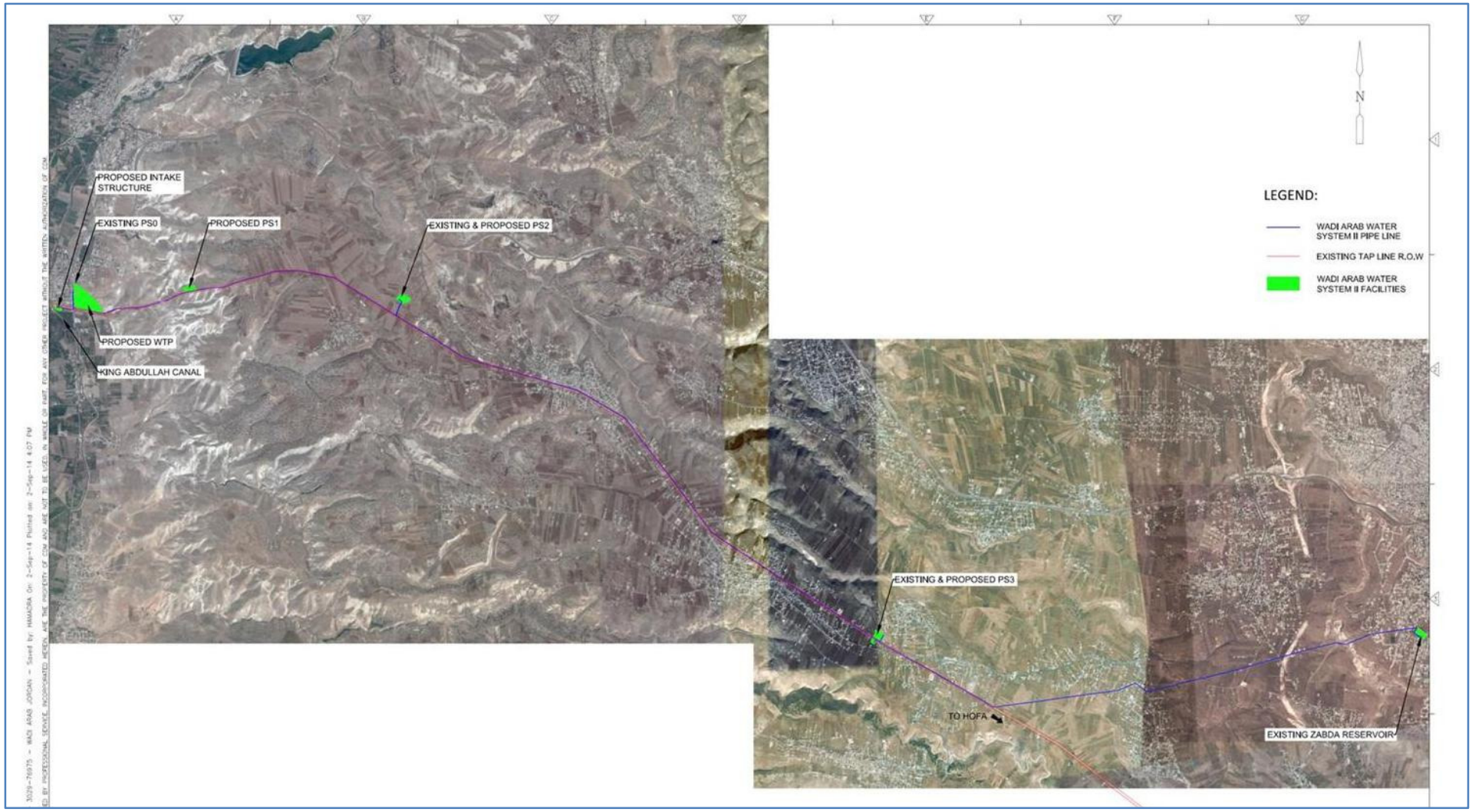


Figure 9: Project Layout

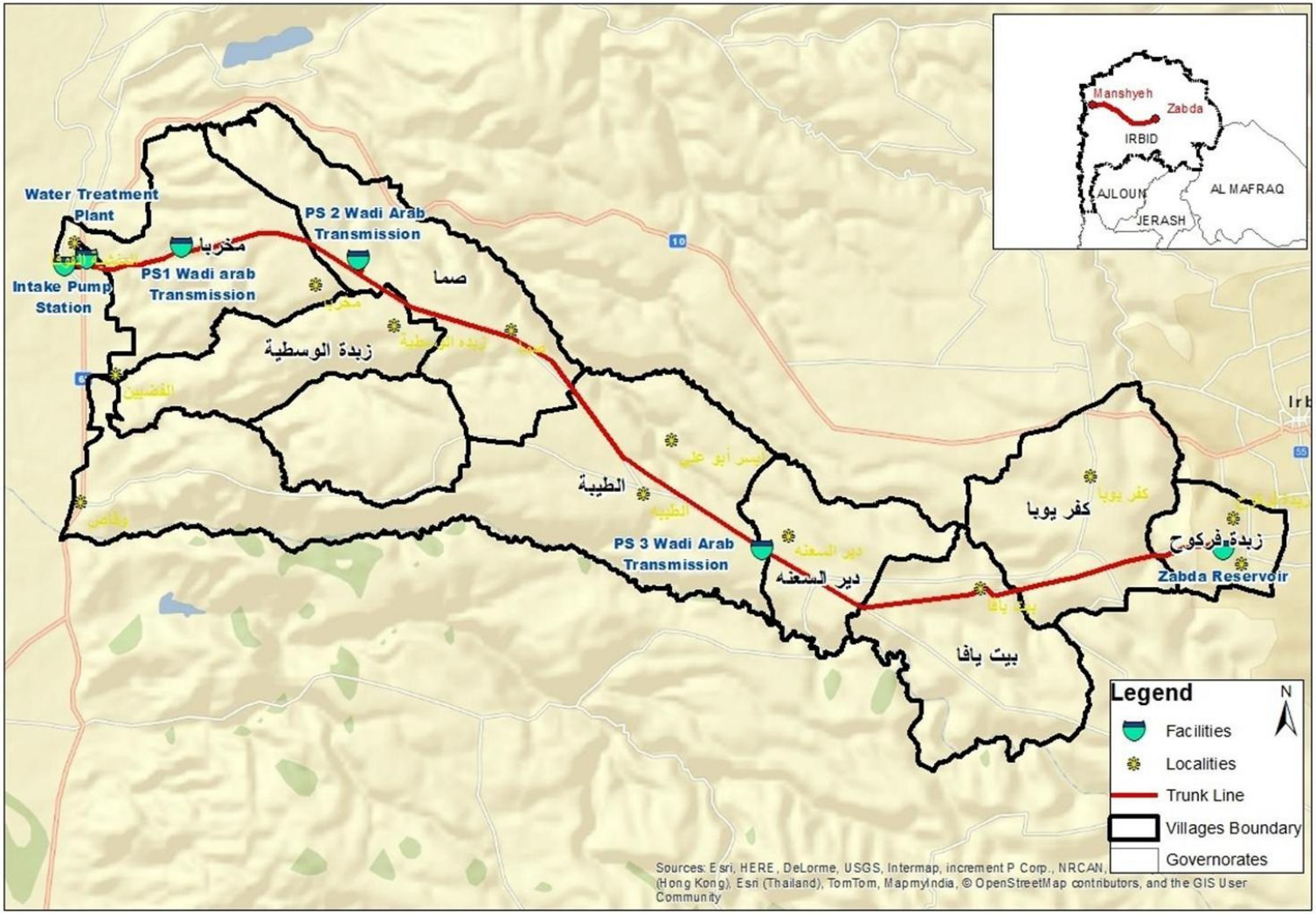


Figure 10 Villages along the Water Transmission Main

2.2 Project Components

2.2.1 Intake, Intake Pump Station and WTP

The new plant will have a design flow of 30 MCM/yr. The Wadi Arab Water System II - WTP comprise the following components:

1. Intake and Intake PS
2. Chlorine Dioxide at Intake PS
3. Coagulant and Aids (both for pre-sedimentation and sedimentation)
4. Pre-sedimentation Basin
5. Chlorine Dioxide – Pre-Sedimentation Basin and/or Sedimentation Basin
6. Ferrous Sulfate
7. Rapid Mix, Flocculation, and Sedimentation Basin
8. Chlorine
9. Dual Media Filters
10. GAC Adsorbers
11. UV Disinfection
12. Clear well, PS0, and Chlorine
13. Post Chlorine
14. Drying Beds
15. Mechanical Dewatering
16. Administration Building
17. Maintenance Building
18. Chemical Building

Figure 11 presents the proposed WTP schematic diagram.

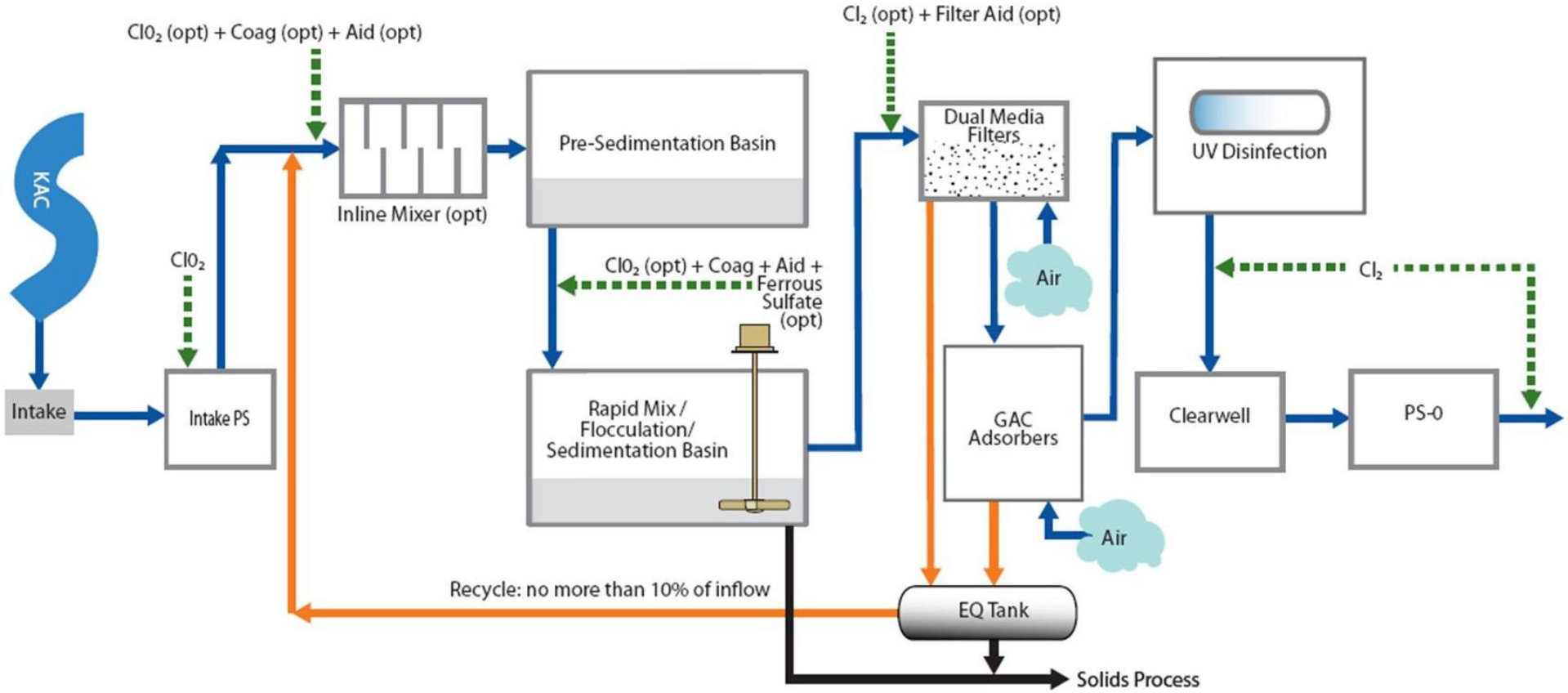


Figure 11: Proposed WTP Schematic

2.2.2 Transmission Pipeline and Pump Stations

The Wadi Arab Water System II transmission system comprises four (4) pump stations and approximately 25.6 km long pipeline. The pipeline size and type has been determined to be Welded Steel Pipe (WSP) with 1000mm in diameter. PS0 is located on the WTP site, PS1 is a new site while PS2 and PS3 are on existing WAJ owned land. PS1 and PS3 will include balancing reservoirs while PS2 will have a blending reservoir for mixing existing Wadi Arab Water System I water with proposed Wadi Arab II water.

Figure 12 presents the schematic diagram for Wadi Arab II water transmission system.

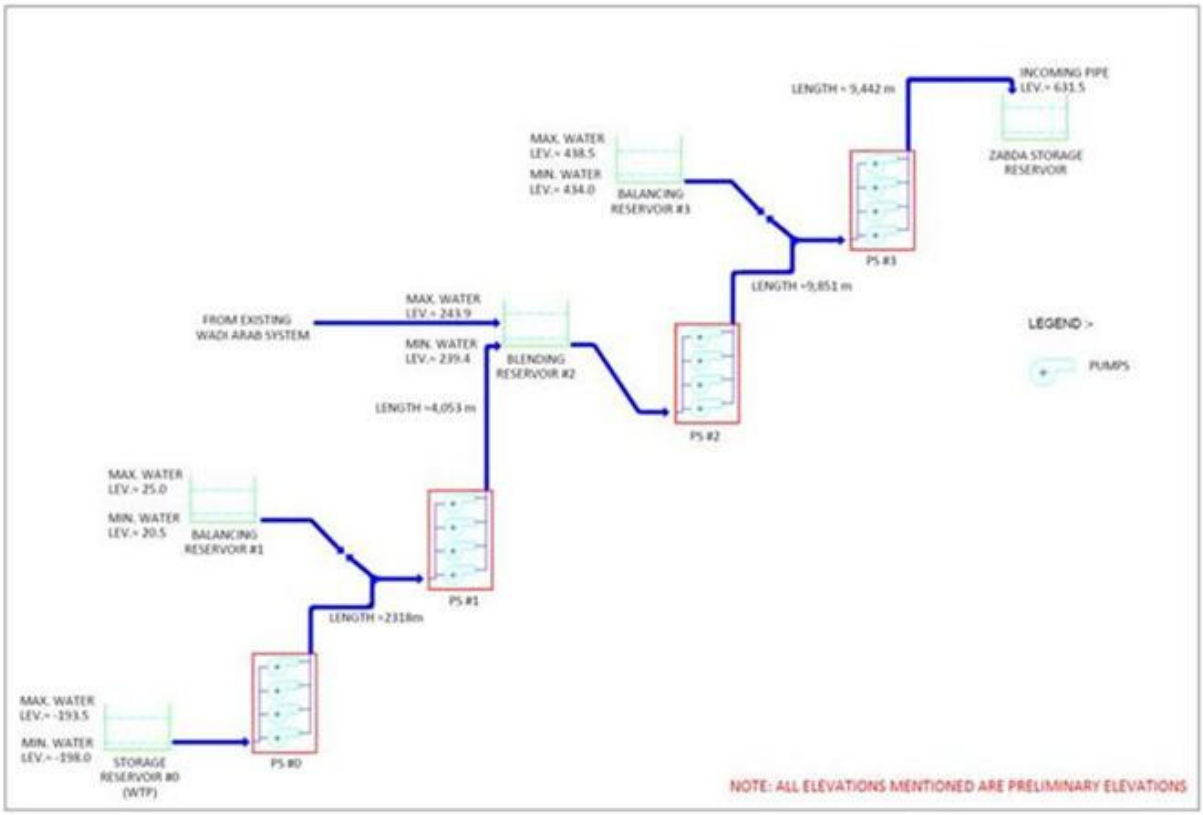


Figure 12: Wadi Arab II – Water Transmission System Schematic

2.3 Nature of Production Processes

2.3.1 Construction Phase

Main Inputs

Construction materials

Civil: cement, several grades of sand, gravel, concrete blocks, bricks, backfilling materials, construction steel, asphalt, etc. Such materials are purchased on the local market and delivered in bulk to the site.

During the construction the contractor will need a supply of water for the construction process as well as a supply of electricity from the electric utility and from generators and a supply diesel for the construction equipment and for lighting of the construction site.

Construction Equipment

All construction equipment will enter the site via the site access road as part of the mobilization or on demand later during construction: large and small cranes, loaders, excavators, concrete mixers, trucks, compactors, forklifts, asphalt laying machines, scaffoldings, construction formworks, water tanks, diesel tanks, etc

Access Roads:

Construction materials and installation equipment for the Intake Pump Station, WTP and PS0 will be delivered into the site via road 65; this road provides access to the Northern Governorates and it also provides access to the Aqaba port to the south where most of the equipment will come from.

For the water transmission pipe line and the pump stations 1, 2 and 3 construction materials and installation equipment will be delivered via the internal roads of the villages along the transmission pipe line; these internal roads are connected to road 10 (that connects Irbid to Northern Jordan Valley); this road is connected also to road 65.

The bearing capability of existing roads should be verified prior to its usage in order to avoid damages to the road's surface and structure.

Electro – Mechanical Materials

The electrical and mechanical equipment will include but not be limited to pipes, fittings, valves, pumps, agitators, mixers, blowers, ducts, vents, high and low voltage cables, earthling equipment, transformers, switch gear, PLC panels, generators, heat exchangers, lighting fixtures, etc. The major electro-mechanical equipment is manufactured abroad and shipped containerized to the site. Trucks will carry the containers from Aqaba port to the site, either directly or with interim storage in an external warehouse. The contractor shall erect a temporary warehouse for the on-site storage.

Labour

The contractor shall confirm whether the staff will be accommodated off site or on site. For the staff accommodated off site, transfer means will be provided from gathering points to the site to minimize the traffic into the site. The number of staff planned for the construction period is presented in **Table 1** below.

Table 1 Planned Number of Staff During Construction Phase

Labour Category	Number of Staff
Daily paid staff (labourers)	250
Operators and drivers	50
Key Staff (Mostly Jordanian Engineers)	30
Total	**380**

Main Outputs

Typical Construction Waste

The main construction waste will result from site clearance, excavation, construction, refurbishment, renovation, demolition and road works.

This mixture of waste materials will be collected as it can be recycled for use in construction and any surplus materials will be transferred to the nearest landfill

Municipal Waste from Workers Camp (if any)

Construction camp waste mainly includes domestic solid waste from offices, restaurants, and septic waste water from baths and kitchens.

Solid waste will be collected in containers to be transferred to the nearest landfill while waste water will be collected in holding tanks to be transferred by tankers to the nearest waste water treatment plant.

2.3.2 Operation Phase

Main Inputs

Raw Water from KAC
As a result of the proposed implementation of the Red Sea-Dead Sea/Phase I swap agreement 30MCM/year transferred from Lake Tiberius to the King Abdullah Canal (KAC).

Electricity
The electrical design will comply with applicable chapters of the International Code Council (ICC), and the Authority Having Jurisdiction (AHJ).

Human Resources
There will be different levels of technical employees, and workers. The number of staff planned for the operation period is presented in **Table 2**

Main Outputs

Treated Water
30MCM/year Complies with JISM Jordan Water Quality Standards (JWQS) (2008), and WHO Guidelines for Drinking-Water Quality" fourth edition (2011)

Dried WTP Sludge

Average Sludge Quantities will be 21,700 kg/day, the material will be sand, silt clay and some organic material with a high iron content due to the use of ferric sulfate as the coagulant.

Table 2: Planned number of Staff During Operation Phase

Staff Category	No. of Staff	Job Description
Managers	1	- Wadi Arab Water System II Manager
Unit Heads	1	- WTP operations
	1	- Facility Maintenance
	1	- Water Quality
	1	- Pump Station operations
	1	- Administration
Engineers	3	- WTP
	3	- Intake PS and PS1,2,3
	3	- Laboratory – Chemical/Process
	3	- Laboratory – Microbiology
	4	- Maintenance – Electrical and Mechanical
Administrative Staff	8	- Administrative
Technicians, Operators and Drivers	12	- WTP technicians
	5	- Lab technicians
	6	- Intake PS and PS1,2,3 technicians
	6	- WTP operators
	6	- Intake PS and PS1,2,3 operators
	12	- Drivers
	6	- Maintenance technicians, mechanics
Assistants and Watchmen	12	- WTP and Lab assistants and laborers
	6	- Intake PS and PS1,2,3 assistants and laborers
	5	- Watchmen
Total	**106**	

2.4 Rapid Field Diagnosis

The study team conducted two site visits; the first Visit on: 4 March, 2015 with Al Yarmouk Water Company representative Eng. Rani Abu AL Haj. During the visit, the team had visited all components of the project including the existing pump stations, pipeline route, and the area specified for the WTP.

The second Visit was conducted on 15 March, 2015 together with the:

- Two Biodiversity Specialists
- Socioeconomic Specialist
- Archaeological and Historical Building Specialist
- Two Environmental Engineers

The study team investigated the project area and the surrounding zone; some sections of the pipeline route could not be reached by car (Wadi area) and was assessed on foot. **Figure 13** below presents some photos taken during the site visit.

Figure 13: Photos of the Site

The situation of project area and surroundings has been assessed and documented through photos and GPS points. The project area including some photos along the route is presented in **Figure 14** to **Figure 18** from Manshyeh to Zabda reservoir.

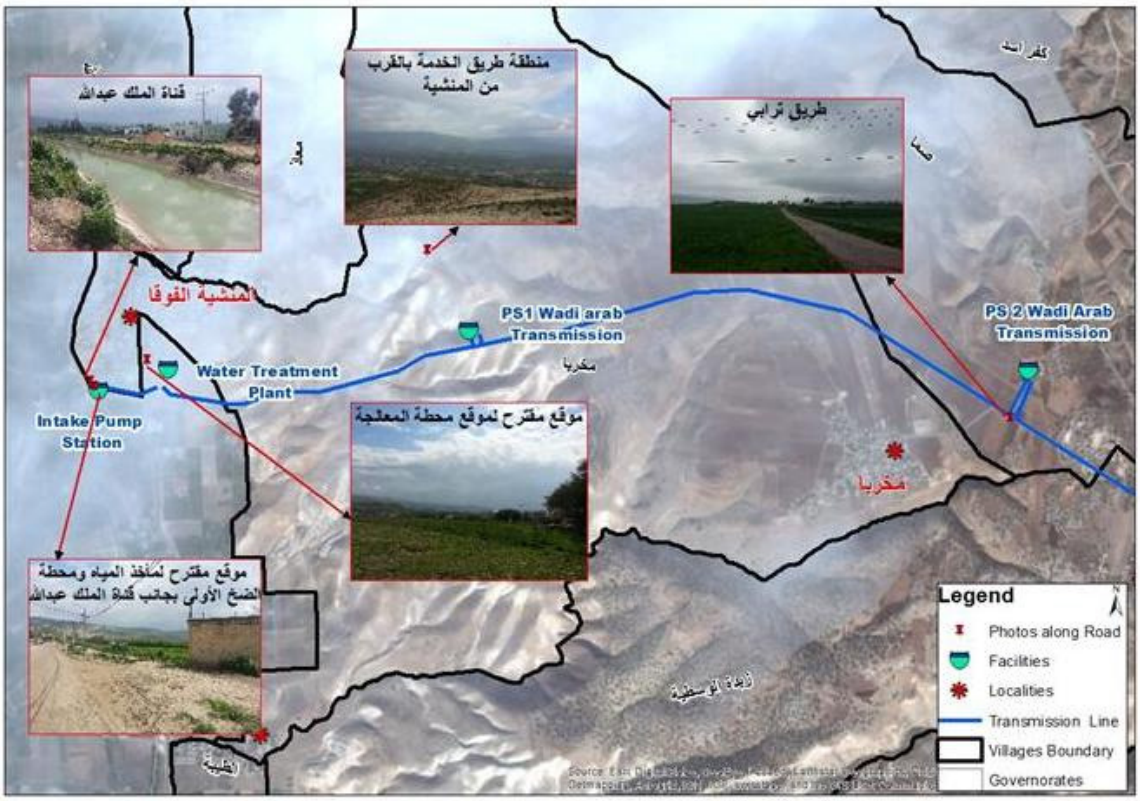


Figure 14: Proposed Intake, WTP, and PS0, 1, 2 Manshyeh- Mekhraba area

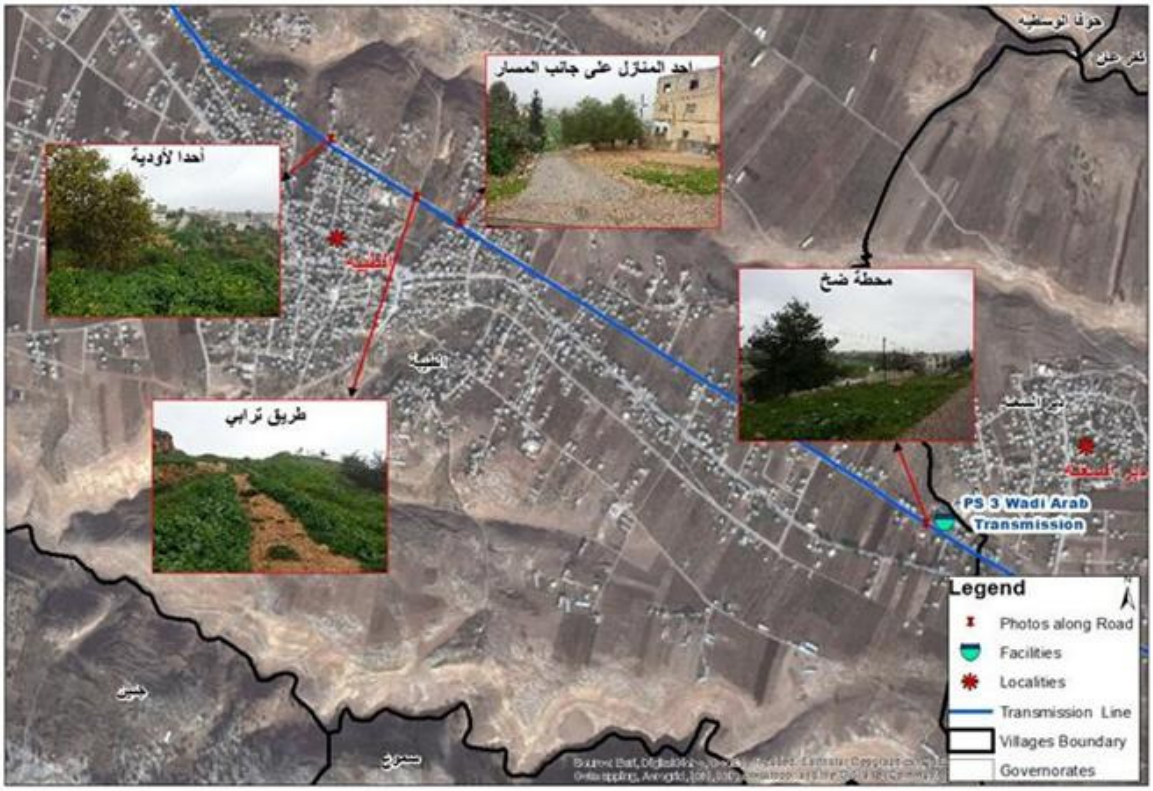


Figure 15: Transmission main and PS3 in Deir Al Se'neh Area

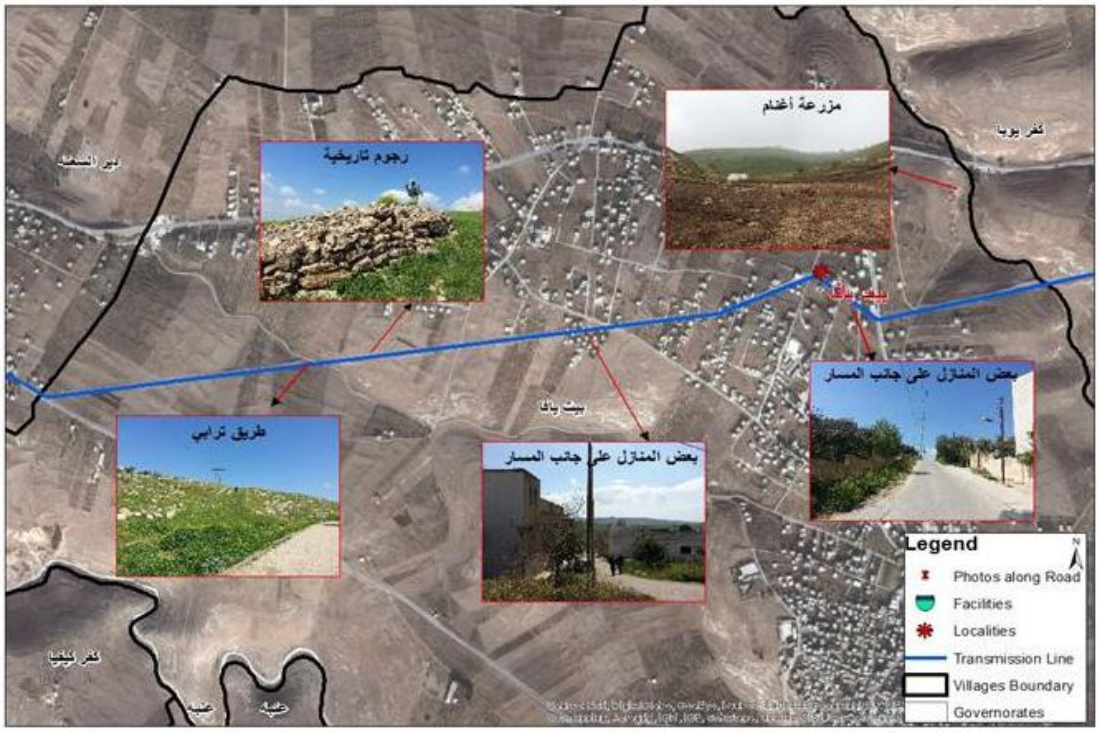


Figure 16: Transmission main in Bayt Yafa- Kafr Youba

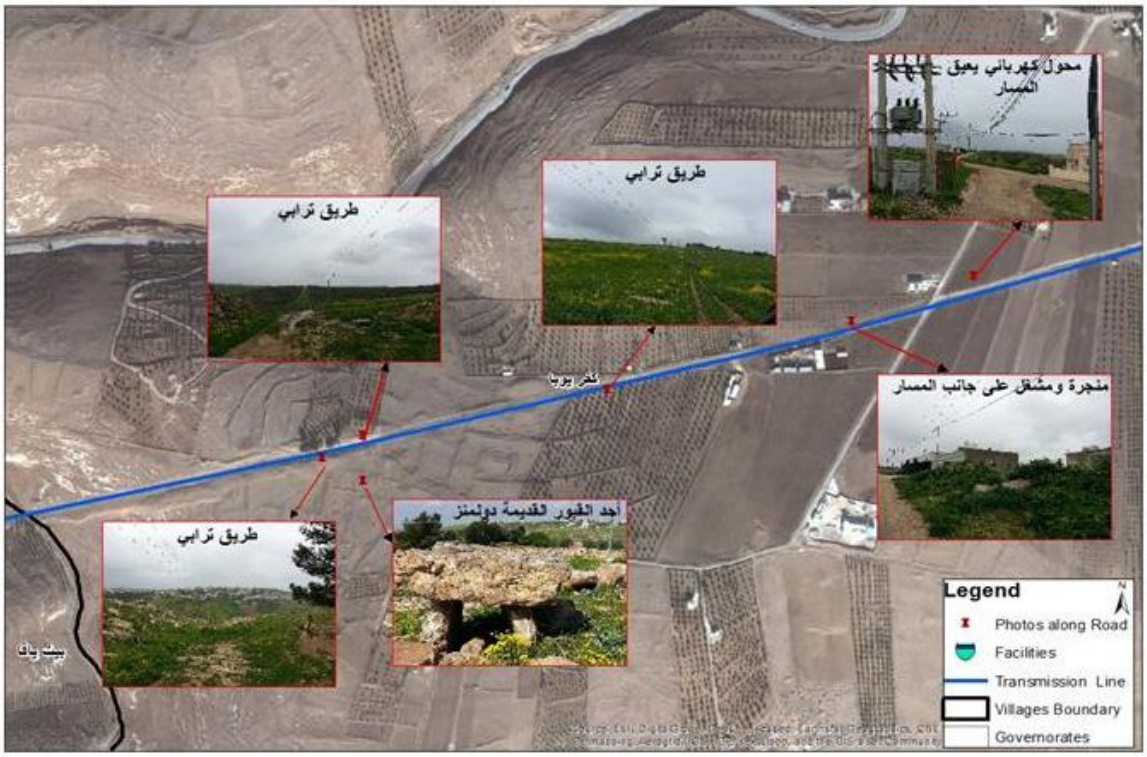


Figure 17: Transmission main in Kafr Youba Village

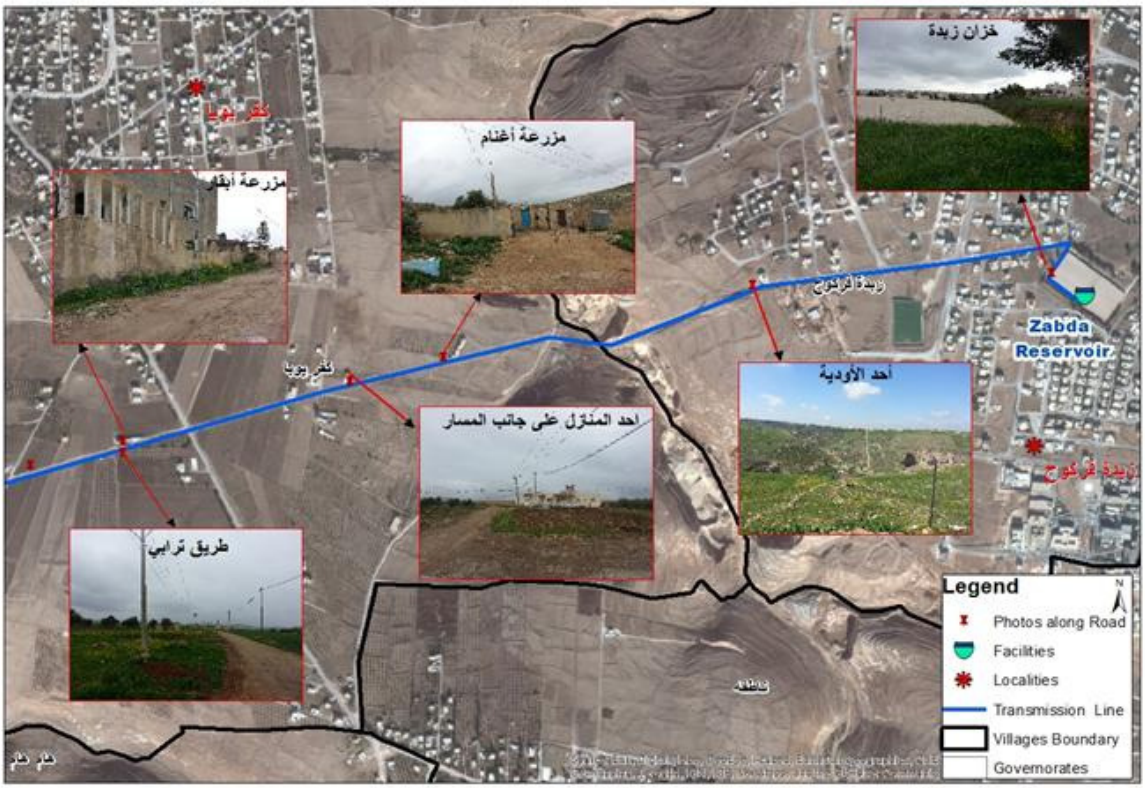


Figure 18: Transmission main in Kafr Youba Village- Zabda Reservoir

Field visits to the proposed project "Wadi Arab Water System II" was conducted where the team investigated the proposed pipeline alignment to survey main habitats and associated flora and fauna across the alignment. The baseline section provides detailed information regarding the conditions in the project area.

The Consultant has visited the location proposed for Intake PS and WTP (**Figure 19**), pump stations, and service road to be established. The status of these areas has been documented for future assessment.

WTP and PS0 Proposed location

Intake PS Proposed location

Figure 19: Proposed Sites of the WTP and PS0 and the Intake PS

3 LEGISLATIVE AND REGULATORY CONSIDERATIONS

Legal requirements have been reviewed and applicable laws and regulations have been identified and summarized in this section. The following national legal requirements have been identified:

Laws

- Environment Protection Law No. (52) for the year 2006
- Water Authority Law No. 18 for the year 1988
- Ministry of Agriculture Law No. 44 for the year 2002
- Natural resources Authority Laws 2002
- Public Heath Law No. 47 for the year 2008
- Civil Defence Law No. (18) for the year 1999
- Traffic Law No. (49) for the year 2008
- Labour Law No. (8) for the year 1996
- Anti Trafficking Law No. (9) of the year 2009
- Antiquities Law No. (21) for the year 1988, and its amendments year 2004
- Acquisition Law (Expropriation), No. 12, year 1987

Regulations

- ESIA Regulation No. 37 for the year 2005
- Air Quality Protection Regulation No. 28 of the year 2005
- Regulation No. 24 of the year for the Management of Hazardous and Dangerous Materials
- Regulation No. 27 for the year 2005 for the Management of Solid Waste
- Underground Water Regulation No. 85 of 2002

Instructions

- Noise Level Control Instructions for the year 2003
- Instruction for the Limitation and Control of Noise for the year 2003
- Instructions for the Management and Handling of Hazardous Waste of the year 2003.
- Instructions for Recycling and Handling of Consumed Oils of the year 2003.
- Instructions for the Limitation and Control of Noise for the year 2003.

Standards

- Ambient Air Quality Standards No. 1140/2006
- Water Quality Standards (JWQS) (2008)
- JISM Jordanian Standards for Treated Sludge and Sludge Disposal, JS 1145 (2006)
- Standards for the prevention and elimination of noise (2003).
- Standard for the Maximum Allowable Limits of Air Pollutants Emitted from Stationary Sources (JS 1189/1998).

Agreements

- **Implementation of Phase I-RSDS Project- Desalination at Aqaba**

Other policies, guidelines

It is requested to have the ESIA prepared in compliance with:

- Environmental and Social Handbook version 9.0 of 02/12/2013, for the Environmental Investment Bank (EIB)

3.1 Laws

The primary environmental legislation is Law No. 12 of 1995 which has been substituted by the Interim Law No. 1 of 2003 and consequently by Law No. 52 of 2006. Environmental legislation forms the backbone of environment protection in Jordan. Jordanian government had issued a number of laws and regulations covering almost all aspects of environmental protection relevant to any developmental activity in Jordan. An overview of the most relevant laws is presented below:

Environmental Law No. 52 for the year 2006

In view of the issuance of the Royal decree with regard establishing the Ministry of Environment, the Interim Law **No. (1) For the year 2003 (Interim Environment Protection Law)** was established to replace the Environment Protection Law No. (12) from the year 1995, and consequently, the cancelling of the Environment Protection Corporation, to be replaced by the Ministry in order to realize the following purposes:

- To consider the Ministry of Environment, the Competent Authority with all that related to the environment Protection and the issues related to same at the national, regional and international level.
- To protect the environment and promote all its elements such as water, air and land in a sustainable manner, as well as to monitor the measuring of these elements and their components.
- To authorize (license) to non government bodies, working in the environment protection domain.
- To coordinate the national efforts aimed at the environment protection, through setting a national strategy for the awareness, education and the environmental connection.
- To prohibit the admission of harmful & hazardous substances, a way or embedding them in the Kingdom's lands.
- To promote the relations between the Kingdom, and the countries, and the Arab, regional and International societies and organizations in the environmental matters, and to strive to implement the agreements related to the environment affairs.
- To establish an advisory body of persons with experience & competence and from the bodies concerned with the environment in order to submit their suggestions to the Minister.
- To set the deterrent penalties with regard to any who causes harm to the environment

  In accordance with this law, the following systems were issued:

  - Nature protection system.

- The system of environment protection from pollution in cases of emergency.
- Water protection system.
- Air protection system
- Marine and coastal protection environment system.
- Natural (reservation) places and public parks system.
- The management of harmful and dangerous materials, its transfer, and handling system.
- The management system of solid waste.
- The evaluating system for environment impact.
- Soil protection system.
- Fees and wages system.

In 2005 and in the field of legislations, 8 Regulations (The Jordanian Environmental Impact Assessment Regulation No. (37) for the year 2005) were issued as per the provisions of the Environmental Protection 'Interim' Law No. 1 for 2003:

- Protecting the Environment from Pollution in Emergency Situations Regulation.
- Air Protection Regulation
- Soil Protection Regulation
- Protection of Marine environment and Seacoasts Regulation
- Natural Reserves and National Parks Regulation
- Management and Circulation of Hazardous and Harmful Substances Regulation
- Solid Waste Management Regulation
- Environmental Impact Assessment Regulation
- Water Protection Regulation (in the pipeline)

In 2006, the interim law No. (1) for the year 2003 was replaced by the Environmental Law No. 52 for the year 2006 with no major changes on the main articles except for issuance of the necessary Regulations for the Environmental Protection Fund.

Water Authority Law No (18) for the year 1988

The Water Authority of Jordan (WAJ) in charge of water and sanitation service provision directly or through public companies that it owns. WAJ is also responsible, together with the Ministry of Water and Irrigation, for water resources planning and monitoring. WAJ also regulates water abstraction by all users, including itself, by issuing licenses.

Agriculture Law No (44) for the year 2002

Ministry of Agriculture is in charge for developing and organizing the agricultural sector to achieve its goals by prohibition of the abuse of forestland or pastureland by removing or vandalizing its signs and fences, throwing debris, dumping solid or liquid waste, or any other contaminated materials. As stipulated by the law everyone who is in violation encounter imprisonment and fine penalty.

- Natural resources Authority Laws 2002

The Law of Public Health No. (47), 2008

The Law stipulates (Article 51): The Ministry of Health supervises the water of sewage system and the sewage system networks and the internal installations and the refinement stations in coordination with other concerned Departments, and according to its own legislations, in order to ensure the presence of health standards and conditions, so that no harm could reach the public health.

Labour Law No. 8 of 1996 and its amendments

Jordanian Labour law number (8) was issued in 1996 to regulate the relationship between the Employer and the Employee, which means that any contract or any term in any contract between both parties that contradicts the labour law is considered invalid. Employment contracts can be limited or unlimited contracts, the law has specified the specific conditions for each.

According to labour law, it is not allowed to employ any foreigner workers without prior consent from the Ministry of Labour. The work permit should not exceed one year and can be renewed for extra years.

Acquisition Law, No. 12, year 1987

Land acquisition is undertaken in accordance with decree (12) of 1987 referred to as the land Acquisition law (LaL) and in accordance to its amendments. The LaL applies in all cases of land acquisition in the kingdom of Jordan.

Conditions for land acquisitions:

Article 3 and article 9 of the LaL stated the two main conditions under which land can be expropriated:

- no land can be taken away unless it is for public benefit and that there is fair and just compensation for any PAPS –
- Article 3 of the LaL the law requires direct negotiation between the purchasers or public benefit project and land owners until agreement is reached –
- Article 9 of LaL. In the event that Agreement cannot be found between the two parties' cases are referred to the primary Court that has jurisdiction in this area and to higher courts if necessary.

Compensation for expropriated land

Article 10 of LaL states compensation should be fair to both PAP owners and tenants. Owners should be compensated for their properties including (e.g., buildings, improvements, trees) at full replacement cost.

Compensation principles

Articles 11-26 of the LaL lists the following key principles and stages under which compensation shall be processed:

- setting the proper amount of compensation for land value is dependent on:
    - The amount of land confiscated,
    - The purpose of confiscation,

- The percentage of land confiscated and,
- The status and size of the leftover land.

- The land owner is responsible for paying any previous taxes on the property concerned prior to compensation.
- upon final agreement reached on compensation amount, approval and authentication By the directorate of land followed by an authentication of the cabinet is required,
- The relevant party or the public benefit project is required to pay the compensation to the land owner directly or deposited the full compensation amount in the treasury under the beneficiary name within three months.

  Non-payment results in a 9% annual interest being added to the compensation starting the day after the three months period.

3.2 EIB Environmental and Social Standards

EIB Environmental and Social Principals and Standards are presented in the EIB Statement of Environmental and Social Principals and Standards for the year 2009, and are elaborated and explained in the European Investment Bank Environmental and Social Handbook (2013). EIB social standards are:

- Standard No. (1): Assessment and management of environmental and social impacts and risks
- Standard No. (2): Pollution prevention and abatement
- Standard No. (3): Biodiversity and ecosystems
- Standard No. (4): Climate-related standards
- Standard No. (5): Cultural heritage
- Standard No. (6): Involuntary Resettlement
- Standard No. (7): Rights And Interests Of Vulnerable Groups
- Standard No. (8): Labour Standards
- Standard No. (9): Occupational And Public Health, Safety And Security
- Standard No. (10): Stakeholder Engagement

EIB social standards aim to "*protect the rights and enhance the livelihoods of people directly and indirectly affected by projects financed by the EIB*" (EIB, 2009). Outcomes expected and targeted from the enforcement and implementation of these standards are oriented toward the benefit of individual well-being, social inclusion and sustainable communities.

EIB social standards pays particular attention to the rights and interests of vulnerable groups. It provides clear basis for assessment of vulnerability and the main vulnerable groups (e.g. women, people with disabilities, indigenous communities, ethnic groups, etc.)

Practices and procedures respective to the implementation of the EIB Standards are explained in the second volume of the EIB Environmental and Social Handbook (2013). These procedures provide detailed elaboration on the objectives to achieve, means (framework and tools) of achieving the objectives and procedures to fully comply with the set-forth standards.

It is worth mentioning that the above standards are based on the principles of the Charter of the Fundamental Rights of the European Union and international good practices and it addresses all obligations and requirements of respective social and human right international conventions and agreements. These standards also exhibit correspondence with the principals of the World Bank operational policies and the IFC performance standards, as can be noted from the presentation below of EIB and IFC standards.

- Standard No. (1): Assessment and management of environmental and social impacts and risks

The first standard underscores the importance of managing environmental and social impacts and risks throughout the life of an EIB project through the application of the precautionary principle. The standard's requirements allow for the development of an effective environmental and social management and reporting system that is objective and encourages continual improvements and developments. The standard includes requirements for stakeholder engagement and disclosure throughout the life of the project

- Standard No. (2): Pollution prevention and abatement

The objective of the second standard is to avoid and minimize pollution from EIB-supported operations. It outlines a project-level approach to resource efficiency and pollution prevention and control in line with best available techniques and internationally disseminated practices.

- Standard No. (3):Biodiversity and ecosystems

The EIB acknowledges the intrinsic value of biodiversity and that its operations may have a potential impact on biodiversity and ecosystems. This standard outlines the approach and measures the promoter has to take to protect and conserve all levels of biodiversity. The standard applies to all habitats (marine and terrestrial) whether or not previously disturbed or legally protected. It focuses on major threats and supports the sustainable use of renewable natural resources and the equitable sharing of benefits from the project's use of natural resources

- Standard No. (4):Climate-related standards

EIB financing as a whole is aligned with EU climate policies, which should be taken into account at all stages of the project cycle, in particular regarding the assessment of the economic cost of greenhouse gas emissions and the climate vulnerability context. Specifically, project promoters must ensure that all projects comply with appropriate national and, where applicable, EU legal requirements, including multilateral agreements, related to climate change policy.

- Standard No. (5):Cultural heritage

Through its projects, the EIB recognizes the central role of cultural heritage within individual and collective identity, in supporting sustainable development and in promoting cultural diversity. Consistent with the applicable international conventions and declarations, this standard aims at the identification, management and protection of tangible and intangible cultural heritage that may be affected by project activities. It emphasizes the need for the implementation of a "chance-find procedure", which outlines the actions to be taken if previously unknown cultural heritage is encountered.

- Standard No. (6): Involuntary Resettlement

This standard concerns projects likely to require "*land acquisition, expropriation and/or restrictions on land use, resulting in the temporary or permanent resettlement of people from their original places of residence or their economic activities or subsistence practices*" (EIB,

2013). More specifically, this concerns acquisition, expropriation and/or restrictions of land owned or being actively used by persons and communities (affected people) who do not have the choice to refuse such displacement (physical or economic). The process of such an action (i.e. displacement) this process is known as *involuntary resettlement.*

The objectives of this Standard are to:

- Avoid or, at least minimize, project-induced resettlement whenever feasible by exploring alternative project designs;
- Avoid and/or prevent forced evictions and provide effective remedy to minimize their negative impacts should prevention fail;
- Ensure that any eviction which may be exceptionally required is carried out lawfully, respects the rights to life, dignity, liberty and security of those affected who must have access to an effective remedy against arbitrary evictions;
- Respect individuals', groups' and communities' right to adequate housing and to an adequate standard of living, as well as other rights that may be impacted by resettlement;
- Respect right to property of all affected people and communities and mitigate any adverse impacts arising from their loss of assets, or access to assets and/or restrictions of land use, whether temporary or permanent, direct or indirect, partial or in their totality. Assist all displaced persons to improve, or at least restore, their former livelihoods and living standards and adequately compensate for incurred losses, regardless of the character of existing land tenure arrangements (including title holders and those without the title) or income-earning and subsistence strategies;
- Uphold the right to adequate housing, promoting security of tenure at resettlement sites;
- Ensure that resettlement measures are designed and implemented through the informed and meaningful consultation and participation of the project-affected people throughout the resettlement process; and,
- Give particular attention to vulnerable groups, including women and minorities, who may require
- Special assistance and whose participation should be vigilantly promoted.

❖ Standard No. (7): Rights And Interests Of Vulnerable Groups

This standard "*sets out to avoid or minimize, or otherwise mitigate and remedy, potential harmful effects of EIB operations to vulnerable individuals and groups whilst seeking that these populations duly benefit from such operations*" (EIB, 2013).

The specific objectives of this standard are to:

- Affirm, respect, and protect the rights and interests of vulnerable individuals and groups within the designated operational scope, throughout the project lifecycle. Such rights include the right to non-discrimination, the right to equal treatment between women and men and the rights of indigenous peoples;
- Adopt a gender-sensitive approach to the management of environmental and social impacts, that takes into account the rights and interests of women and girls, men and boys, including specific attention to the differentiated burden of impacts that women and girls might face;

- Identify and avoid adverse impacts of EIB operations on the lives and livelihoods of vulnerable individuals and groups, including women and girls, minorities and indigenous peoples. Where avoidance is not feasible, to reduce, minimize, mitigate or effectively remedy impacts;
- Ensure that vulnerable individuals and groups are duly and early on identified in EIB operations and that engagement is meaningful, taking into account individuals' and communities' specificities, and delivered in an appropriate form, manner and language; and
- Enable vulnerable groups, including women and girls, minorities and indigenous peoples to benefit from EIB-financed operations.

❖ Standard No. (8): LABOUR STANDARDS

This standard seek to protect and support the fundamental rights of workers in EIB-financed operations through ensuring promoter respects the Core Labour standards of the International Labour Organization (ILO), as well as at promoting the relevant rights under the UN Guiding Principles on Business and Human Rights for the project to be financed and through the project entire lifecycle.

The specific objectives of these standards are to:

- Foster and realize non-discrimination and fair and equal treatment and opportunity at work;
- Promote the freedom of association and collective bargaining;
- Ensure, develop and maintain a sound worker-management relationship;
- Promote compliance with national labour and employment laws and with internationally recognised labour standards as defined by the ILO, particularly its Core Labour Standards (as defined in the following section of these standards). Standards regarding health and safety provisions are specifically dealt with in Standard 9;
- Protect workers, including vulnerable categories (such as migrants, indigenous peoples or illiterate workers)26 and workers engaged by promoters' primary contractors and first-tier/direct suppliers, from unacceptable forms of labour and employment practices, exploitation and violation of the core labour rights; and,
- Avoid the use of forced and child labour.

❖ Standard No. (9): Occupational And Public Health, Safety And Security

This standard aims to protect and secure public and occupational health, safety and security and promote dignity of workers and citizens affected by EIB operations. The specific objectives of this standard are to:

- Promote and protect the health and safety of employees at work throughout the project life cycle by ensuring safe, healthy, hygienic and secure working and accommodation conditions and, effectively, a working environment that respects and safeguards the right to privacy, and when appropriate, to the enjoyment of the highest attainable standard of physical and mental health of workers and their families(e.g. in workers accommodation);
- Ensure that promoters duly anticipate, avoid or minimise, and effectively mitigate risks and adverse impacts to the health and safety of host communities within the project's determined area of influence (including all associated facilities) as well as end users, during both construction and operation phases;

- Help promote public health and safety across the project's area of influence by inter alia supporting and promoting programmes which aim at preventing the spread of major communicable diseases;
- Ensure the provision of private or public security to protect the project's workers and assets consistent with international human rights standards and principles; and
- Ensure effective access to grievance mechanism and recourse to remedy for all project workers and members of the public in cases of violations of their rights falling within the scope of the present Standard.

❖ Standard No. (10): Stakeholder Engagement

This standard provides "*systematic approach to stakeholder engagement that the promoter is expected to build and maintain by way of a constructive relationship with relevant stakeholders*" (EIB, 2013). This approach constitutes stakeholder analysis and engagement planning, timely disclosure and dissemination of/access to information, public consultations and stakeholder participation, and a mechanism ensuring access to grievance and remedy.

The specific objectives arising there from for the promoter amount to:

- Establish and maintain a constructive dialogue between the promoter, the affected communities and other interested parties throughout the project life cycle;
- Ensure that all stakeholders are properly identified and engaged;
- Engage stakeholders in the disclosure process, engagement and consultations in an appropriate and effective manner throughout the project lifecycle, in line with the principles of public participation, non-discrimination and transparency;
- Ensure that the relevant stakeholders, including commonly marginalised groups on account of gender, poverty, educational profile and other elements of social vulnerability, are given equal opportunity and possibility to voice their opinions and concerns, and that these are accounted for in the project decision-making; and,
- Duly verify and assess that the quality and process of engagement undertaken by third parties on the project conform to the provisions included in the present standard.

4 ESIA SCOPING PROCESS AND FINDINGS

4.1 Scoping Objectives

The Jordanian ESIA regulation number (37) of the year 2005 and the EIB Guidelines for Environment and Social Assessment require the consultation with all related project stakeholders in order to identify valued environmental and social components to be addressed in the ESIA study (scope). The ESIA will assess significance of the anticipated impacts of the proposed project (activities) on each identified component. The scoping process for this project was launched in March 2015, and it aims to:

- Ensuring that inputs of stakeholders as well as experts in the field are not overlooked and are affirmed.
- Ensuring coordination with related governmental bodies in compliance with the ESIA procedures.
- Identifying stakeholders and interest groups, environmental issues of concern and assessing their significance. These include issues raised by related governmental organizations, non-governmental organizations (NGO's), civil society organizations and the identified Project Affected People (PAP's).
- Identifying legal environmental requirements and obligations by the project through its life cycle.
- Identifying relevant component studies to establish the baseline for the conditions of the area of the project.
- Finalizing the ESIA terms of references (TORs).

4.2 Scoping Methodology

The adopted scoping methodology included three main activities:

1. Pre-scoping preparations
2. Conducting the scoping session
3. Reporting on the scoping findings

4.3 Pre-Scoping Preparations

The preparations for the scoping session help formulate a preliminary understanding and reference material on the project and its processes as well as the issues that would likely be considered in the Environmental and Social Impact Assessment (ESIA). The pre-scoping activities included:

1. Technical meetings with the Project Key Stakeholders to establish a better understanding of the nature and scale of the proposed project
2. Site visits to the proposed project immediate action area and its surroundings
3. Preparation of technical material describing the proposed project, project components and the expected related environmental issues

4. Planning for the scoping session:
    - Preparing the session agenda
    - Recommending a list of participants and discussing it with the Ministry of Environment
    - Production of the scoping session material including a presentation and a summary for distribution
    - Arranging logistics including venue and workshop support tools
    - Extending the invitations to the participants in coordination with the Ministry of Environment

The consulting team conducted site visits to the project area and its surroundings to investigate the local environmental settings, the involved communities and potential Valued Environmental Components (VECs).

Meetings were conducted with the Ministry of Environment, the Project Key Stakeholders and other relevant stakeholders to obtain information and perspective concerning the environmental issues related to the project and to identify other stakeholders to be included in the scoping session.

A list of relevant stakeholders was prepared which included participants from governmental organizations, project key stakeholders (owner, donor and fund manager), non-governmental organizations, and representatives for the local communities living within the project corridor. This list was revised, approved and invited by the Ministry of Environment to participate in the scoping session. The list of invitees is provided in **Appendix 1**. The list of participants and their contact information is provided in **Appendix 2.**

A pre-scoping document that contained the description of the project and a preliminary account of the anticipated environmental aspects to be investigated was prepared and distributed to the key stakeholders prior to the scoping session.

The venue for the session was to be in the same vicinity of the major population centre close to the project area to help assure adequate representation and attendance of the local community. ***The Municipality of Greater Irbid*** was selected for the venue for conducting the scoping session.

4.3.1 Conducting the Scoping Session and Findings

The project scoping session was held at the ***Municipality of Greater Irbid*** in Irbid on Tuesday, March 24th, 2015. The agenda of events is presented in Appendix **3**.

The outcomes of the main events are presented below.

Opening, the opening session was chaired by representatives of, Ministry of Water and Irrigation, Ministry of Environment, and the USAID representative.

Background Presentation: the scoping session discussion was started with a background presentation. That was aimed at explaining the scoping process and the objectives of the scoping

session, as well as a description of the project and its items. The first presentation was followed by a discussion session as discussed in the following paragraph. The background presentation was delivered by the ESIA study team (Eng. Mohammed Hawari). **Appendix 4** presents a copy of the presentation in English.

Discussion, a discussion session followed the first presentation to provide further insight and clarifications on various aspects of the project including its objectives, components, activities and design. The outcome of the discussion is summarized below. **Appendix 5** presents a full documentation of the discussion in Arabic Language.

Inquiry/Concern	Response/Comment
Is there any impact of Manshya landfill on the project?	The landfill is 3 km away from the site and should have no effect on the project
What is the Environmental consideration regarding Dogara WWTP	Dogara WWTP will not affect the KAC or any other water resources in the area; the effluent is directly bypassed to irrigation tanks without affecting water resources from Wadi Arab Dam or KAC. Water will be taken from Al Wehda Dam, Tiberius Lake, and some wells.
What is the anticipated impact of the project on the Agricultural activities, especially the water intake will be at KAC	Additional water will be provided to KAC from Tiberius Lake as per SWAP agreement; accordingly, the water provided for agricultural activities should not be affected and will still be the same.
The residents are complaining of previous project at Mu'ath Municipality which is still open till the moment.	This previous project is conducted by the contractor Hussain Ateyah and GITEC is supervising the construction. Usually, the contractor cannot close the trench till testing the pipes and making sure that it is ready for operation.
Currently, there is a shortage in water provided for agricultural activities. Moreover, the water is polluted and undrinkable.	Eng. Sultan from WAJ: Agricultural water will not be touched; these are additional amount for drinking purposes. On the other hand, the water coming from Tiberius Lake is not polluted, and the Jordanian Government will not accept or approve any polluted water. Eng. Mohammed Abbadi from MOH: MOH regularly tests all sources of drinking water and ensures conformity to standards. The records show that water from Tiberius Lake is 100% within Jordanian standards. Eng. Ruba Nemrat from JVA: We ensure that water in Tiberius Lake is within standards, and under continuous monitoring by Control Directorate.

Inquiry/Concern	Response/Comment
Have you worked on Acquisition (if any)?	The Transmission main will follow the TAP line or Wadi Arab I which is owned by WAJ already. Pump stations will be constructed at same location of existing ones. The acquisition will only be needed for WTP, Intake pump, and Pump station no. 1, as well as service road which is 1.2 km. to PS 1

VECS Presentation: The second presentation gave necessary details regarding the Environmental and Social Considerations of the project according to the assessment of study team during their rapid diagnosis visit. The presentations were prepared in a way that can facilitate initiation of the discussion. The presentation was delivered by the ESIA study team (Eng. Rania Al Omari). **Appendix 4** presents a copy of the presentations in English.

Plenary Discussion Session

Plenary discussion was opened for all participants to express their concerns, the Facilitator: Mr. Majdi Salameh encouraged each of the representatives to participate in the discussion session.

Below is a list of main points raised and discussed during the session:

- Storage, handling, safety requirements for chlorine quantities in the WTP
- Noise impacts during construction stage
- Air quality measurements at the WTP site. It was agreed during the session that air quality measurements are not necessary along the transmission line, as the impact per area will be temporary.
- Sludge Management
- Land acquisition for the WTP and PS0, PS1, and the service road
- Public health and safety during construction phase
- Design of the WTP and conformity with Jordan Seismic Code
- Quantities of halogenated Methane
- Procedures for facilitating traffic during construction phase
- Archaeological Chance Finds Procedure of any archaeological or historical site during construction phase.
- Impacts on Biodiversity during construction phase.
- Environmental Monitoring plan during operation phase is required
- Risk of flooding in valley areas during construction of transmission line.

4.4 Conclusion

The main outcome of the scoping session is the Terms of References for the ESIA. This section presents the conclusions and the TOR based on the analysis of the findings, the results of supporting research, and professional opinion. The TOR and scoping report has been approved by Client, EIB, and MoE on 7th May, 2015.

Based on the scoping session, Consultant's rapid field diagnosis, as well as Consultant experience the Valued Environmental Components (VECs) that should be studied through the ESIA have been summarized and rated according to their significance. **Table 3** below presents the VECS and their significance for each phase of the study. The significance of the impacts, as well as residual impact after mitigation have been further qualified in this ESIA report.

Table 3: Results of the Scoping Session

VEC No.	Valued Component	Construction			Operation and Maintenance		
		Significant	Medium significance	Insignificant	Significant	Medium significance	Insignificant
1	**Physical Environment**						
1.1	Water Quantity and Quality			-ve	+ve		
1.2	Air Quality			-ve			Neutral
1.3	Flooding in Wadi Area		-ve				Neutral
1.4	Wastewater From Domestic Use			-ve			-ve
2	**Socio-economic**						
2.1	Noise	-ve					-ve
2.2	Traffic and Transportation		-ve				Neutral
2.3	Public Health and Safety		-ve		+ve		
2.4	Land acquisition and compensation		-ve				Neutral
2.5	Employment	+ve			+ve		
3	**Biodiversity**			-ve			+ve
4	**Archeology , Cultural & Natural Heritage**			-ve			Neutral

VEC No.	Valued Component	Construction			Operation and Maintenance		
		Significant	Medium significance	Insignificant	Significant	Medium significance	Insignificant
5	**Waste hazardous Material Management**						
5.1	Construction Waste		-ve				Neutral
5.2	Sludge Management			Neutral		-ve	
5.3	Chlorine Storage and Handling			Neutral	-ve		
5.4	Halogenated Methane			+ve			+ve

1. (+ve) Positive Impact is predicted
2. (-ve) Negative Impact is predicted
3. (Nutral) No positive or negative impacts predicted.

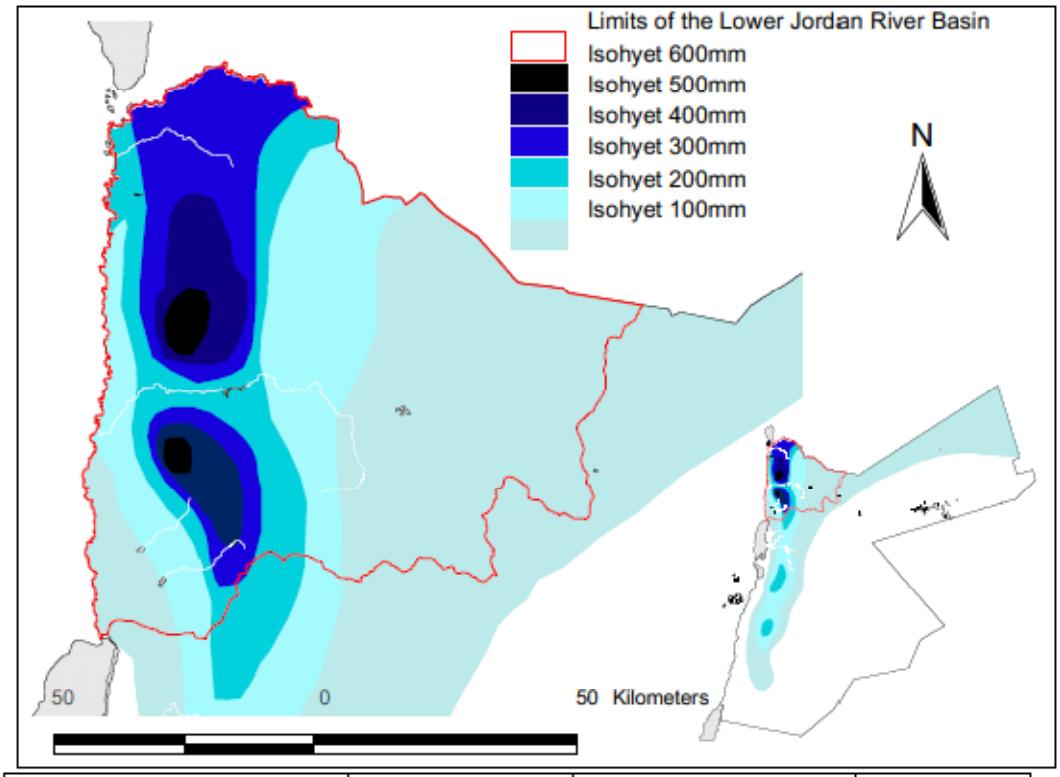
5 ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS

5.1 Physical Environment

5.1.1 Water Resources in Jordan

5.1.1.1 Introduction

The water shortage in Jordan is extremely severe due to the nature of the area and due the transboundary resources, which are shared with neighbourhoods who own same problem. More than 90% of Jordan land receives less than 100 mm per annum of rainfall. This is shown in **Figure 20** below, which is quoted from " Historical Trajectory of a River Basin in the Middle East: the Lower Jordan River Basin (in Jordan)" (Van Aken et al. 2007). The water supply problem becomes greater due to cost of energy required for water conveyance and due to Climate Change impact.



Agro-Climatic Zone	Mean Precipitation (mm)	Agro-Climatic Zone	Mean Precipitation (mm)
Northern Jordan Valley	345	Northern Uplands-South	295
Southern Jordan Valley	220	Transition Area	210
Northern Uplands-North	485	Western Desert	115
Northern Uplands-Transition	415	Average LJRB	293

Figure 20: Rainfall Distribution

5.1.1.2 Projections of Climate Change Impact on Rainfall and Available Water Resources

According to the result of the mean minimum annual temperatures out of "The climate change implication on Jordan: A case study using GIS and Artificial Neural Networks for weather forecasting" (Matouq et al. 2013), it is expected that, in general, the desert region as well as the

central region of Jordan will have a lower minimum temperature. However the Northern Region will keep its mean temperature with very low changes. The mean annual maximum temperature results show an increase in the whole country.

The results show that, for the northern regions, the predicted rainfall (2009–2018) will range between 520 and 630 mm, which is higher than previous decades (1979–1988 and 1989–1998). The central region will have rainfall amounts between 150 mm and 300 mm which are almost the same quantities compared to previous decades 1979–1988 and 1989–1998.

For the deserts regions, the predicted rainfall for the coming years until 2018 will range from 70 to 110 mm. When comparing it with the amount that had fallen in 2009 we can conclude that the rainfall is in a decreasing trend. In some areas, the predicted data showed both decrease and increase at the same time depending on the location. For example, in the north region there will be an increase in total rainfall up to 30 mm, while in the southern region a decrease in total rainfall up to 50 mm is predicted.

The reduction in rainfall due to climate change impact will reduce the available water sources for irrigation for both sources; from outside Jordan and the sources initiated inside the Kingdom. While the sources decrease, the demand is increasing as shown in **Figure 21** below which is quoted from "Jordan Water Sector Facts and Figures 2013" by the Ministry of Water and Irrigation.

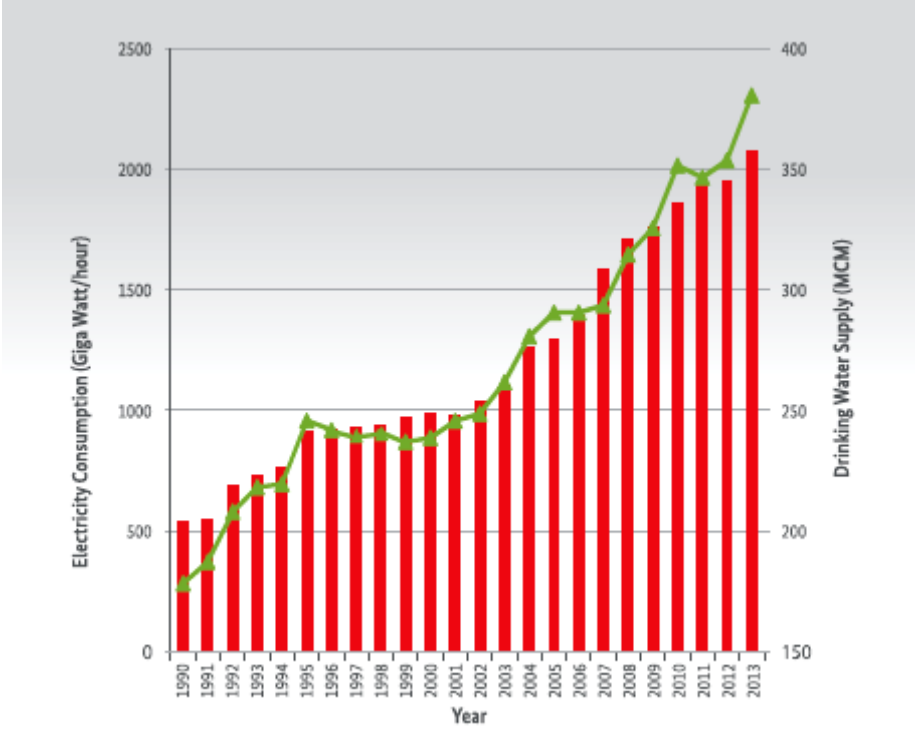


Figure 21: Relation between Source and Demand

Because of the limited available water resources in Jordan, the increase in the domestic water consumption leads to the reduction in the irrigation water consumption. **Table 4** shows the consumption of all sectors for the period between 2000 and 2013 and the two pies figures show the consumption in 2000 and 2013, respectively. Domestic consumption in 2013 is increased by almost 50% to be 42% of the total water resources compared with 29% in year 2000. This increase has an effect on irrigation water supply, which is reduced from 66% in year 2000 to 54% of total consumption in year 2013. The reduced irrigation supply can be partially compensated out of the treated wastewater, which has increased by more than 50% between year 2000 and

year 2013 to be more than 120 MCM in year 2013 compared with less than 80 MCM on year 2000, as shown in the histogram (**Figure 22**) below.

Table 4: Water Uses (2000-2013) (MCM-Million m^3)

Year	Municipal	Industrial	Irrigation	Total Uses
2000	239	37	541	817
2001	246	33	487	766
2002	249	37	517	803
2003	262	36	506	804
2004	281	38	541	860
2005	291	38	603	932
2006	291	38	588	917
2007	294	49	589	932
2008	315	39	574	928
2009	326	37	500	863
2010	352	40	501	893
2011	347	37	515	899
2012	354	33	462	849
2013	381	39	481	902

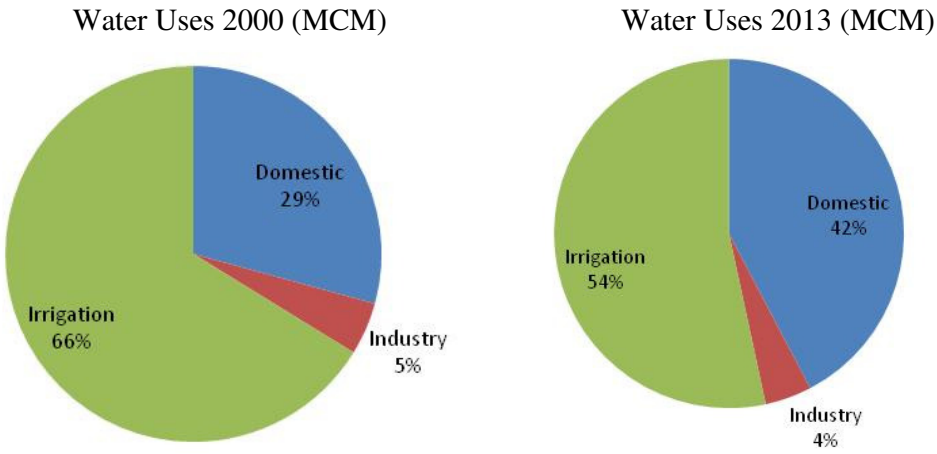


Figure 22: Comparison between Water Uses in Years 2000 and 2013

5.1.1.3 Jordan Water Resources

[Nadhir Al-Ansari1, et.al, Water Supply Network Losses in Jordan, Journal of Water Resource and Protection, vol. 6, pages 83-96, 2014]

The total precipitation amounts to 8.2 km^3 and about 92% of it is lost by evaporation. The country is estimated to be below the water poverty line by 682 million m^3/year. The developed surface water potential was approximately 295 million m^3 in 2007, and is projected to reach 365 million m^3 by 2022 by building new dams and desalination projects.

Jordan relies heavily on its groundwater resources which accounts about 54% of the water supply extracted from 12 groundwater basins (**Figure 23**).

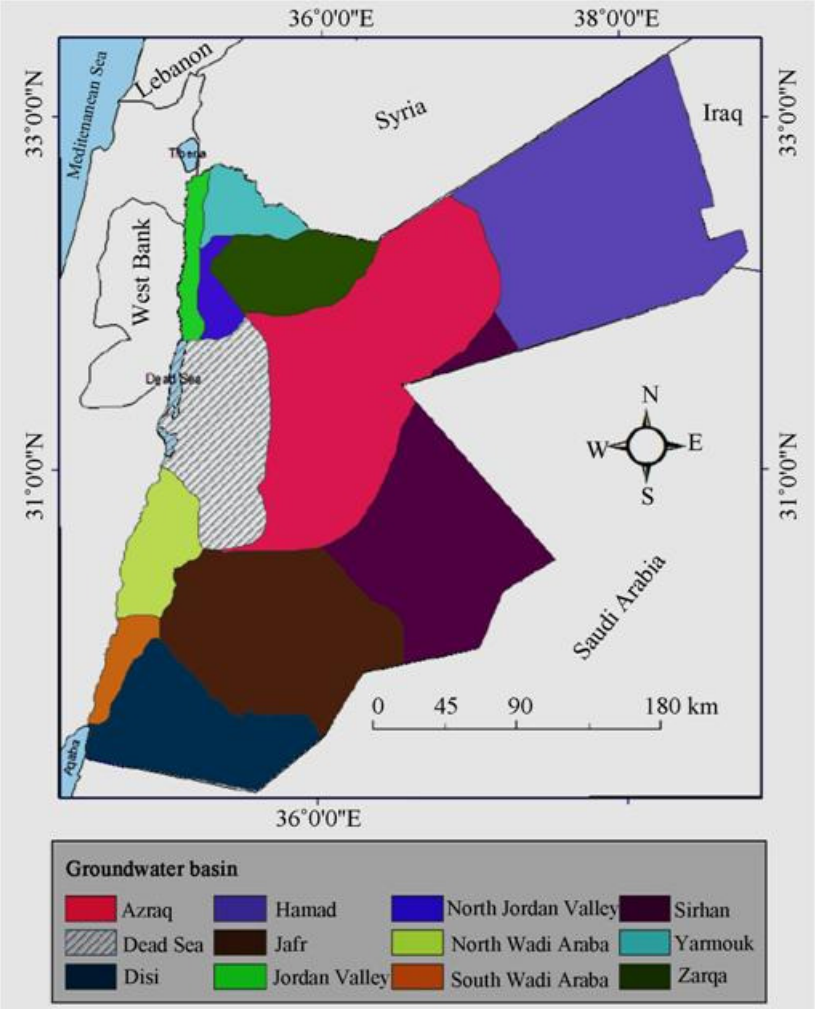


Figure 23: Ground Water Basins in Jordan

Extraction from renewable groundwater resources is estimated at about 450 million m^3/year while the safe yield is estimated at about 275.5 million m^3/year. Extraction of groundwater is beyond sustainable limits causing a deficit of 151 million m^3/year in 2007 as an example.

Surface water resources form about 37% of the total water supply from 16 basins **Figure 24**. Yarmouk accounts for almost 50% of the country's surface water resources.

Other water sources are nonrenewable groundwater (fossil water), treated wastewater (110 million m^3 in 2009) and brackish water. The contribution of treated wastewater is increasing with time where it was only 7 million m^3 in 1984 and increased to about 67 million m^3 in 1996. For these reasons, Jordan is considered to be one of the poorest countries in terms of its water resources.

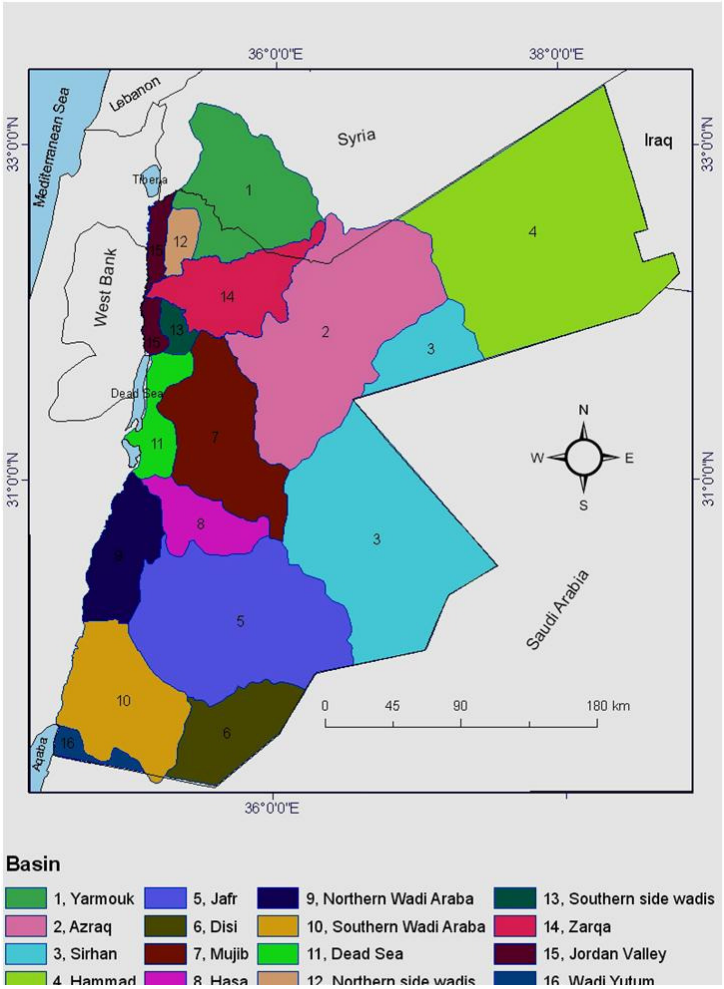


Figure 24: Surface Water Basins in Jordan

5.1.1.4 Water Resources for Northern Jordan

[Jordan - Wadi Al Arab Water Sector PPP (EIB (FEMIP)]

The Northern Jordan comprise of northern Jordan Valley area along with Irbid Governorate, the geophysical nature of the study area is varied, with the city of Irbid located on a plateau at an elevation of around 500m above sea level, whilst the sources of water associated with the study area are generally in the low lying valley areas as low as 200m below sea level. More specifically, the sources of water relevant to the western region of the Irbid Governorate include:

- **Groundwater from the Wadi Al Arab well field**. This is the current major source of potable water for the city of Irbid and these wells are located in the Wadi Al Arab area at the Northern tip of Jordan near the Yarmouk River. The Wadi Al Arab supply is augmented by water supplied from the Manshyeh wells and the Tabaqat Fahel wells in the Jordan valley.

  The existing Wadi Arab Transmission System was developed in the mid-1980s and delivers approximately 20 MCM per year to Irbid (with a possible capacity of 25-28 MCM), carrying water from the Wadi Al Arab, Tabaqat Fahel and Manshyeh well fields to the Zabda Reservoir in Irbid. The two well fields are pumped from below sea level at the Wadi Arab

PS0 pump station, to join the flows from the Wadi Al Arab well field at the Wadi Arab water treatment plant. From here, the flows are pumped successively at 3 booster pump stations PS1, PS2 and PS3 to reach Zabda reservoir in Irbid. The total pumping head from the base of the Jordan valley to Irbid is over 900m. This is the existing Wadi Arab Water System I.

- **Groundwater from the Mukheiba wells located at the Northern boundary of Jordan near the Yarmouk River, at Al-Hamma town**. These artesian wells have been in operation for more than 25 years and water production has varied from 15 to 30 MCM per year. This well field is considered by MWI/WAJ to be a secure and a reliable water source. Currently, flow from this source is discharged into the Mukheiba canal which joins into the King Abdullah Canal (KAC) which supplies irrigation water in the Jordan valley and potable water to Amman (Zai Water Treatment Plant (WTP)).

- **Surface water from Lake Tiberius.** This is a key water source for Jordan and it supplies water into the KAC through the Deganya pipeline. The treaty between Israel and Jordan specifies the quantities and seasonality of the transfers from Lake Tiberius into the KAC.

- **Surface water from the Yarmouk River and the Al Wehdeh Dam.** The Yarmouk River is the primary source of water for the KAC. Water enters the KAC at Adassiya weir on the Yarmouk River. Flows in the Yarmouk River and the amount that Jordan can abstract from the river are controlled by the Al Wehdeh Dam sited on the border between Syria and Jordan. The amounts that Jordan can abstract from the river and the dam are set out in the Yarmouk River water agreements between Syria and Jordan and Israel and Jordan. MWI confirmed that WAJ actively reviews the management of the agreements and that further abstraction from a combination of the sources would be feasible.

- **Treated Wastewater.** The construction of a new MWI project for Wastewater treatment upgrade is in progress and includes the rehabilitation of the existing Central Irbid and the Wadi Arab wastewater treatment plant (WWTP) so that the effluent from these two plants, in addition to the effluent from the newly built Al-Shallalah WWTP, can be reused for irrigation purposes. This project also includes reclaimed water transmission system that brings the treated WW up to the irrigation network bypassing the KAC.

5.1.1.5 Wells Within the Northern Governorates

(National Master Plan for the Jordan River Valley by Royal Haskoning 2015)

The following section provides information on the wells within the Northern Governorates :

- **Well Characteristics.** The third formation B2/A7 from the surface is mostly utilized for groundwater abstraction. The depth of wells ranges from 11 m to 1,183 m with an average depth of 375 m, and the yield of the wells ranges from 6 m3/h to 280 m3/h with an average of 59 m3/h. Information on well depth, and yield in 2012 are given in **Table 5**. The Wadi Al Arab Wells include the Wadi Al Arab, Mansheya and Tabaget Fahel Wells that provide water to the Wadi Arab Water System I.

Table 5: Well Characteristics by Regional Operation Unit (ROU)

ROU	Surface Elevation (m)			Well Depth (m)			Yield in 2012 (m3/h)			Number of Wells
	Max	Min	Ave	Max		Max	Min	Ave	Max	
Wadi Al Arab*	257	-200	-6	1183	11	384	280	25	132	21
Ramtha	590	435	532	680	104	477	80	11	40	14
Irbid	628	200	424	615	286	436	115	8	46	19
Bani-Kinana	480	53	254	750	210	437	80	42	59	8
Bani-Obaid	746	700	716	435	196	350	75	12	40	5
Al Koura	746	180	496	495	192	307	85	38	49	7
North Shouna	50	-165	-89	471	138	246	100	15	45	8
Ajloun	860	215	513	589	397	499	150	8	57	9
Jerash	961	242	625	506	73	230	130	7	52	28
(North) Badia	1050	653	787	622	264	426	90	20	47	27
Mafraq	800	578	640	590	100	360	120	6	45	30
Za'atary*	825	640	738	500	290	387	100	15	57	33

Source: Compiled by the JICAStudy Team using YWC data
Note: *Wadi Al Arab and Za'atary are not the ROU name but the well fields' name.

- **Water Production Amount.** The well production amount in million cubic meters per year (MCM/year) by ROU is shown in **Table 6**.

- **Change of Water Level.** There are 48 observation wells in the northern governorates; Water levels were measured for 40 wells in 2011 and 38 wells in 2012. Water level in wells across the northern governorates is observed to decline by 1.03 m/year. As a result, the water yield has reduced. The amount of water pumped in 2003 is described in the report issued by CDM in 2005. The amount of water pumped in 2012 is observed to be 30 % less in the same wells compared to the pumped amount in 2003. As a countermeasure, YWC has continued to rehabilitate wells and drill new wells to maintain the water production volume at a constant level.

Table 6: Water Yield by ROU in the Northern Governorates

ROU	Water Yield (MCM/y)		
	2011	2012	2013
Wadi Al Arab (mostly for Western Source)	23.36	21.87	22.32
Bani Kinana	1.07	3.10	3.29
North Shouna (mostly for Western Source)	1.08	1.42	1.78
Al Koura	3.11	3.20	3.12
Irbid Qasabat	6.96	5.99	5.97
Ramtha	2.41	2.21	1.99
Bani Obaid	0.79	1.03	1.03
Ajloun	2.53	3.27	3.50
Jerash	3.51	4.20	4.61
Mafraq Bwaida, Za'atary (partly for Eastern Source)	26.73	27.35	26.31

Source: Yarmouk Water Company (YWC)

5.1.1.6 Existing Network Distribution Within the Northern Governorates

The existing water distribution network system in Irbid and suburbs including the locations of Zabda and Hofa reservoirs and pumping stations are shown in **Figure 25**. This figure shows not only Irbid and suburbs but also the Bani Kinana district to which water is currently supplied from local (internal) sources. However, in the future, water has to be supplied to some areas in the district from the Irbid system because the production of water from internal sources in this district cannot meet the increase in demand. The Bani Kinana district is situated at a lower elevation than Irbid city so water can be distributed by gravity from the Zabda system.

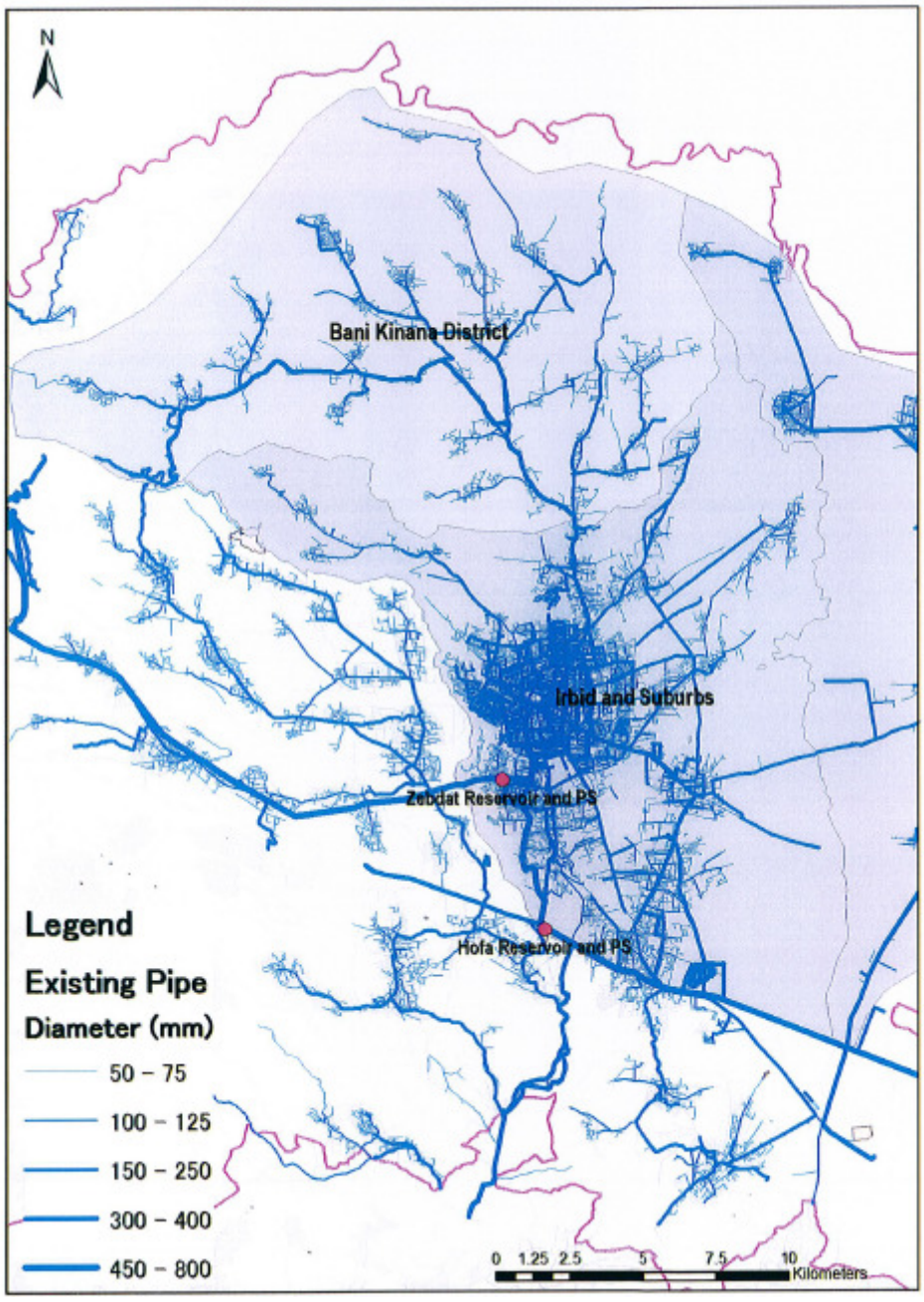


Figure 25: Distribution Network in Irbid City and Suburb with Bani Kinana District

5.1.1.7 The Jordan River

(National Master Plan for the Jordan River Valley by Royal Haskoning 2015)

The Jordan River Valley (JRV) forms part of the larger Jordan Rift Valley (Arabic: الغور Al Ghor). The internationally recognized World Heritage values of the valley are strongly related to its unique historic, religious, cultural, economic and environmental values, not at least due to its typical rift valley topography.

The Jordan River, the river with the lowest elevation in the world, originates on the slopes of Jabal al-Sheikh (Mount Hermon) on the Syrian-Lebanese-Israeli border, flows southward through northern Israel to the Lake of Tiberius, and then divides Israel and the occupied West Bank on the west from the Kingdom of Jordan on the east before emptying into the Dead Sea at an elevation of about 400 meters below sea level.

The Lower Jordan River is the section of the Jordan River that flows between the Lake of Tiberius and the Dead Sea. As it flows out of Tiberius Lake, the Lower Jordan River intercepts with the Yarmouk River and next meanders for about 200 km river path length through the Jordan Valley down to the Dead Sea. The Lower Jordan River basin is shared by Jordan, Israel and Palestine and is renowned around the world for its remarkable geographic features, its ancient civilizations and its religious relevance.

About 247,000 registered Jordanians live on the eastern side of the river together with an estimated a quarter million foreign workers originating mainly from Egypt, Iraq and recently from Syria.

The environmental and ecological values of the basin have declined drastically during the last sixty years: its water has been diverted; its ecological systems crimpled and its natural absorption capacities have been pushed to the limits. Large flows of untreated wastewater and saline water are discharged directly into the basin and substantial parts of the basin are no longer accessible for the inhabitants who live there.

Through education and advocacy campaigns, major research and regional rehabilitation efforts, some real changes have already been made. For instance, new sewage treatment plants have been constructed or planned in Jordan, Israel and Palestine, which will enable treatment of polluted wastewater flowing currently into the river. Earlier research concluded that the Jordan River will require 400 - 600 MCM of fresh water per year to reach an acceptable rehabilitation level.

A recent agreement between Israel and Jordan allows for 10,000 m^3/day of fresh water from Lake Tiberius to flush the Jordan River (**Appendix 6**).

- **Ground Water Resources**

(National Master Plan for the Jordan River Valley by Royal Haskoning 2015)

The groundwater system in the Jordan River Valley consists of a shallow aquifer system from the Plio-Pleistocene ages, which overlays the upper sub-aquifer system of the Upper Cenomamian and Turonian ages and the deep confined aquifer of the Lower Cenomamian age. The groundwater in the JRV is subject to increasing salinity levels, particularly in the south. Earlier studies suggest that the salinity in the shallow aquifer is derived from adjacent aquifers and up coning of deep brines that flows through the Jordan Rift Fault system; and from contamination of agricultural return flows and sewage effluents. In addition, groundwater resources are particularly scarce and overexploited.

Surface Water Flow
(National Master Plan for the Jordan River Valley by Royal Haskoning 2015)

The major water resources in the Jordan River Valley are the Jordan River, Lake of Tiberius and the Yarmouk River. The Lake of Tiberius is the largest fresh surface water reservoir in the region. The basin of the Upper Jordan River (UJR) is the main water contributor to the Lower Jordan River (LJR). The basin of the Yarmouk is the second largest water contributor to the Lower Jordan River. It covers a total estimated area of 6,968 km^2 and is shared between Syria (77%), Jordan (22%) and Israel (1%). The catchment boundary is defined by the Jabal al Arab Mountains in the east and the Golan Heights in the west. Syria has built many dams in the Yarmouk River sub-basin, which is part of the wider Jordan River basin. The country historically uses about 450 MCM/yr of surface and groundwater resources in the basin, mainly for agricultural purposes. Israel is the largest user of water from the Jordan River basin, with an historical annual withdrawal of up to 640 MCM, of which 55 MCM goes to Jordan since 1995 as part of the Israeli Jordanian Peace Treaty. Jordan uses historically about 290 MCM/yr of water from the Jordan River basin, which together with 55MCM from Israel totals 347 MCM. Water diverted from the Yarmouk River to the King Abdullah Canal (KAC) is used for irrigating crops in the Jordan Valley and for domestic use in Amman. However, given the consecutive years of drought faced in the region and the impacts of climate change, the historical utilization rates of the past for all countries is a poor indication of present and future extraction rates.

South of the Yarmouk, the Jordan River Valley includes nine major Jordanian water streams that enter the valley from the east. **Figure 26** shows the tributaries of Jordan River from both sides, Jordan and Israel. It is estimated that 100 MCM flows annually from the Jordan River Basin into the Dead Sea area, either as surface water or as groundwater.

Most of the side Wadis do not discharge into the river anymore, and a substantial part of the water resources from the Upper Jordan River, including the Lake of Tiberius, has been diverted. Where the Jordan River had historically an annual flow of around 1,250 MCM, it contains today not more than 40 to 100 MCM per year, with its maximum base flow more or less at the confluence of Wadi Al Rayyan (Wadi Al-Yabis).

The northern most section of the river is regulated in Israel by the Degania Dam at the exit of Tiberius Lake. South of the Yarmouk River, the river is fed by streams and channels, although most water resources of the Wadis in Jordan have been developed and diverted for agricultural or domestic purposes, and only undeveloped Wadis supplying winter flows and floods directly into the LJR. Seven dams were constructed in Jordan since the 1960‘s with a total live storage capacity of 265 MCM, which diverts water mainly for agricultural purposes.

Water Balance
(National Master Plan for the Jordan River Valley by Royal Haskoning 2015)

During the 1950s the Jordan River closely resembled its historic natural water balance, not yet much influenced by artificial human interception: about 605 million cubic meters (MCM) was discharged into the Jordan River through the Lake of Tiberius and 455 MCM originated from the Yarmouk River. Additional inflow came from the Yarmouk basin as well as from the Zarqa River basin, as well as from annual rain floods from the West Bank. The outflow of the Jordan River in 1950 into the Dead Sea was about 1285 CM. This amount was about equal to the total evaporation from the surface of the Dead Sea, leading to an average stable surface water table of the Dead Sea.

By the year 2000 the water balance had changed drastically and substantial flows were meanwhile diverted by the riparian countries of the Jordan River Basin:

1. About 100 MCM per year was diverted by Israel from the Upper Jordan river system, which reduced the inflow into the Lake of Tiberius
2. About 440 MCM per year was diverted by Israel from the southern mouth of Lake Tiberius, at the Degania Dam, to feed to the Israeli National Water Carrier (NWC)
3. About 155 MCM per year is withdrawn by Jordan from the Yarmouk River to feed the Amman, the Zarqa Region and for irrigation in the Jordan Valley.
4. Brackish water from springs north and west of Tiberius Lake was diverted through the Salt Water Carrier to the Alumot Dam, from which it flows into the Jordan River.

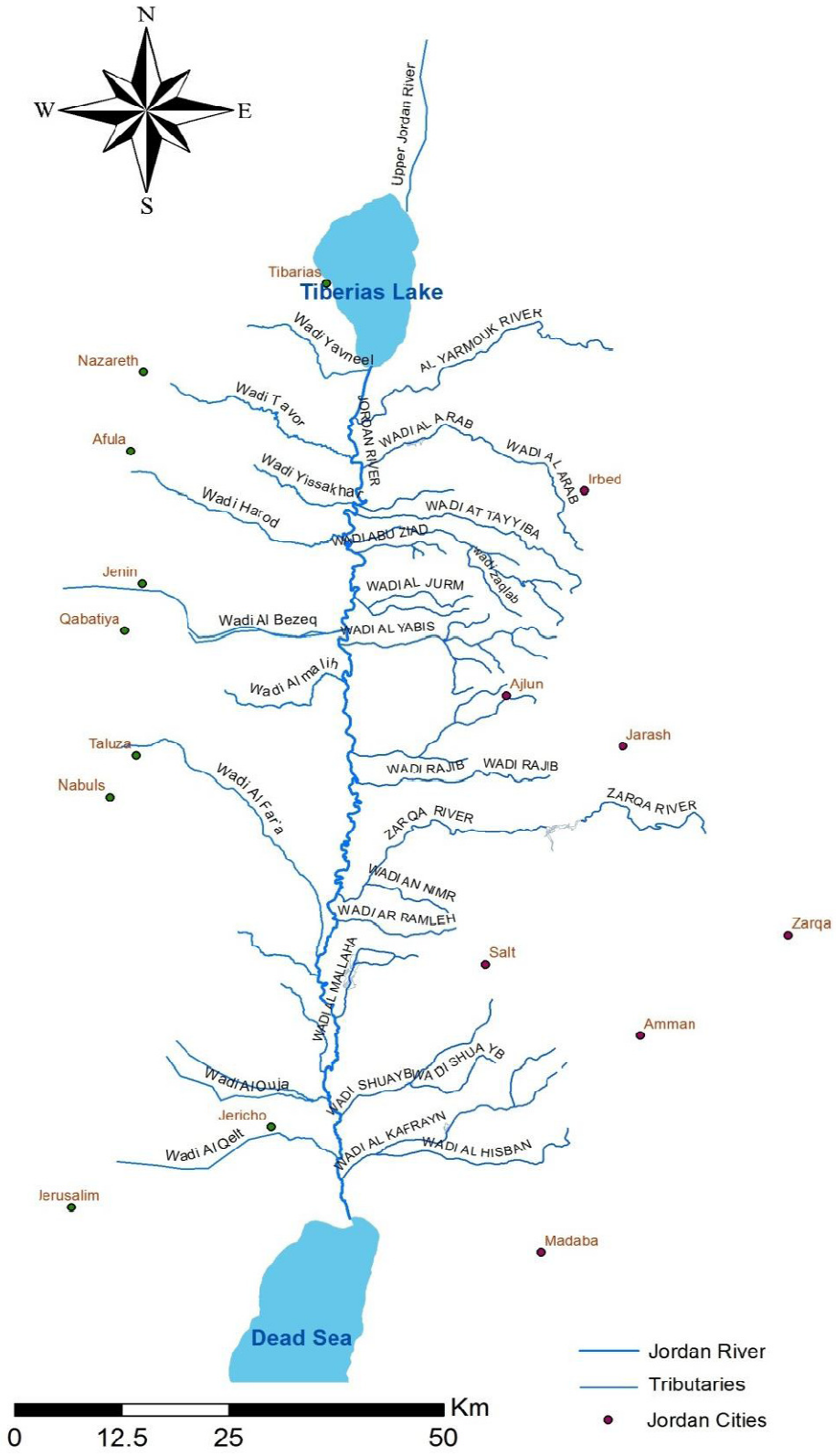


Figure 26: The Jordan River and its Tributaries

- **Fauna**
  (National Master Plan for the Jordan River Valley by Royal Haskoning 2015)

Due to the dry climate and high evaporation rates in this lower part of the LJR basin, also effluents from agricultural and domestic water usage evaporates or infiltrates into the subsurface, before it reaches the LJR. Eventually, about 30 MCM of highly polluted water flows from the Lower Jordan River into the Dead Sea on an annual basis. The Dead Sea, which relies on the Lower Jordan River as its primary water source, is reaching a critical point of irreversible damages.

The current low flow levels and bad water quality of the Lower Jordan River have severe impacts on the area‘s unique ecosystem and to the approximate 500 million migratory birds that migrate through the Jordan basin twice a year as the valley is important for both resident birds species and for the safe stop-over of huge numbers of birds which fly annually along the rift valley between Africa & Northeast Europe.

In terms of fauna, the Jordan River Valley is dominated by the presence of agriculture. Despite these agricultural activities there are small depressions and wadis that have the potential to act as safe corridors for fauna and wildlife. About 29 bats species were recorded in the Lower Jordan River and Dead Sea basins and its surrounding areas. In addition, 40-50 aquatic invertebrates, 24 mammals, 3 amphibian, 150 birds, 21 reptile and 3 fish species have been recorded in the same area.

- **Expected changes/Risk**
  (National Master Plan for the Jordan River Valley by Royal Haskoning 2015)

Several threats were identified in the report to the ecosystem, out of which the following list is related to the water resources:

1 Fragmentation of Habitats
2 Inappropriate Agricultural Development
3 Water Pollution
4 Over-Extraction of Water

- **Proposed Mitigation**
  (National Master Plan for the Jordan River Valley by Royal Haskoning 2015)

The challenges to ecosystems and biodiversity protection in the Lower Jordan River Valley (LJRV) are particularly to create a stronger legal, management and information framework that enables adequate allocation, management and enforcement of nature protection. In particular this challenge will be to:

- Reduce deficiency in relevant laws and regulatory guidelines
- Strengthen enforcement through increasing financial and technical capacities
- Strengthen responsibilities related to laws and regulations
- Release the national biodiversity policy
- Increase communication, education and public awareness
- Increase financial resources

- Increase technical capacities at the institutional level
- Increase civil local community participation
- Address climate change in conservation of biodiversity

5.1.1.8 Lake Tiberius

➢ **General Description**
(National Master Plan for the Jordan River Valley by Royal Haskoning 2015 and http://www.ocean.org.il/Eng/Kineret/LakeKineret.asp

There are no lakes in the region except Lake Tiberius which is now used as a reservoir in Israel, and it represents the only natural freshwater lake. It is located in the northern part of the Dead Sea rift in the Afro-Syrian rift valley. The drainage basin of the lake covers an area of 2,700 square kilometers and includes the western slopes of the Hermon Mountain, the southeastern areas of the Lebanese mountains, the eastern Galilee, Golan Heights and the Hula valley.

Lake Tiberius capacity is about 4000 MCM, and receives most of its water from the northern Jordan River.

The average annual water inflow to Lake Tiberius is 800 MCM. About the same quantity leaves the lake annually: through evaporation (280 MCM), via the National Water Carrier (370 MCM) for water supply throughout Israel which represents 50% of drinking water need, and overflow (80 MCM) into the southern Jordan River through the Degania dam. Additionally about 90 MCM/Y are pumped for local consumption around the lake and allocated to the Kingdom of Jordan as part of the 1994 Peace Treaty. The water salinity in the lake is 240 ppm.

The lake is classified as mesotrophic with meso-oligotrophic summer epilimnion. The prominent event of phytophlankton dynamics in the lake is the heavy bloom of the thecate dinoflagellate between late February and late May. Approximately 5-15% of the perdinium biomass is consumed by fish.

Two adverse environmental effects from sewage inflow and nutrient fluxes from cultivated fields are observed. There are increased levels of intestinal bacteria and enhancement of algal concentrations beyond permissible limits.

Experimental observation over a 25 year period showed significant reduction in organic nitrogen loading and the biomass of zooplankton. As light but important increase in soluble reactive phosphors and ammonia loading were also observed.

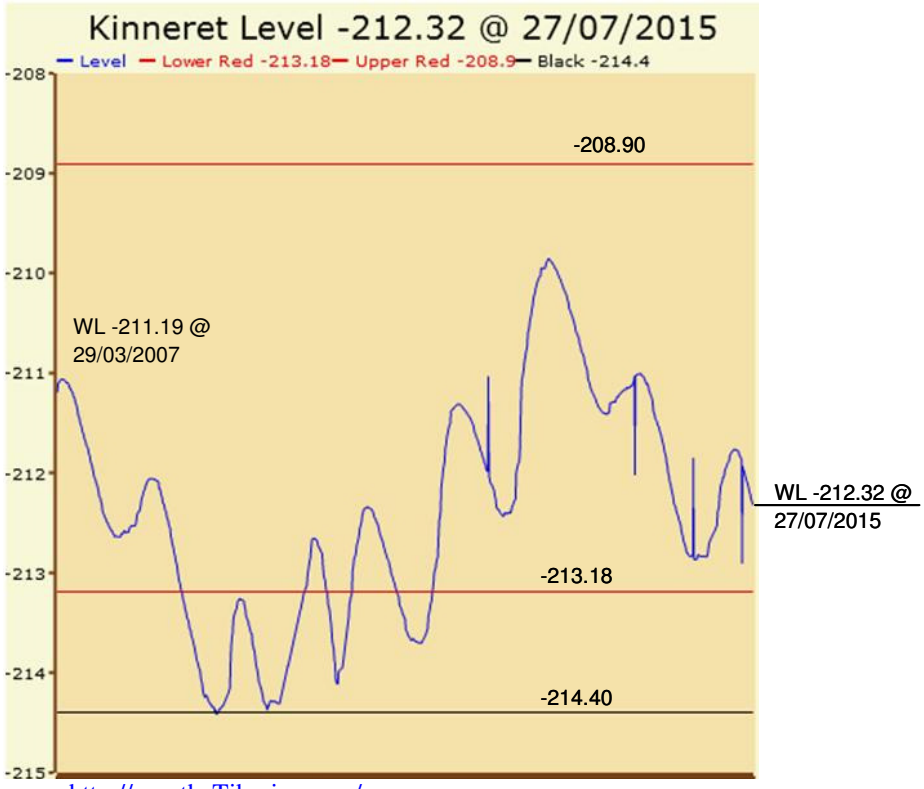
➢ **Water Level**

The water level of the lake is formally legislated by the water commission and is controlled by the pumping regime and overflow regulations.

Water level of Lake Tiberius varies between 209 and 215 m below sea level. At the highest water level the lake surface area is 168 square kilometers, the maximal water depth is 46 m and the lake volume is 4,150 million cubic meters (MCM). The average depth of the lake is 25 m.

Due to seasonal fluctuations in rainfall and in the annual water consumption from Lake Tiberius, (Kinneret), the water level fluctuated between -208.30 and -214.70 m over the last four decades.

These changes in water level affected the water storage capacity (20% variation) and the lake surface area (6% variation), see **Figure 27**.



Source: http://savetheTiberius.com/

Figure 27: Water Level Fluctuations

➢ Water Quality

The raw water received at KAC from Lake Tiberius is subject to daily monitoring program by Zai WTP laboratories; daily samples are collected and analyzed to make sure of the quality of the raw water at KAC. In addition, Ministry of Health (MOH) and Control Directorate at JVA regularly tests all sources of drinking water and ensures conformity to standards. The records show that water from Tiberius Lake is 100% within Jordanian standards.

➢ Water Balance in the Northern Governorates

(Study on Water Sector for the Host Communities of Syrian Refugees in Northern Governorates- Water Supply Master Plan-January 2015 by JICA)

Depending on the source report, the inflow to Lake Tiberius ranges from 760 to 630 MCM/year after deducting the amount consumed in the Lake watershed while evaporation from the Lake ranges from 230 to 285 MCM/year. The National Water Carrier (NWC) consumes anywhere from 300 to 440 MCM/year. The NWC according to the Royal Haskoning report provides 370 MCM/year which represents 50% of the drinking water needs in all of Israel. Additionally, Israel has constructed 5 desalination plants currently producing 640 MCM/year with an additional capacity of 90 by year 2020.

Historical water levels in the lake and the monitoring of water quality from the lake in the KAC are provided in the preceding sections of the ESIA. Based on the agreements and MOUs identified below that have increased the quantity of water to Jordan from Lake Tiberius since the

original Peace Treaty, it can be assumed that the NWC has planned for other sources of water than the lake to account for these increases to Jordan.

The Peace Treaty of 1994 allowed for Jordan to receive from Lake Tiberius a total of 55 MCM/year while Israel was allowed to pump from the Yarmouk River to Lake Tiberius 40 to 80 MCM/year and to use 25 MCM/year. The residual amount (40 to 80 less 25) that can be returned to Jordan is not considered to be part of the total mentioned below from the agreements and MOUs. In 2011, a MOU was signed which allowed Jordan to purchase an additional 20 MCM/year from Lake Tiberius. In 2013, Israel agreed to provide 9 MCM/year for the Lower Jordan River.

The Swap Agreement was signed in 2013 which committed an additional 50 MCM/year from Lake Tiberius to Jordan and this water could be received before completion of the Red Sea Dead Sea Project. Therefore, the total from Lake Tiberius to Jordan could reach 125 MCM/year and this water would be directed to the KAC for domestic use in Amman and Irbid and for irrigation in the Jordan Valley. The 2011 MOU allotted volume from the lake along with the reduction in KAC water being used for irrigation due to the use of treated effluent for irrigation will provide the raw water volume for the proposed project. Additionally, it is understood that the 2013 Swap Agreement volume could also be received in advance of the Red Sea Dead Sea Project.

The Yarmouk River water enters the KAC in the Jordan Valley. The contribution to the KAC for drinking and irrigation purposes is estimated at 90 MCM/year and is supplemented by 20 MCM/year from the Mukheiba Wells, and 10 to 15 from Wadi Arab Dam. The construction of a new MWI project for wastewater treatment upgrade is in progress and includes the rehabilitation of the existing Central Irbid and the Wadi Arab wastewater treatment plant (WWTP) so that the effluent from these two plants, in addition to the effluent from the newly built Al-Shallalah WWTP, can be reused for irrigation purposes. This project also includes reclaimed water transmission system that brings the treated wastewater up to the irrigation network bypassing the KAC. As a result, 25 MCM/year is expected from treated effluent from Northern Governorate WWTPs for irrigation purposes.

JICA Study Team estimated the water demand, water supply and demand balance for the northern governorates is shown in **Figure 28**,, while location of sources and demand is presented in **Figure 29**.. The groundwater in the northern governorates is currently 72 MCM/year with an additional 19 MCM to be supplied by improvements to eastern wells and Disi water allocation. If the available water for northern governorates is 91 MCM/year, the supply can meet the demand until year 2019, but the supply will be much lower than the demand if the demand of Syrian refugees is counted.

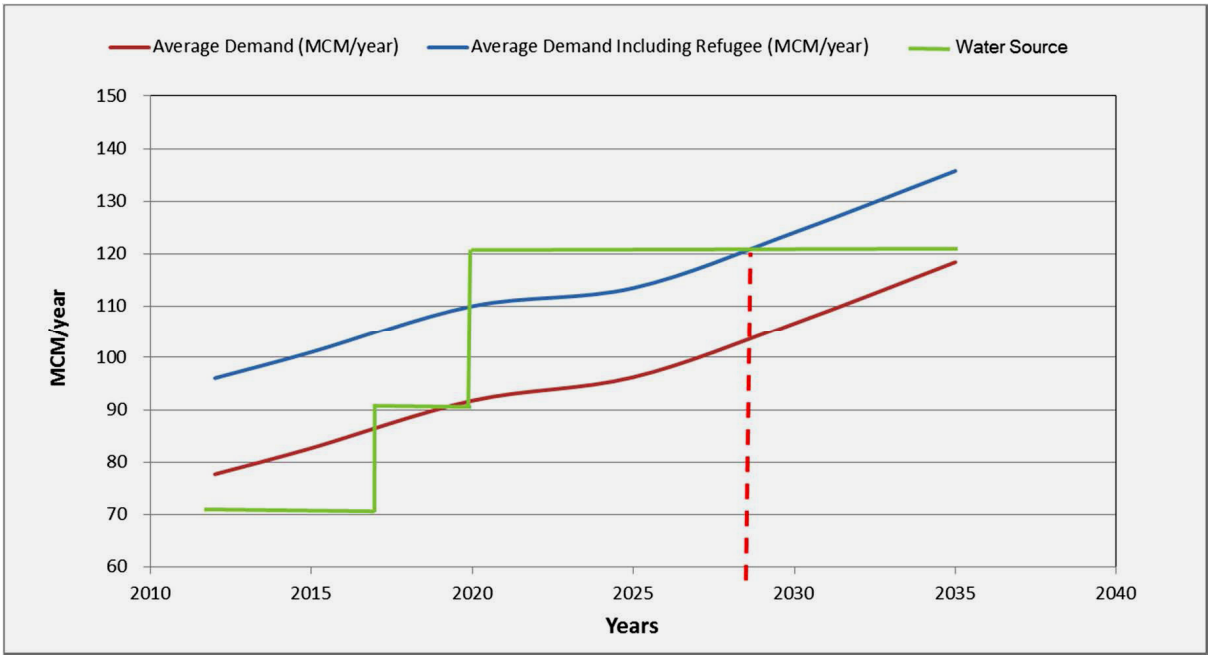
If the available water for the northern governorates is increased by 30 MCM/year to 121 MCM/year by the proposed Wadi Arab Water System II, the supply can meet the demand to year 2035 and beyond but the supply can meet the demand of only up to year 2028 if the demand of Syrian refugees is counted. The water allocation in the northern governorates is provided in the next section of the

ESIA. As noted in Section 5.1.1.5 production from wells within the Northern Governorates has declined by 30% between 2003 and 2012 but the Yarmouk Water Company has been rehabilitating and drilling new wells to maintain production at 72 MCM/year. There may be an opportunity when the proposed project is completed and operational to manage some of the groundwater sources to allow for some recovery while still meeting the expected demand in the northern governorates in the short term.

The JICA Study Team reported that non-revenue water (NRW) ratio is still high at about 40-70 % in the northern governorates although various efforts have been made to reduce it, such as by rehabilitating old pipes. High NRW ratio is due to several factors, such as poor water network condition, lack of isolated water supply zones, intermittent water supply, meter inaccuracy, use of water through illegal connection, and meter reading errors.

The leakage ratio in Jordan is assumed from past experience to be half of the NRW ratio. Therefore, the estimated leakage ratios of the northern governorates and Irbid are 24.2 % and 22.6 %, respectively. The number of complaints of leakage due to corrosion by diameter and material shows that 90 % of the instances of corrosion occur in galvanized pipe and 95 % occur in pipes of diameter less than 50 mm. Galvanized pipe is a corrosion prone material and needs to be replaced with some other material. To reduce leakage, the JICA Study Team recommended as a priority, the replacement of the galvanized pipe with pipe of another material.

Figure 30 provides a schematic of the water balance in the northern governorates and the source references for the information are provided.



Note: Year 2020 is the earliest year when additional water source of 30 MCM/y is available.

Figure 28: Water Supply and Demand Balance for the Northern Governorates

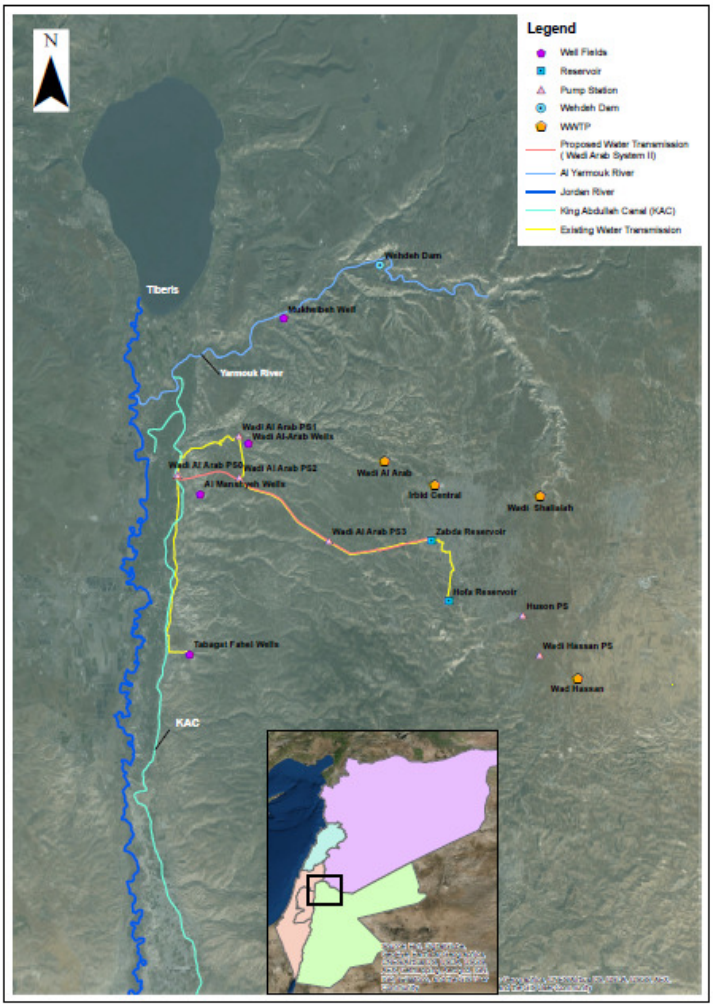


Figure 29:water sources and demand locations

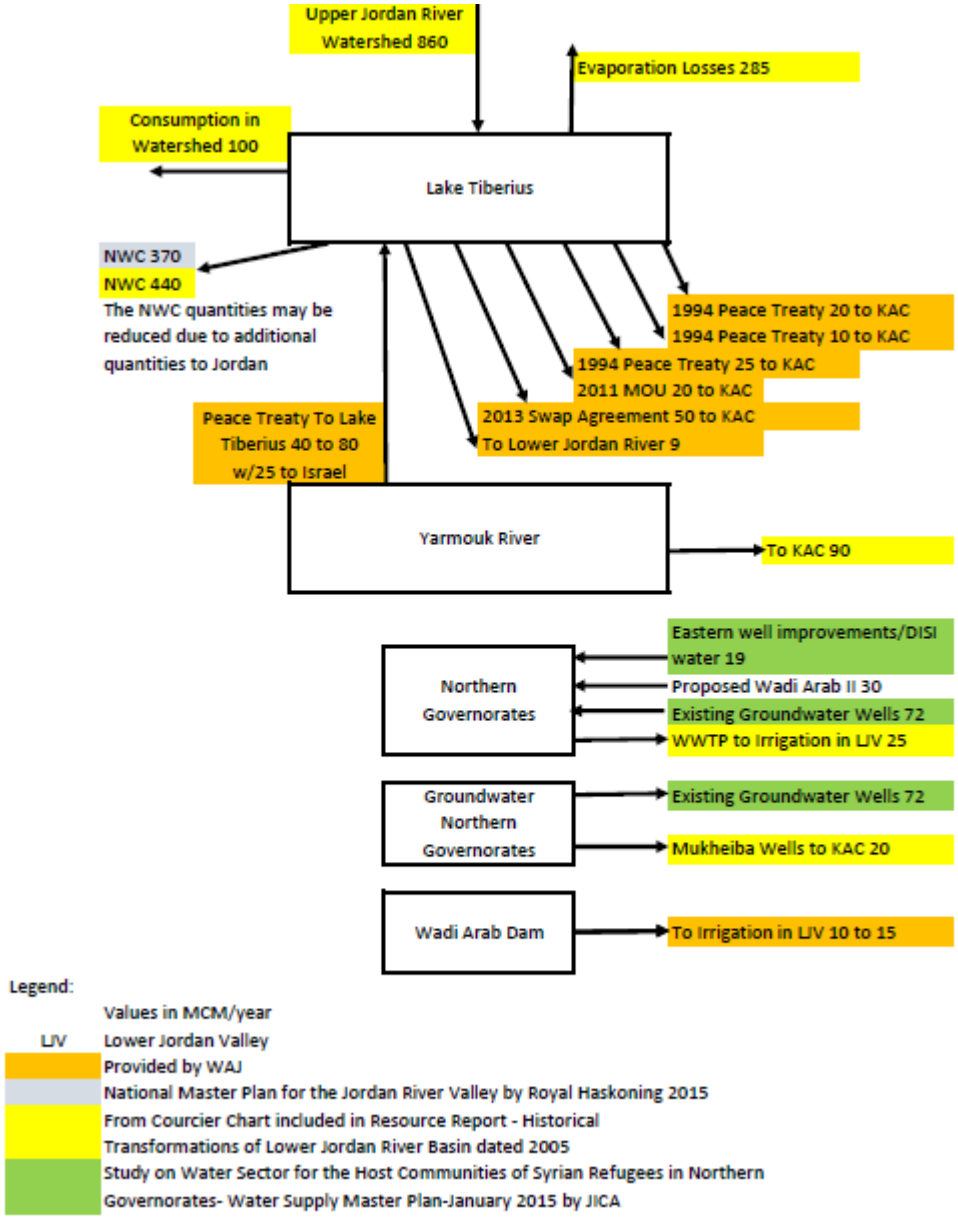


Figure 30: Water Balance Schematic

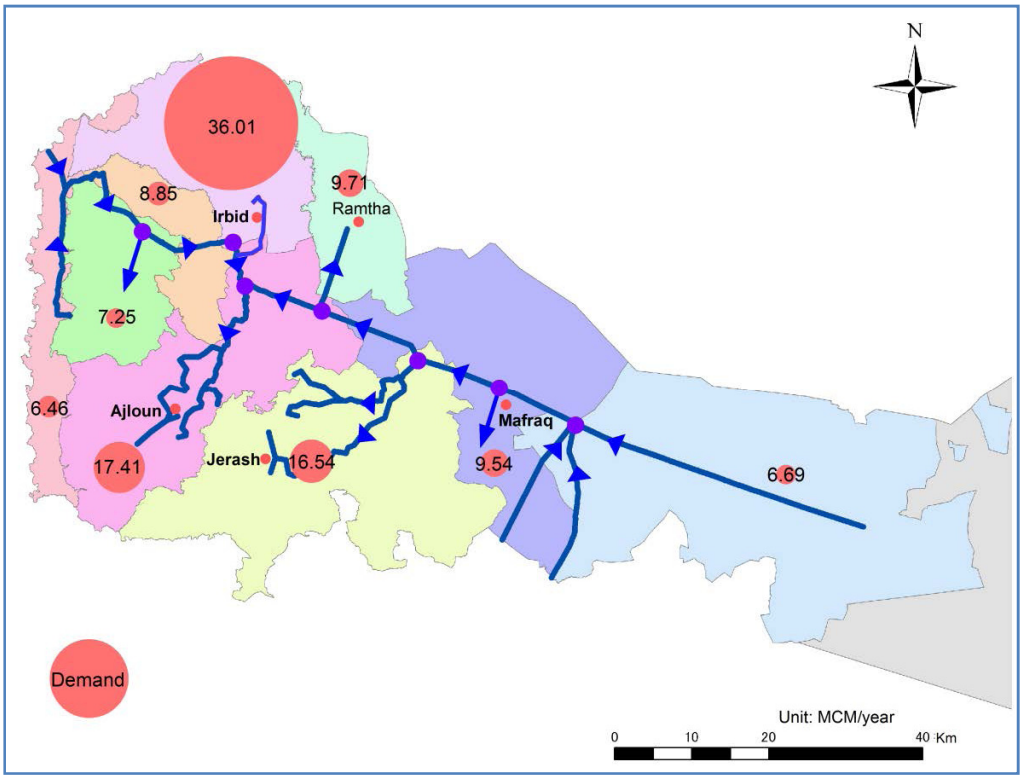
➢ Water Allocation

(Study on Water Sector for the Host Communities of Syrian Refugees in Northern Governorates- Water Supply Master Plan-January 2015 by JICA)

Water demand for each sub-transmission zones have been estimated considering population and per capita average demand. Average demand in 2035 will be about 118 MCM/year and, demand in sub-transmission zones are shown in **Figure 31**.

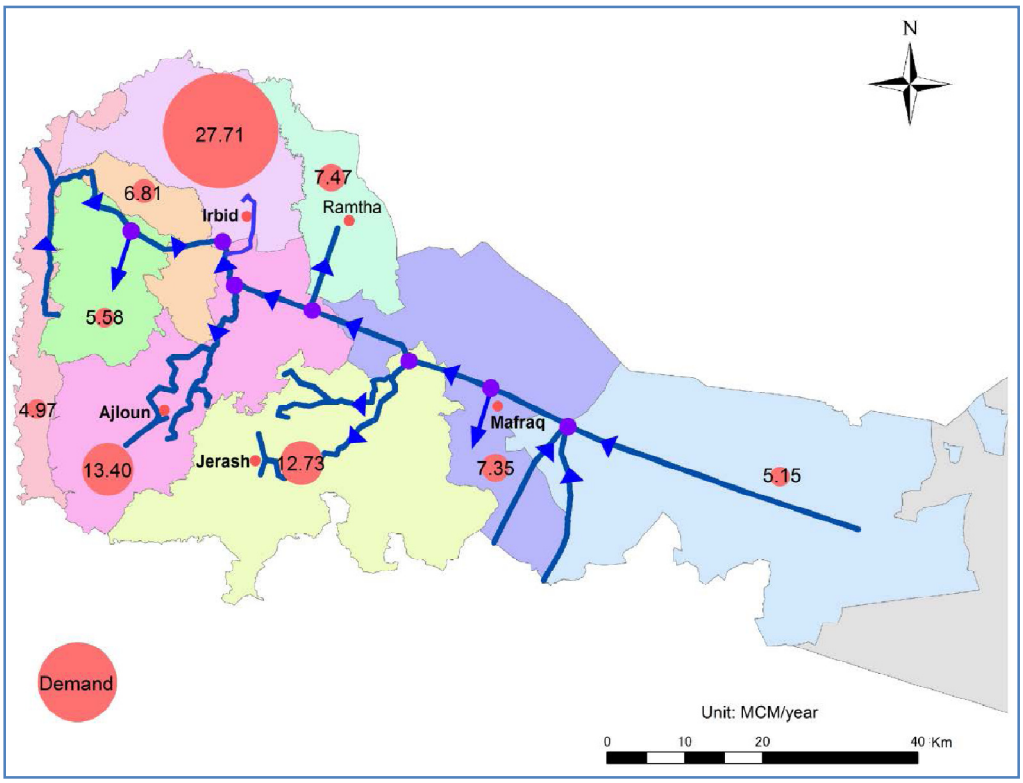
The water allocation to each sub-transmission zone in case 91 MCM/y is available is shown in **Figure 32**. Total available water of 91 MCM/year is distributed to each sub-transmission zone in proportion to the water demand of each sub-transmission zone in 2035. 27.7 MCM/year is allocated to the area covered by Zebda sub-transmission zone and 7.47 MCM/year to Ramtha sub-transmission zone. This allocated water is total water availability of both internal and external sources.

The water allocation to each sub-transmission zone in case 121 MCM/y is available is shown in **Figure 33**. In this case, 121 MCM/year is more than the water demand in 2035. Therefore, water allocation is made using the water demand in 2035, total of which is 118 MCM/year. 36 MCM/year is allocated to the area covered by Zebda sub-transmission zone and 9.71 MCM/year to Ramtha sub-transmission zone.



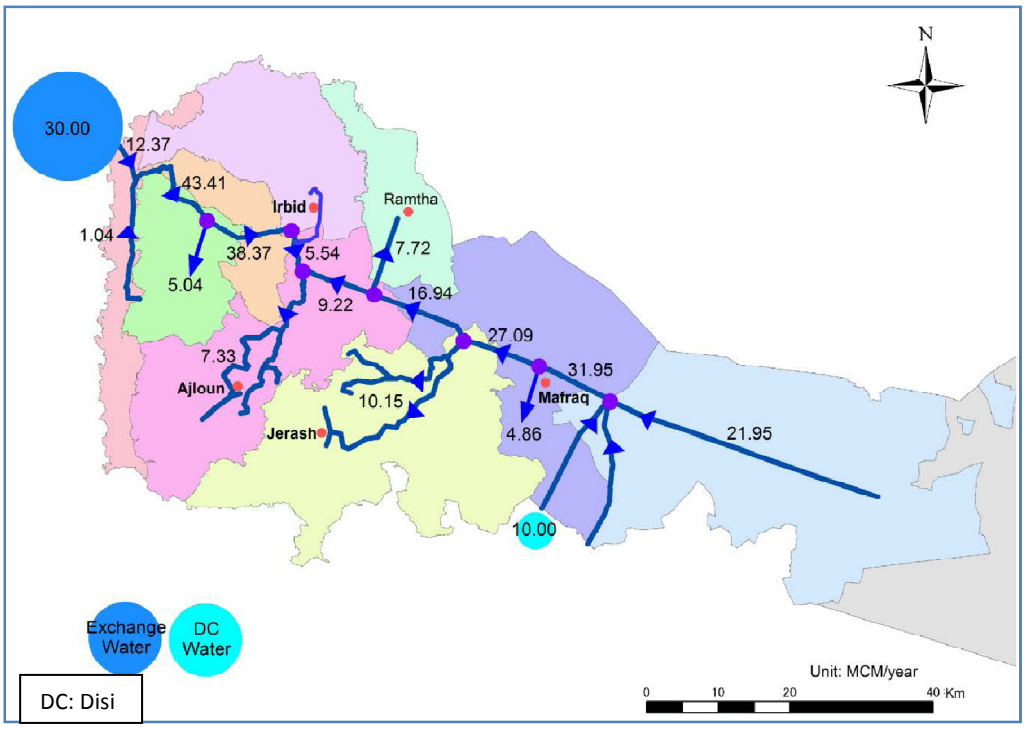
Source: JICAStudy Team

Figure 31: Annual Water Demand in 2035 by Sub-Transmission Zone



Source: JICAStudy Team

Figure 32: Water Allocation (91 MCM/y) to Sub-Transmission Zones



Source: JICAStudy Team

Figure 33: Water Transfer for Water Demand in 2035 (121 MCM/y)

➢ Estimated Additional Wastewater

(Study on Water Sector for the Host Communities of Syrian Refugees in Northern Governorates- Water Supply Master Plan and Sewerage Master Plan - January 2015 by JICA)

Based on the amounts of Water allocated for each sub transmission Zone **Table 7** below was derived in order to estimate the additional wastewater that will be directed to the existing wastewater treatment plants to identify if additional upgrade other than that identified by JICA Master Plan will be required.

Table 7: Estimated Additional Wastewater by year 2035

Area	Annual water Demand in 2035	Water Allocation of 91 MCM to sub-transmission zone	Difference in MCM to be covered by 30 MCM Exchange Water from Tiberius	The Difference in m^3/d	Generated WW in m^3/d is 80% of water supply
North Shounah	6.46	4.97	1.49	4,082	3,266
Deir Al-Sina	7.25	5.58	1.67	4,575	3,660
Kufur Youba	8.85	6.81	2.04	5,589	4,471
Irbid	36.01	27.71	8.3	22,740	18,192
Ramtha	9.71	7.47	2.24	6,137	4,910
Ajloun	17.41	13.4	4.01	10,986	8,789
Jerash	16.54	12.73	3.81	10,438	8,351
Mafraq	9.54	7.35	2.19	6,000	4,800
Badiah	6.69	5.15	1.54	4,219	3,375

Table 8 presents the % population served currently by the existing Wastewater Treatment Plants and expected flow from the additional exchange water supply (30 MCM from Tiberius) if 80% of population is served.

Table 8: Expected Wastewater Flow to WWTP

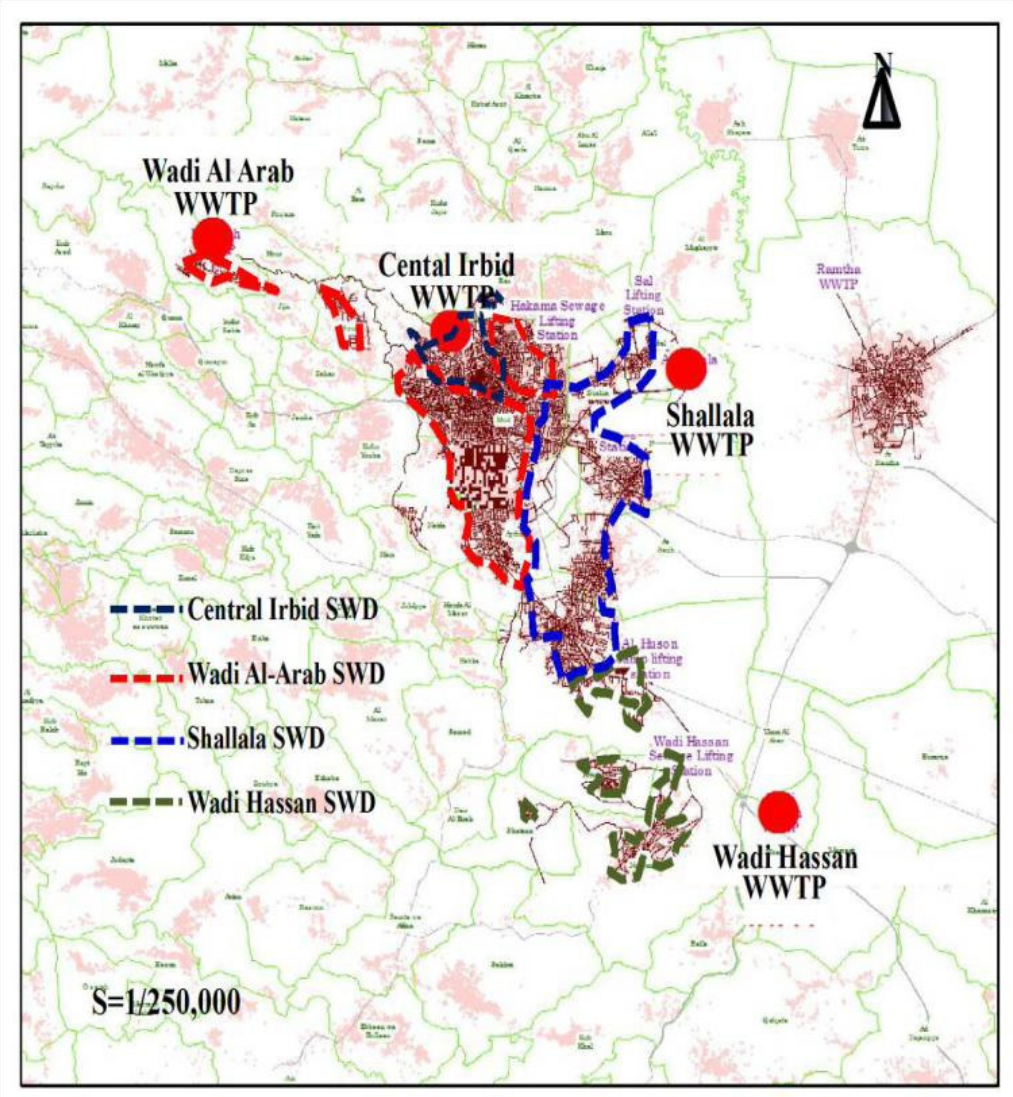
Area	Generated WW in m^3/d is 80% of Water Supply	Existing WWTP	% of Served Population	Expected WW Flow if 80% of Population is Served
North Shounah	3,266	Not Served-Design was carried out in 1999 to serve it	0%	
Deir Al-Sina	3,660	Not Served	0%	
Kufur Youba	4,471	Not Served	0%	
Irbid	18,192	Central Irbid, Wadi Al-Arab, Shallala & Wadi Hassan	52%	14,553
Ramtha	4,910	Ramtha		3,928
Ajloun	8,789	Kufrunja	42%	7,031
Jerash	8,351	East & west Jerash	69%	6,681
Mafraq	4,800	Mafraq	8%	3,840
Badiah	3,375	Not Served	0%	

Figure 34 shows the existing WWTP in Irbid Governorate. It can be seen that the North Shounah, Deir Al-Sina and Kufur Youba are not served by any of the existing WWTP in Irbid Governorate.

The effluent from existing WWTP in Irbid Governorate is used to replace fresh water for irrigation purposes category Bb-1 restricted irrigation. (Category Bb-1: Irrigation, Cooked vegetables, parks, playgrounds and roadsides in populated area.)

Consolidated Consultants was part of the Team to design the Wastewater collection and treatment for North Shounah with Messers Metcalf and Eddy 1998-2000, which was funded by USAID, but the project was not implemented due to priority of shifting funds to water projects.

The existing WWTP with their current capacity and expected upgrade based on JICA Team Master Plan report in 2015 is presented in **Table 9**. It can be seen that additional generated wastewater will not affect the existing WWTP as the proposed upgrade covers this increase. However, if by time the service area increased, a potential will be there for expansion of the WWTP.



Source: JICA Team

Figure 34: Existing WWTP in Irbid Governorate

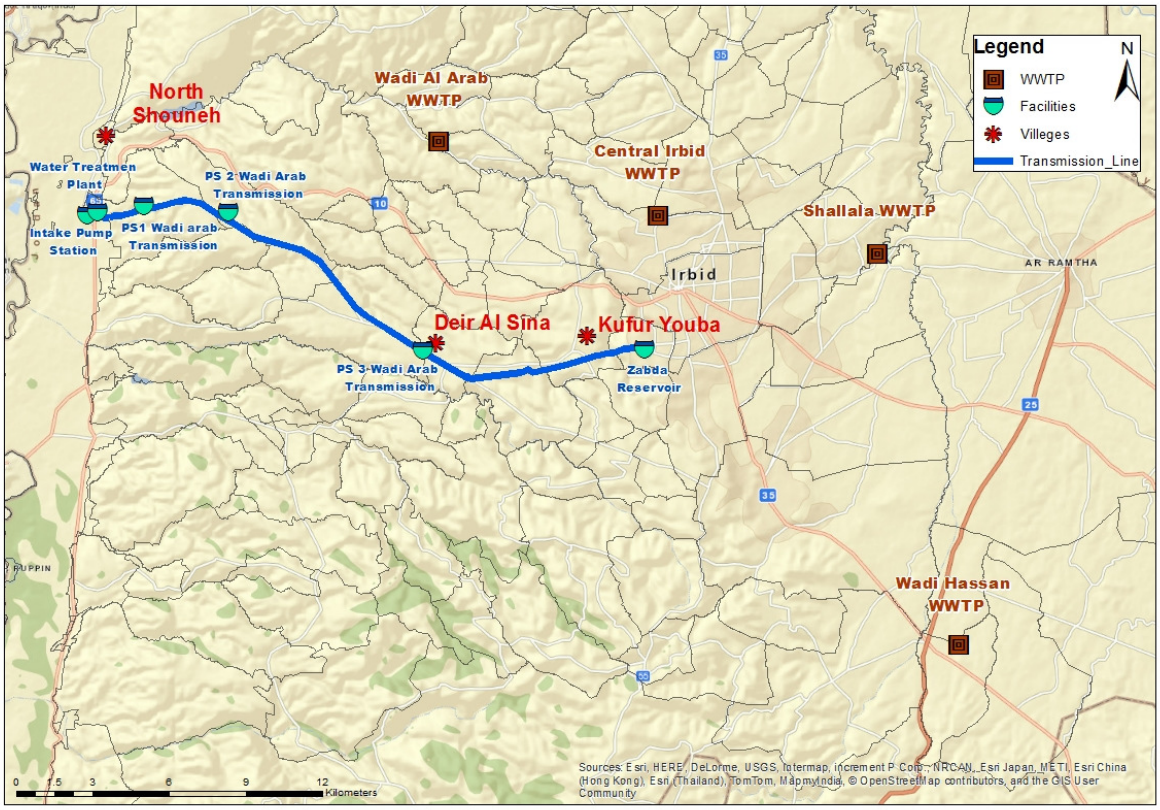


Figure 35: Existing WWTP in Irbid Governorate vs. Localities not served by WWTP.

Table 9: Existing WWTP and Proposed Upgrade

	Irbid						Jerash		Ajloun
	Central Irbid	**Wadi Al-Arab**	**Shallala**	**Wadi Hassan**	**Ramtha**	**Mafraq**	**East**	**West**	**Kufrunja**
Design capacity m^3/day	6,000	20,800	13,700	1,000	2,700	1,800	3,750	9,550	1,900
Improved capacity by modifying treatment	11,950				5,400	6,500			
Capacity increase by proposed upgrade		10,500	8,500	1,200	8,800	7,200	7,050		7,100
Upgraded capacity m^3/day	**11,950**	**31,300**	**22,200**	**2,200**	**14,200**	**13,700**	**10,800**	**9,550**	**9,000**
Expected WW flow if 80% of population is served	**14,553**				**3,928**	**3,840**	**6,681**		**7,031**

5.1.1.9 The Peace Treaty

The Israel – Jordan Treaty of Peace, sometimes referred to as the Wadi Araba Treaty, was signed by the State of Israel and the Hashemite Kingdom of Jordan in December 1994. With regard to water related matters the following elements of particular importance within the context of the current study.

Water Allocation from the Yarmouk River
The agreement stipulates that during the summer period from 15 May to 15 October of each year, Israel shall receive 12 MCM and Jordan is to keep the rest of the Yarmouk water flow. During the winter period, from 16 October to 14 May of each year, Israel is entitled to receive 13 MCM and Jordan is to keep the rest of the flow. Furthermore, Israel is entitled to borrow an additional 20 MCM during the winter period, to be transferred back to Jordan during the next summer. With regard to excess flood waters from the Yarmouk that would otherwise flow into the Lower Jordan River, it was agreed that both Jordan and Israel are allowed to utilize this water in equal portions for their own purposes.

Water Resources from the Lower Jordan River (LJR)
The agreement stipulates that during the summer period of each year, Jordan shall receive 20 MCM from the Lower Jordan River upstream of the Yarmouk from Israel. During the winter period Jordan shall receive an additional 20 MCM from Israel from the LJR south of the Yarmouk. With regard to remaining water flows in the LJR south of the Yarmouk it was agreed that both Jordan and Israel are allowed to utilize this water in equal shares for their own purposes, provided that neither party would harm the water quality of the LJR. A Joint Jordanian – Israeli Water Committee has been established to monitor the actual water flows and water allocations.

Saline Springs and additional water resources
Furthermore, the agreement stipulates that Jordan is entitled to receive 10 MCM of desalinated water from Israel, originating from the saline springs near Lake Tiberius, provided that this is financially feasible. If so, it has been agreed not to discharge the brine into the LJR basin. Currently, this saline water is conveyed from these springs directly to the LJR through the Saline Water Carrier by Israel. The agreement confirms that Israel will explore the possibility of financing the operation and maintenance cost of supplying this desalinated water to Jordan, while Jordan will explore the possibilities to finance the required capital expenditures. Finally, the agreement includes the intension to jointly develop an additional 50 MCM of drinkable water, without yet specifying its source, for the benefit of Jordan.

Operations and Maintenance
From an operational point of view, the agreement states that Israel accepts responsibility for operating, supplying and maintaining systems on Israeli territory that supply water to Jordan. Under this set-up Jordan is allowed to choose the related operator, provided these operations only serve Jordan (so not Israel at the same time). Israel guarantees easy access for the involved operations personnel and equipment.

Water Storage
Both parties agree to co-operate in the development of a new water storage dam in the Yarmouk River, downstream of the Adassiya Diversion, and of a storage facility in the LJR south of the Yarmouk confluence and north of Wadi Al Rayyan (formerly Wadi Al Yabis)

Water Quality
Both parties agree to protect the Jordan and Yarmouk Rivers and related groundwater systems and water supply systems against pollution, contamination, harm and unauthorized withdrawals

of each other's allocations. They agree to jointly monitor the quality of water along their border, using jointly (to be) established monitoring stations under the Joint Water Committee. This includes treatment of municipal and industrial wastewater to agricultural standards before discharging it into the Yarmouk and the Jordan Rivers. It also includes trans-boundary supply of water under this agreement against the national quality standards.

Groundwater
Under this agreement Israel is entitled to retain the previous use of groundwater wells in Wadi Araba now under Jordanian sovereignty as detailed by the agreement. Meanwhile Jordan agrees to enable repair or replacement of any failing well by Israel, connect it to the Israeli electricity and water systems and treat it, and Israel agrees to supply Jordan with related well logs and technical information. Furthermore, if the Joint Water Committee decides this is hydro-geologically feasible and not harming Jordan‘s interests, Israel may increase the extraction rate from these Jordanian wells up to 10 MCM per year above the 1994 yields. Such an increase had to be carried out within five years from signing of the agreement.

Information and Notification
The agreement stipulates that the Joint Water Committee (JWC) is the official body through which relevant data on water resources is to be exchanged from one party to the other. The JWC can assign sub-committees to perform technical tasks, such as a northern sub-committee and a southern sub-committee. Furthermore, deliberate changes in the Jordan and Yarmouk Rivers require prior mutual agreement. In particular, both parties agreed to six months advance notice of projects likely to change the quality or flow of either river along their common boundary via the Joint Water Committee. Also, planning for increasing water supplies and improving efficiency is to be done in a co-operative manner within the context of bilateral, regional or international cooperation agreements.

5.1.2 Air Quality

5.1.2.1 Instrumentation and Measurement Site

A mobile Air Quality Monitoring (AQM) station, equipped with US-EPA approved analyzers and certified meteorological sensors, was used to monitor and assess the air quality by continuously measuring the concentrations of; Sulfur Dioxide (SO_2), Nitrogen Oxides (NO_X, NO & NO_2), Carbon Monoxide (CO) and Carbon Dioxide (CO_2), in addition to recording the meteorological parameters, Wind Speed, Wind Direction, Temperature, and Relative Humidity. **Table 10** presents a summary of the monitored parameters along with the principles and US-EPA approvals for the used instruments.

Table 10: Monitored Parameters, Principles and Modes of Operation

Parameter	Principle of Operation of Measurement	US-EPA Approval
SO_2	Ultraviolet (UV) Fluorescence	EQSA-0802-149
NO_X, NO & NO_2	Chemiluminescence	EQSA-0202-146
CO/CO_2	Non-Dispersive Infrared (NDIR)	RFCA-0206-147
WS & WD	Mechanical	---
RH & Temp.	Electronical	---

The AQM station was installed at the northwest border of the proposed project site for the WTP in Wadi Al-Arab (**Figure 36**). The latitude and longitude coordinates of the monitoring site are at 32°35'6.68"N and 35°36'18.06"E, respectively. The measurements were conducted for a period of three consecutive days to provide baseline data of the existing air quality at the site of the proposed project.

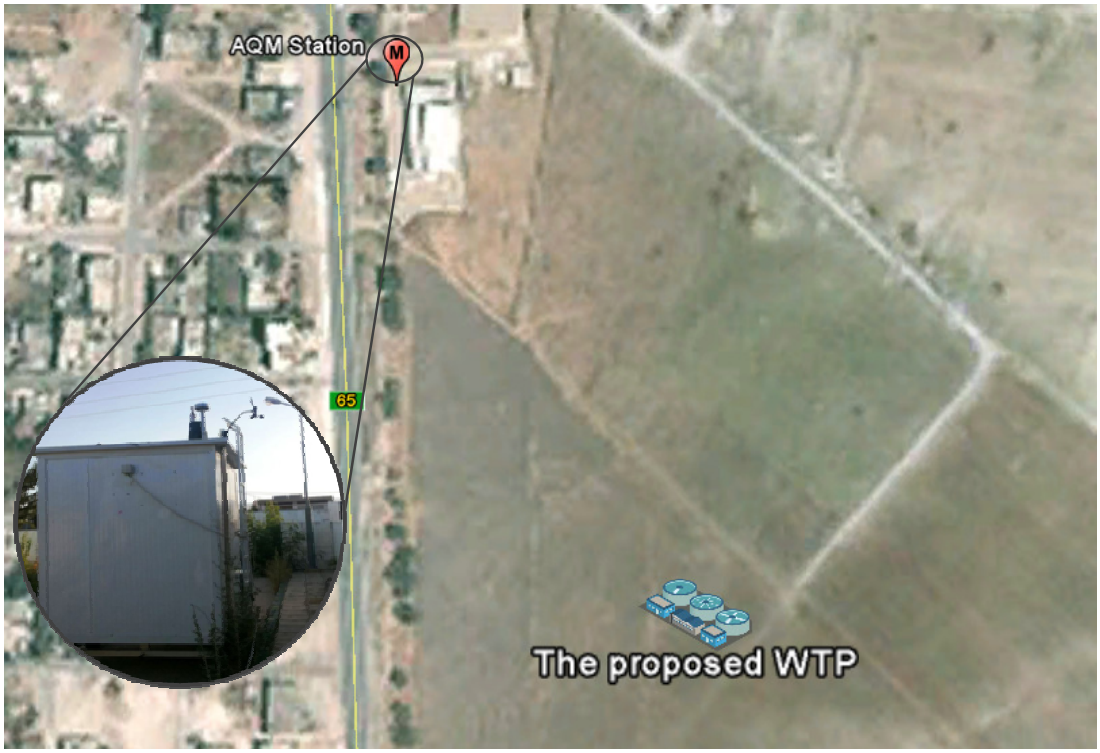


Figure 36: Satellite image showing the location of AQM station

Table 11 presents coordinates of air and noise measurements.

Table 11: Coordinates and location of measurements

Station Name	X	Y
Zabda Reservoir	228594.85	215730.57
Intake Pump Station	206775.53	220956.93
Water Treatment Plant	207193.80	221085.99
PS1 Wadi Arab Transmission	208978.26	221318.24
PS 2 Wadi Arab Transmission	212309.90	221100.22
PS 3 Wadi Arab Transmission	219913.65	215686.14

5.1.2.2 Standards and Regulations

Ambient air quality standards have been established in Jordan for certain pollutants considered harmful to the public and the environment. These standards define the maximum allowable concentrations and number of exceedances for pollutants over a given averaging period. A summary of these standards (JS 1140/2006) is shown in **Table 12**. The monitoring results of pollutants were compared to the JS 1140/2006 to verify compliance with its limits.

Table 12 Jordanian Ambient Air Quality Standards (JS 1140/2006)

Pollution	*Averaging Period*	*Maximum Limit*		*Number of allowable exceedances*
		*ppm**	*µg/m³***	
SO_2	1-hour	0.300	786	3 times during any 30 consecutive days per year
	24-hours	0.140	367	1 time during any 12 months
	Annual	0.40	105	---
NO_2	1-hour	0.210	395	3 times during any 30 consecutive days per year
	24-hours	0.80	151	3 time during any 12 months
	Annual	0.50	94	---
CO	1-hour	26	29,786	3 times during any 30 consecutive days in the year
	8-hours	9	10,311	3 times during any 30 consecutive days in the year

* *ppm: parts per million*

** *µg/m³: microgram per cubic meter*

5.1.2.3 Results

A. Meteorological Parameters

Results of wind monitoring in Wadi Al-Arab during the monitoring period (i.e. June 12-14, 2015) showed that the prevailing wind direction was west-northwest (WNW) with a frequency of 25.0%, followed by northwest (NW) with a frequency of 18.1%. With regard to wind speed, the prevailing wind speeds were those speeds of 0.5-1.5 m/sec with a frequency of 37.5%, see **Figure 37** and **Table 13**

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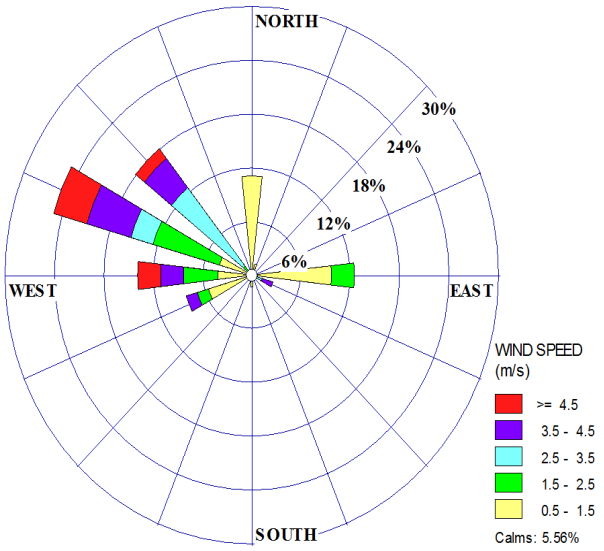


Figure 37: Wind Rose at the Monitoring Location during June 12 - 14, 2015

Table 13: Distribution of Wind Speed and Direction on June 12 - 14, 2015

Directions / Wind speed (m/s)	0.5 - 1.5	1.5 - 2.5	2.5 - 3.5	3.5 – 4.5	> 4.5	Total (%)
N	11.11	0.00	0.00	0.00	0.00	11.11
NNE	1.39	0.00	0.00	0.00	0.00	1.39
NE	0.00	0.00	0.00	0.00	0.00	0.00
ENE	0.00	0.00	0.00	0.00	0.00	0.00
E	9.72	2.78	0.00	0.00	0.00	12.50
ESE	0.00	0.00	1.39	1.39	0.00	2.78
SE	0.00	0.00	0.00	0.00	0.00	0.00
SSE	0.00	0.00	0.00	0.00	0.00	0.00
S	1.39	0.00	0.00	0.00	0.00	1.39
SSW	0.00	0.00	0.00	0.00	0.00	0.00
SW	0.00	0.00	0.00	0.00	0.00	0.00
WSW	5.56	1.39	0.00	1.39	0.00	8.33
W	4.17	4.17	0.00	2.78	2.78	13.89
WNW	4.17	8.33	2.78	5.56	4.17	25.00
NW	0.00	1.39	11.11	4.17	1.39	18.06
NNW	0.00	0.00	0.00	0.00	0.00	0.00
Sub-total	37.50	18.06	15.28	15.28	8.33	94.44
Calms						5.56

As shown in **Figure 38**, the atmospheric temperature at the monitoring site ranged between 19.2°C and 35.1°C with a mean value of 26.9°C. Time series of relative humidity is presented in **Figure 39**, where values fluctuated between 33% and 79% with a mean value of 57%. However, the hourly records for the meteorological parameters are presented in **Table A-1**, **Appendix 7**.

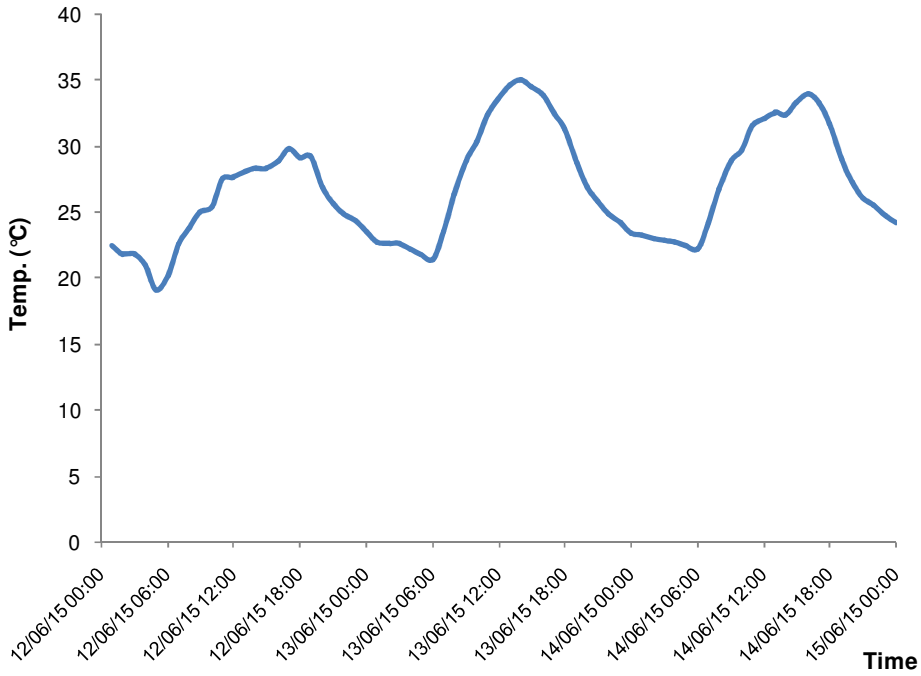


Figure 38: Time Series for Atmospheric Temperature During June 12 - 14, 2015

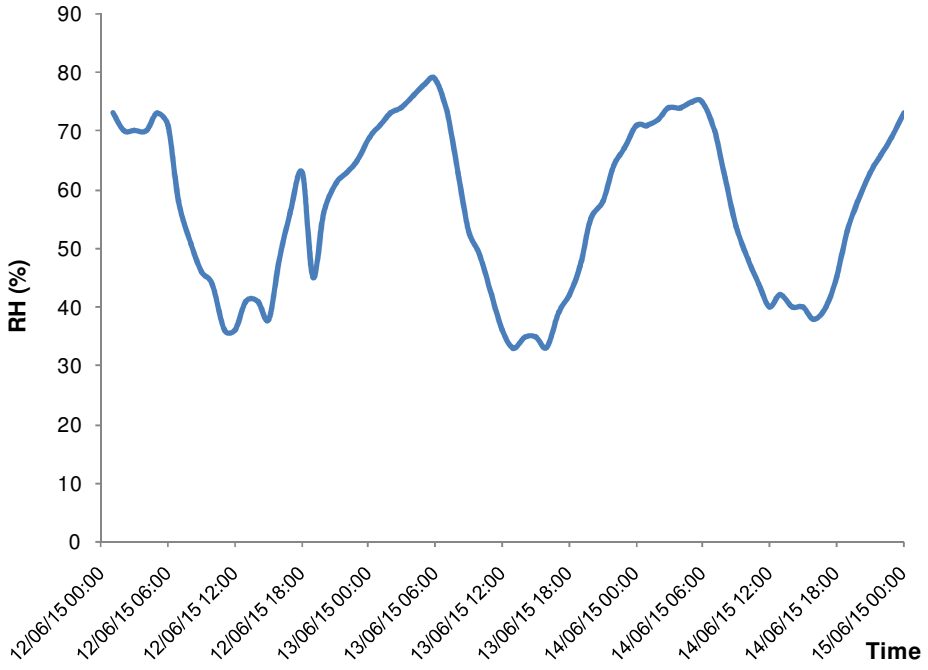


Figure 39: Time Series for Relative Humidity during June 12 - 14, 2015

B. Air Pollutants

Table 14 below shows a summary of the obtained air quality-monitoring results during the monitoring period (June 12 – 14, 2015) near the proposed WTP site in Wadi Al-Arab. The results will be discussed in details in within this section.

Table 14: Summary of the Measured Ambient Air Quality Background Levels at the Monitoring Site of Wadi Al Arab (June 12 – 14, 2015)

Pollutant	Max. Hourly Average (ppm)	No. of Hourly Average Exceedances to JS:1140/2006	Max. Daily Average (ppm)	No. of Daily Exceedances to JS:1140/2006	Max. 8-hour Average for CO (ppm)	No. of 8-hour Exceedances for CO to JS:1140/2006
SO_2	0.012	0	0.007	0		
NO_x	0.023	NS	0.007	NS		
NO	0.010	NS	0.002	NS		
NO_2	0.013	0	0.005	0		
CO	0.706	0	0.175	0	0.055	0
CO_2	393.8	NS	365.0	NS		

NS: No standard available

SO_2 Monitoring Results

It can be seen from the obtained results (**Table A-2**, **Appendix 8**) that the maximum hourly average of SO_2 reached a value of 0.012 ppm, while the daily average concentration had a maximum value of 0.007 ppm throughout the whole monitoring period. Therefore, neither exceedances were recorded to the hourly limit of 0.300 ppm nor to the daily limit of 0.140 ppm specified in Jordanian standards (**Table 12**).

NOx Monitoring Results

The maximum hourly NO_X, NO and NO_2 average concentrations were 0.023 ppm, 0.010 ppm and 0.013 ppm, respectively. Whereas, the maximum daily NO_X, NO and NO_2 average concentrations were 0.007 ppm, 0.002 ppm and 0.005 ppm, respectively.

Thus, no exceedances for Nitrogen Dioxide (NO_2) concentrations were recorded according to JS: 1140/2006 during the monitoring period. It should be mentioned here that among nitrogen oxides, only nitrogen dioxide (NO_2) has limits in Jordanian standards.

CO Monitoring Results

Low CO levels were observed during the monitoring period **(Table A-2**, **Appendix 8**). The maximum hourly average was 0.706 ppm, which is far below the limit of 26 ppm specified by JS 1140/ 1999. The highest 8-hr rolling average concentration of CO was 0.175 ppm, which is also well below the standard limit of 9 ppm.

CO_2 Monitoring Results

Carbon dioxide occurs naturally in the atmosphere, but the burning of fossil fuels releases excess amounts into the air, where it traps the sun's heat causing global warming or which is called the climate change. Monitoring of CO_2 might be a good indicator about the quantities of the burned fossil fuel and how much of other pollutants are emitted as a result. However, there is no Jordanian standard or guideline about the levels of CO_2 in the ambient air.

During the monitoring period, the hourly concentrations of CO_2 varied between 320 and 394 ppm at the proposed project site. The average concentration throughout the entire period was 352 ppm, with a maximum daily concentration of 365 ppm.

5.1.2.4 Conclusion and Recommendation

The monitoring of the ambient air quality (SO_2, NOx, CO, and CO_2) near the proposed project (Wadi Al-Arab WWP) during the period June 12-14, 2015 showed that the hourly, 8-hr (for CO) and daily average concentrations were far below the relevant limits stated in the Jordanian Ambient Air Quality Standard (JS 1140/2006).

Results of wind speed and wind direction monitoring showed that the prevailing wind direction was west-northwest (WNW) with a frequency of 25.0 %, followed by northwest (NW) with a frequency of 18.1%. While the prevailing wind speeds were those speeds of 0.5-1.5 m/sec with a frequency of 37.5%. The obtained prevailing directions are consistent with the predominant conditions known in the entire country.

5.1.3 Ambient Noise Level Measurements

5.1.3.1 Instrumentation and Measurement Sites

Spot noise monitoring was carried out at 5 proposed facilities locations of the project; namely; Intake Pump Station, Water Treatment Plant, PS1, PS2 and PS3. In order to determine the ambient baseline sound level profile, measurements were undertaken using data logging Sound Level Meter Model Extech HD600 (Hand Held Type II noise meter).

The noise meter was hand-held and positioned such that the microphone, equipped with a windshield, was pointing opposite to wind direction. The noise meter was set to automatically record a range of noise related parameters as follows:

- Each location will be monitored for a period of three days that include one weekend among them.
- At each location, the daily noise measurement shall be conducted for a period of 15 min. at day time and 15 min. at the night time.
- Noise level meter has auto logged every second, and summarized on a five-minute bases. Values were then calculated for LA_{avg}, LA_{max}, LA_{min} (i.e. the average, maximum and minimum) A-weighted Sound Pressure Level of the residual noise in dBA for the monitoring period.

The noise meter was set to record the following modes:

- Time weighting of F (fast)
- Frequency weighting of A, for human ear
- The instrument was calibrated with an acoustic calibration cell

5.1.3.2 Standards and Regulations

Allowable noise limits are governed by the Jordanian instructions for elimination of noise for the year 2003, which defines the maximum allowed noise limits for the different land-use types during day time and night time as listed in **Table 15** These limits are applicable for ambient noise outside workplace, for noise limits within workplace; instructions issued by Ministry of Labour are adopted.

The project area is categorized as Residential Areas within Villages; therefore the measured noise level will be compared with limits set for this category.

Table 15: Maximum Allowable Noise Limits

Area	Allowable Limits for Noise Levels (dBA)	
	Day	Night
Residential areas within cities	60	50
Residential areas within suburbs	55	45
Residential areas within villages	**50**	**40**
Residential areas with commercial activities, services, light handcrafts, and city centre	65	55

Area	Allowable Limits for Noise Levels (dBA)	
	Day	Night
Industrial areas (Heavy Industry)	75	65
Places of education, worship, treatment and hospitals	45	35

5.1.3.3 Results

The results of noise level monitoring are summarized in **Table 16**, **Table 17** and **Table 18** below; all measurements were carried out during day time and night time. As can be seen from these data, LA_{avg} is above the allowed limits, while the minimum levels are generally in compliance the standards for Noise at most of the proposed facilities of the project except for the Intake Pump Station location, and the proposed location for the Water Treatment Plant. These relatively higher levels of noise at these two locations other than the others are mainly due to:

- Existing pumping activities at the proposed locations for Intake pump station and the nearby location for the water treatment plant.
- The higher levels of traffic activity at these two locations in relevance to the locations of PS1, PS2 and PS3.

The exceedance events that were recorded at Locations of PS1, PS2 and PS3, were due to a traffic activity from mainly the farmers vehicles, and also for the irrigation pump that are at the nearby farms, which may also operate at night time when this exceedance was recorded.

Any additional noise generated from the Project construction activities needs to be taken into account and appropriate mitigation of adverse health impacts applied especially for the workers in the project, such as wearing protective ear muffs or plugs by workers during construction and operation.

Table 16: Results of Day 1 Noise Measurements

Location	Time	LA_{avg}	LA_{max}	LA_{min}
Intake Pump Station	Day Time	68	72	62
	Night Time	64	77	61
WTP	Day Time	65	80	54
	Night Time	63	65	60
PS1	Day Time	55	62	49
	Night Time	44	54	42
PS2	Day Time	62	73	55
	Night Time	56	68	45
PS3	Day Time	49	57	44
	Night Time	39	49	37

Table 17: Results of Day 2 Noise Measurements

Location	Time	LA_{avg}	LA_{max}	LA_{min}
Intake Pump Station	Day Time	66	72	60
	Night Time	65	79	50
WTP	Day Time	64	79	51
	Night Time	62	82	53
PS1	Day Time	53	75	37
	Night Time	55	70	37
PS2	Day Time	35	48	31
	Night Time	65	76	50
PS3	Day Time	60	71	45
	Night Time	36	48	31

Table 18: Results of Day 3 Noise Measurements

Location	Time	LA_{avg}	LA_{max}	LA_{min}
Intake Pump Station	Day Time	63	78	51
	Night Time	59	66	51
WTP	Day Time	57	73	34
	Night Time	60	73	50
PS1	Day Time	53	71	43
	Night Time	61	73	54
PS2	Day Time	59	69	41
	Night Time	63	74	56
PS3	Day Time	59	69	41
	Night Time	58	69	51

5.1.3.4 Conclusion and Recommendation

The proposed locations for the project facilities generally experience higher levels of noise than that of the relevant Jordanian standard. The proposed locations are within rural and farming areas, and the existing practices of water pumping at WAJ stations or for irrigation at private farms, the higher domestic travel at day time, and high transporting of agriculture crops at night time, leads to the conclusion that the effect is negligible.

5.2 Biological Environment

Jordan is relatively a small country. Its position as part of the Eastern Mediterranean region along with its geological properties, have created several bioclimatic regions within the country and hence a variety of ecosystems habitats and species. As part of Jordan's commitment to conserve its biological heritage and satisfy its obligations to International conventions, and national laws and regulations it became mandatory that any planned development will need to assess its impact on national biological diversity.

The current study aims at informing the development agencies by providing them ecological and biological baseline information at planned development areas so that development can mitigate any expected adverse impacts on diversity of species as well as ecological integrity within the country. The current study was conducted through combined ground truthing field and desktop (literature review) studies. These studies aimed at defining the biogeographical regions influencing biodiversity along the development area and accordingly defining the general vegetation types occurring and emphasis on species diversity both flora and fauna accruing within the area. More details were given on status of species recorded or expected to occur in the area.

This pipeline stretches between the Mediterranean and the Irano-Turanean realms where the former is prevailing in almost 70% of the pipeline towards the west. Atypical Mediterranean elements largely referred to as the non-forest type that exhibits outcropping limestones and heavy soils (**Figure 40**).

The Irano-Turanean elements become more evident as we head to the west towards the western slopes comprising natural grassland steppe vegetation and large agricultural areas. And hence this section is largely a part of the transitional areas between proper Irano-Turanean and the Mediterranean **(Figure 40**).

The alignment under consideration was divided into 2 major segments (**Figure 40**), based on the biogeographic regions crossed by the proposed pipeline. This segmentation is basically to cope with the construction and operation phases of the project.

The First (Eastern) **Segment (A)** includes the part of alignment starting at the Zabda reservoir in Irbid in a heavily populated area, ending at Sama- Makhraba Area.

This part falls almost entirely within the existing network of roads totalling 15 km in length, all of which occur within the Mediterranean ecozone of Jordan.

The second **Segment (B)** encompasses the alignment starting at Makhraba Area all the way west reaching the Eastern Ghor Canal ending at the intake pump station totalling 8.5km, falling entirely within the Irano-turanianecozone of Jordan.

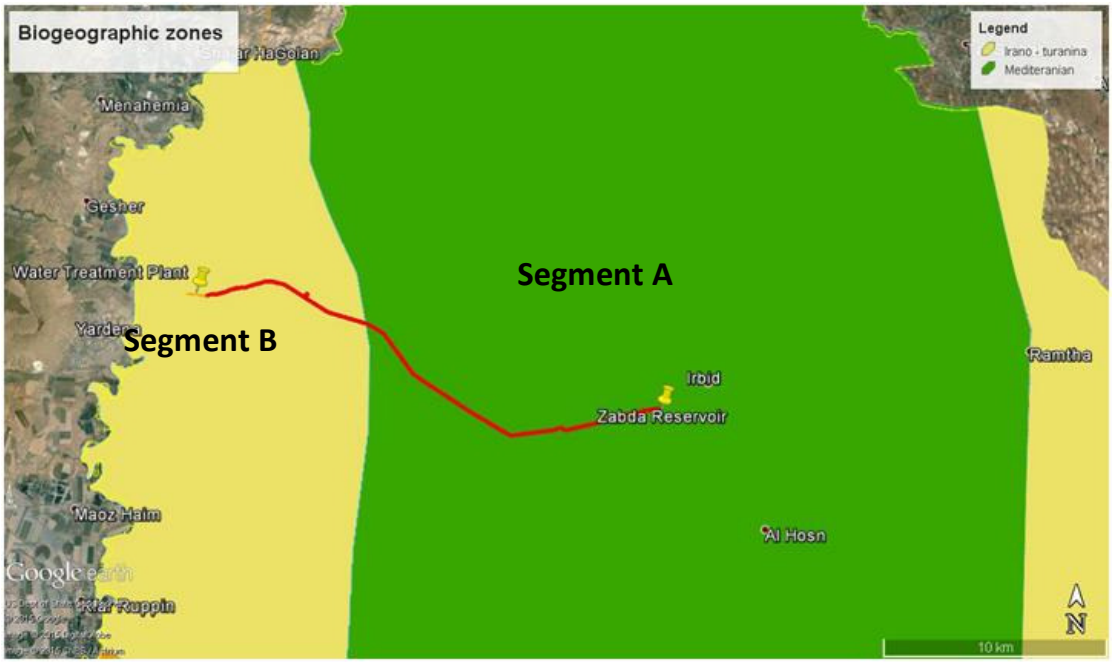


Figure 40: Biogeographic Zones of the Project Area

- **Biogeography**

Biogeographically, the alignment crosses two specific bio-geographic regions recognized in Jordan, Mideterranean and Irano-Turanean, with the first bioregion dominating throughout the proposed corridor (**Segment A**).

Irano-Turanean realm is evident at the alignment part that extends along (**Segment B**). The soil is mostly poor, eroded and has the calcareous or loos type. This soil is moderately productive and is best used for moderate herbivory. The Irano-Turanean parts are treeless zones where steppe vegetation dominates. Substantial green stands accrue at large wadis.

Segment (A)

The first segment is a mixed forest and non forest Mediterranean area and are usually vegetation rich with Mediterranean elements, and as the area is interspersed with many run offs and wadis of various sizes, substantial vegetation can be supported.

The monotonic habitat coverage and deterioration of the first part of **Segment A**, leaves little chance for biodiversity to inhabit or depend on this type of habitat for feeding. Field investigation proved that this part of the corridor is not of any significance to bird populations.

Few areas along the corridor still enjoy its naturalness. Many parts have been subject, through the years, to human interferences and alterations. Main human land use changes include urbanisation, establishing of road networks and creation of agricultural areas on the expense of natural habitats. Several distinguished habitats can be of concern to the current development. These include mainly:

1. Natural (Oak) Forest stands, occurring mainly in the Mediterranean region especially in section A, have the highest Oak trees density.
2. Non-forest areas of the Mediterranean region and presented in most of sections within the Mediterranean region.

3. Rocky slopes along the corridor mainly in the Mediterranean region and occur almost in all sections.

These habitats and the microhabitats are home for a diversity of vertebrate fauna that differ in their home and feeding ranges. Small vertebrates such as reptiles (lizards and snakes) and small mammals like rodents enjoy short home and feeding ranges. However, larger mammals such as foxes require larger home and feeding ranges.

The non forest type of the Mediterranean is characterized by a slope dominating Sarcopoteriumspinosum, a typical Mediterranean element indicating after forest succession. Soil and rainfall factors support good vegetation cover and cultivation of crops. Few dispersed high shrubs do occur in the site such as wild almond trees, deciduous oaks, karob and others. A diverse mammalian and herpetofuanal species are expected to occur at these sites. Vast areas along the slopes are afforested by tree elements of Aleppo Pine (Pinushalepensis). The afforestation efforts by the government of Jordan had started since early fifties.

The scarcely scrubby and bushy areas exist outside populated areas, these spots are often productive for migrant warblers and shrikes. It is good place also for Roller, Red-rumped Swallow, Graceful warbler and Southern Grey Shrike. Migrating raptors and storks can also pass over these sites though in low numbers.

Characteristic breeding species to the area are inhabitant to the remnant woodland of the area including, Collared Dove, Palm Dove, Turtle Dove (to a leaser content), Hoopoe, Lesser Whitethroat, Spotted Flycatcher, Blackbird, Great Tit, Woodchat Shrike, Masked Shrike, Jay, Green Finch, and Goldfinch. It is good place also for Roller, Red-rumped Swallow, Graceful warbler and Great Grey Shrike.

Flora and Vegetation Types

Most of this development falls under the Mediterranean climate. The Irano-Turanean realm is also evident. This climate condition of enhanced precipitation and soil characters of the Mediterranean supported the growth of forest tree species and woodlands. Under each of these large realms various vegetation types can be recognized (**Figure 41**).

Figure 41: Vegetation Types Recognized within the Study Area

Description of the Vegetation Types
These are accounted for below according to the biogeographic zone it belongs i.e The Mediterranean and the Irano-Turanean. In the Former two main vegetation types can be recognized such as the Deciduous Oak Forest (in Red) and the Mediterranean non forest type (in Peach). The Irano-Turanean realm however is also represented by two vegetation types that are termed as the Artimisiaherba-alba steppe (Green) and the mixed steppes and Sharo Arabian vegetation (Orange).

The Deciduous Oak Forest:
The forest is dominated by *Quecusithaburensis. Quercusethaburensis* is used as the indicative name of this type of forest as in some studies the un-unified taxonomic status refer to species like *Q. boissieri*and *Q. aegilops*. These forests are found in patches mostly surrounded by the non-forest type and occur at low altitudes that range from 100m at Yarmouk basin to 750 m to the south of Yarmouk basin in areas such as Um Qeis, Malka and mountainous ridges overlooking Yarmouk basin and the northern parts of the ridges overlooking the upper Jordan valley (Dair Abu Said). They form discontinuous areas between Amman and as far as the Yarmouk River.

They grow on red or brown soil of hard limestone parental rock. Most of these forests are not protected and therefore subject to degradation. These forests do not form dense stands, but density does increase at arcs i.e valleys running through the hills and mountains they dominate (**Figure 42**). These forests have been subject to sever pressures from grazing and wood collection.

Along the pipeline, individual Oak trees can be seen along the road between the Pumping stations 2 and 3. Other trees and high shrubs that can also exist within these forests are *Ceratoniasiliqua, Oleaeuropea, Styraxofficinalalis, Pistaciaatlantica, Crataegusazarolus, Amygdaluscommunis, Rhamnuspalaestinus, Retamaraetam.* Other herb and bushes include *Dactylisglomerata, Urgineamaritima, Hordeumgalucum, Viciahybrida, Trifolium* spp., *Carlinahispanica, Poabulbosa, Tulipa spp. Alceaacaulis, Salvia* spp. *Euphorpiaheirosolymitana, Sarcopoteriumspinosum.*

Figure 42: Aerial Photo Showing the Scattered Distribution of the Deciduous Oak Forests

The Mediterranean non Forest Type:

Along the Pipeline, this occurs at mountainous parts surrounding the deciduous oak and can be seen all the way from the reservoir area till after the pumping station no.2. Some refer to this as a secondary (degraded forest) and use the term Batha Mediterranean to indicate it. It occurs at steep limestone scrub and is dominated by dwarf-scrub communities. Plant associations include *Ononisnatrix* and A*nchusastrigosa, Salvia dominicia* and *Ballotaundulata.* Few areas are in association with *Sarcopoteriumspinosum.* Other species include R*hamnuspalaestinus, Calycotomevillosa*and *cistusvillosus, Varthemiaiphionoides, Ononisnatrix, Capparisspinosa, Asphodelusaestivus, Asphodeline sp., Visia spp., Thymus capitatus, Asparagus aphyllus, Sinapisalba,* sp. *Silenecolorata, S. aeagyptiaca, Trifoliumpurpureum, T. campestre, T. resupinatum, Tragopogoncoelesyriacus, Silybummarianum, Anagalisarvensis*, *Papaver sp., Anemone sp.* and many others.

Within this type and along the pipeline, the natural habitats are highly impacted by development (residential, road construction and farming). Therefore weedy vegetation dominates most of the existing habitats (**Figure 43**).

Figure 43: Images to Habitats within the Non-Forest Mediterranean Vegetation Showing the Weedy Vegetation and Existing Impacts of Development

The Irano-Turanean realm, dominated by steppe vegetation, becomes more evident on western sides of the Mediterranean. The western alignment forms a relatively narrow strip bordering the Mediterranean.

Intensive farming of various crops essentially affects all species of mammals and reptiles. In addition, the proposed pipe line runs along already constructed roads and residential areas. Only resilient species and species adapted to live close to human habitation can exist.

Mammals could be represented by TristramJird, Wagner's Gerbil, and the Middle East Blind Mole Rat, *Spalaxehrenbergi.* Roaming canids such as the Red Fox could also be encountered. Reptiles such as the starred Agama, associated with rocky areas, and the Snake-eyed Lizard are common are will not be affected by digging since they will move away to safer areas within their home range.

Segment (B)

Scarcely scrubby and bushy areas exist outside populated areas; these spots are often productive for migrant warblers and shrikes.

Within the Irano-Turaneanbioclimate vegetation is sparse and limited to annual and little shrubby vegetation. Most habitats in these areas are deteriorated due to increased urbanisation. The poor habitat coverage and deterioration leaves little chance for wild birds to inhabit or depend on this type of habitat for feeding. Field investigation proved that this part of the corridor is not of any significance to bird populations.

Artemisia Herba-Alba Brush

This is limited to a narrow strip on the western borders of the Mediterranean. It exists as grassland slopes of sharply defined erosion gullies. Main plant associations include *A. herba-alba* and *Anabasis Syriaca, A. herba-alba* and *Poasinaica* and *Stipabarbata*. Other associations include *Helianthemumvescarium* and *Achillea* sp. Other species include *Centaurea* sp. *Retamaraetam*, *Capparisovata,Salsolavermiculata*, *CarlinaHispanica, RutaChalepensis, Teucriumpollium*. Planted tree species such as *Schincus mole*, *Eucalyptus* sp. *Prosopis* sp. and *Acacia*sp.were also observed (**Figure 44**).

Figure 44: Images to Habitats within the Irano-Turanean Steppe Vegetation on the Western Slopes

Transitional Steppe-Saharo Arabian
Which occur at end of the pipeline surrounding the proposed WTP plant. This appears as a desert region scrub on limestone and marls, bare bed rocks. Cultivation is wide spread in this part. Plant associations include parts of *Salsolavermiculata*and *Anabasis articulata, Centaurea damascene* and *Lactucaorientalis*, *A. herbaalba* and *Anabasis syriaca.*

The presence of the King Abdullah water Channel encouraged agriculture in these parts. Citrus farming, vegetables cropping is widely spread. The southern parts of this segment is yet under the tropical influence which is indicated by the presence of *Ziziphusnumularia* and Castor oil plant, *Ricinuscommunis*, planted trees such as *Acacia* and *Parkinsonia* trees, *Ficuselastica* and other tropical *Ficus* sp. In degraded areas and dumped farm sides *Alhagimarourum and Urtica sp.* are dominant (**Figure 45**).

Figure 45: Transitional Steppe-Saharo Arabian

5.2.1 Mammals

Within this section, the presence of at least 12 species of mammals has been confirmed previously from areas close to the study site **Table 19**, International Union for Conservation of Nature IUCN status of each species are also given. This includes the Golden Jackal, *Canisaureus*. This species occurs in high populations around the thick and bushy vegetation around the Jordan River, and perhaps visit the area occasionally seeking food. However, its presence in the study area can be considered accidental. A noteworthy species is the Egyptian Mannose, *Herpestes ichneumon,* collected from areas along the Jordan Valley extending from North Shounha to Wadi Al Mujib. The Red Fox, *Vulpesvulpes,* is a wide spread species occurring in all types of habitats. Similarly, the Wild Boar, *Susscrofa*, can be found even in at higher elevations while foraging. This is a quite common species breeding in areas around the Jordan River, and invades farmlands and cultivated fields and considered as a pest.

Bats are exemplified by the Egyptian Fruit Bat, *Rousettusaegyptiacus* ,that frequent fruit cultivated areas along the Jordan Valley. This species has a wide home range that can extend over 30 km from its roosting sites. The Kuhl'spipistrelle,*Pipistrelluskuhlii,* is another common bat in the Jordan Valley that is certainly present near cultivated field and open water bodies.

Of the insectivores, the Long-eared Hedgehog, *Hemiechinusauritus,* could be found along open fields or in wadi systems. At least four species of rodents are known to occur is such habitat, including TristramJird, the Eastern Spiny Mouse, the House Mouse and Wagner's Gerbil.

Table 19: Mammals Known from the Study Area along with Their IUCN Status

Order	Scientific Name	Common Name	IUCN Status
Carnivora	*Canisaureus*	Golden Jackal	Least Concern
	Vulpesvulpes	Red Fox	Least Concern
	Herpestes ichneumon	Egyptian Mannose	Least Concern
Artiodactyla	*Susscrofa*	Wild Boar	Least Concern
Chiroptera	*Rousettusaegyptiacus*	Egyptian Fruit Bat	Near Threatened
	Pipistrelluskuhlii	Kuhl'spipistrelle	Least Concern
Insectivora	*Hemiechinusauritus*	Long-eared Hedgehog	Least Concern
Rodentia	*Acomysdimidiatus*	Eastern Spiny Mouse	Least Concern
	Dipodillus*dasyurus*	Wagner's Gerbil	Least Concern
	Merionestristrami	TristramJird	Least Concern
	Musmusculus	House Mouse	Least Concern

5.2.2 Reptiles

At least 23 species of reptiles and two species of amphibians (*Bufoviridis*and*Ranabedriagae*) occur in the study area (**Table 20**). This is based on some field observations, as well as published records. Noteworthy species is the Greek Tortoise, *Testudograeca,* especially in the upper part that should be considered during digging. Other species are considered common and have no threat criteria.

Other species of concern is the Palestine Viper that occurs in the cultivated field with trees. This is a highly venomous species and care should be taken during camping within the area.

Table 20: List of Reptiles Occurring in the Study Area along with their IUCN Status

Family	Scientific Name	Common Name	IUCN Status
Testudinidae	*Testudograeca*	Greek Tortoise	Least Concern
Gekkonidae	*Hemidactylusdawudazraqi*	Turkish Gecko	Least Concern
	Ptyodactyluspuiseuxi	Levante Fan-Fingered Gecko	Least Concern
	Mediodactyluskotschyi	Kotschy's Gecko	Least Concern
Chamaeleonidae	*Chamaeleochamaeleon*	Common Chameleon	Least Concern
Agamidae	*Stellagamastellio*	Starred Agama	Least Concern
	Trapelusruderatus	Rudarate Agama	Least Concern
Lacertidae	*Ophisopselegans*	The snake-eyed lizard	Least Concern
	Phoenicolacertalaevis	Lebanon Lizard	Least Concern

Family	Scientific Name	Common Name	IUCN Status
Scincidae	*Eumecesschneideri*	Schneider's Skink	Least Concern
	Trachylepisvittata	Bridled Mabuya	Least Concern
	Ophiomoruslatastii	Latast's Snake Skink	Least Concern
Typhlopidae	*Typhlopsvermicularis*	The Worm Snake	Least Concern
Colubridae	*Dolichophisjugularis*	Large Whip Snake	Least Concern
	Eirenis coronella	Crowned Dwarf Snake	Least Concern
	Eirenisdecemlineata	Narrow-striped Dwarf Snake	Least Concern
	Eirenislineomaculatus	Striped Dwarf Snake	Least Concern
	Eirenisrothi	Roth's Dwarf Snake	Least Concern
	Hemorrhoisnummifer	Coin Snake	Least Concern
	Malpoloninsignitus	Montpellier Snake	Least Concern
	Natrix tessellata	Dice Snake	Least Concern
Atractaspididae	*Micrelapsmuelleri*	Mueller's Ground Viper	Least Concern
Viperidae	*Daboia palaestinae*	Palestine Viper	Least Concern

The proposed project does not overlap with any protected area and the closest protected areas to the pipeline are Yarmouk protected area (10 km to the N of the alignment) and Ajloun Protected Area (14 km to the S of the alignment) **Figure 46**. Given the far distance between the project corridor and Yarmouk and Ajloun Protected Areas, the project is not anticipated to affect the biodiversity within and around these protected areas.

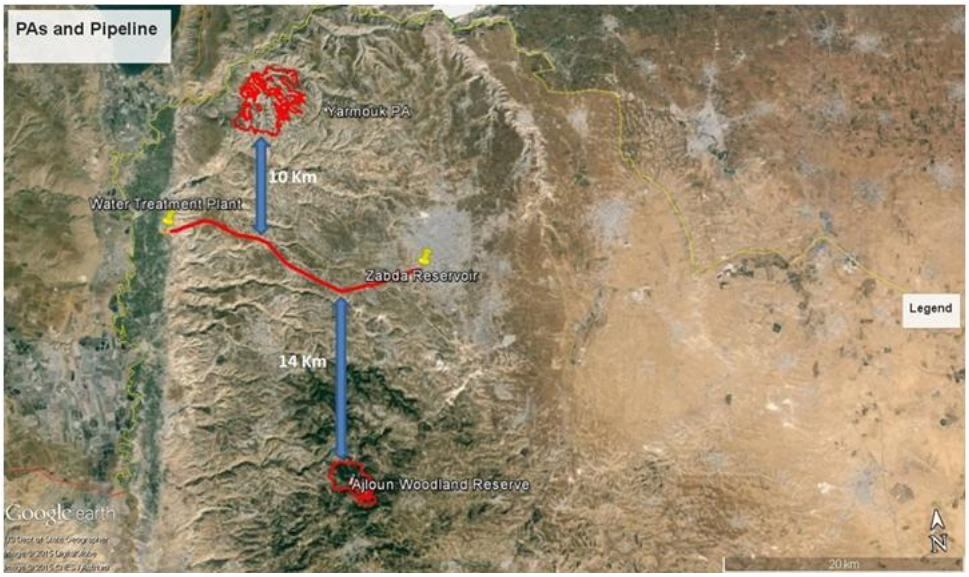


Figure 46: Project Alignment and Protected Areas

There is an inextricable link between food production, energy and water systems, where the use and strains on one of these resources can affect the others. Water is needed to produce electricity and transport fuels. Similarly water production, distribution and treatment are all energy intensive functions and can be affected by energy shortages and pricing. Impacting of water quantity and quality will therefore affect food security. Climate change has an impact on this link as it will impact availability of water resources through changing precipitation patterns especially in a country like Jordan that is already facing physical water scarcity. Physical water scarcity occurs

when there is not enough water to meet demand due to sever environmental degradation, declining or depleted ground water reservoirs, and unequal distribution.

The current development, although will increase local resilience to climate change, however, water treatment and pumping from below sea level to almost 650 masl will be energy demanding. Also, the effluents resulting from the treatment if returned to the canal will increase salinity and its impact can be exacerbated if the amount of water in the canal is compromised by reduced precipitation in the upstream. This can impact food production and security in Jordan valley dependent on the canal. It is recommended at least in terms of energy use that processes such as water treatment and transport are powered by renewable energy sources either partially or totally.

5.3 Socio-Economic Conditions

5.3.1 Irbid Governorate

5.3.1.1 Location and Administrative Regions

Irbid Governorate is located to the far north of the Kingdom, and its land extends to the Jordanian-Syrian borders in the north and the borders with Palestine from the West. The governorate is bordered by Syria (the Golan Heights) from the north, the Jordan River from the west, Mafraq Governorate from the east, and Jarash, Ajlun and Balqa Governorates from the south.

The eastern regions of the governorate (Ramtha) are part of the Huran Plains that cross Syria and Jordan, while the northern parts overlook the Golan Heights. The western part is made up of medium-height plateau sloping gradually to below sea level in the Jordan Valley. The southern region (Al Mazar Al Shamali) has a high mountainous typography adjacent to the Ajloun Mountains.

Administratively, Irbid Governorate consists of nine districts, namely: Al-Qasabah, Ramtha, Koura, Bani Kinanah, North Ghor, Bani Obaid, North Mazar (Al Mazar Al Shamali) Taybeh and Wastieh, see **Figure 47** below.

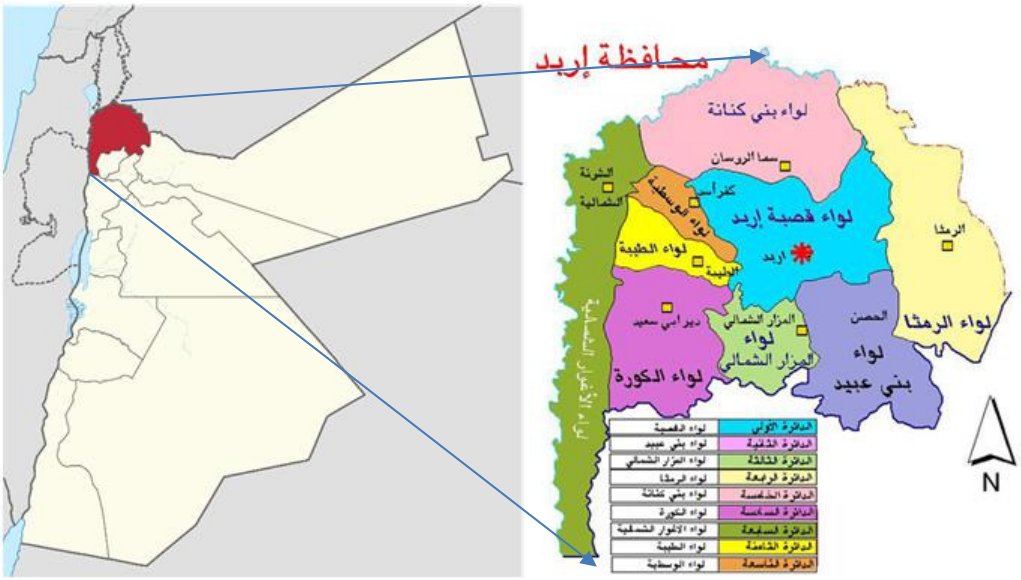


Figure 47: Location and Administrative Regions (Districts) of Irbid Governorate

5.3.1.2 Population and Demographic Trends

Irbid Governorate has the second largest population and the highest population density in Jordan. According to DOS (2012) statistics, the total population of the governorate of Irbid has reached about 1.137 million people which accounts for 17.8% of Jordan's overall population. Male population represents 51.2% of the governorates total population, whereas females account for the remaining 48.8%. About 17.1% of the governorate's population resides in the country-side and outskirts of Irbid city **Table 21**.

Table 21: Main Demographic Indicators of Irbid Governorate Districts Population Dependency Rate Area (Km^2) for the Year 2012

Districts	Population	Dependency Rate	Area km^2	Population Density	Less than 15 years old	15-64 years old	65+ years old
Al-Qasabah	460,090	66.3	253.8	1951.4	63.5	60.1	3.3
Ramtha	133,690	71.6	274.5	487.1	39.2	58.3	2.5
Koura	111,530	79.8	178.5	624.9	41.2	55.6	3.2
Bani Kinanah	93,580	68.0	252.9	370.1	36.6	59.5	3.9
Northern Ghor	104,370	76.1	246.4	423.7	39.8	56.8	3.5
Bani Obaid	114,610	56.9	188.4	608.3	36.1	60.3	3.6
Northern Mazar (Al-Mazar Al Shamali	54,100	72.3	86.2	627.7	38.3	58.1	3.7
Taybeh	35,680	77.0	63.5	562.2	9.9	56.5	3.6
Wasatieh	29,450	72.5	45.8	643.3	38.3	58.0	3.7
Governorate of Irbid (Total)	1,137,100	69.9	1571.8	723.4	37.8	58.9	3.4
Jordan Total (Kingdom Level)	6,388,000	68.2	88793.5	71.9	37.3	59.4	3.3

Source: Department of Statistics

As can be noted from the table above, Irbid Governorate enjoys very young age structure which alerts further rapid population growth. However there are other factors contributing to rapid population growth in Jordan in general, and in Irbid in particular.

Jordan population grew from 586,200 people back in 1952 to 900,800 in 1961 and to 2,133,000 in 1991 (this period also constitute the migration of Palestinians to Jordan following the 1967 war), and 4,139,358 in 1994 when many expat Jordanians returned from Iraq and the Gulf Region due to the gulf war. Jordan population reached 5,103,639 people in 2004, and continued to grow to reach about 6,675,000 people in 2014. Population growth rates, natural increase and net migration during the periods from 1952 and 2004 are presented in **Table 22**.

Table 22: Population growth rates, natural increase and net migration in Jordan

Period	Population Growth Rate %	Natural Increase Rate %	Net Migration %
1952-1961	4.8%	3.2%	1.6%
1961-1979	4.8%	3.6%	1.6%
1979-1994	4.4%	3.6%	0.8%
1994-1999	3.3%	2.7%	0.6%
1999-2004	2.6%	2.2%	0.4%

Source: the Department of Statistics, the Year book, 2004 (After AL-Mahasneh et. al., 2012)

Irbid, among other Jordanian major cities, witnessed waves of migrants which formed significant proportion of its population growth next to natural increase rates. The population of Irbid was 781,715 persons in year 1994 and 952,000 in 2004. The growth rate was 18.16% and 17.8% for the two mentioned years respectively (AL-Mahasneh et.al, 2012). AL-Mahasneh et.al (2012) estimated Irbid population to grow, based on the growth rate trends established on data published by the Department of Statistics, to reach 1,210,221, 1,538,503, 1,955,821, and 2,486,336 in years 2014, 2024, 2034 and 2044 respectively. Based on the above, Irbid urban area is expected to continue growing in response to the rapid population growth, and accordingly the demand on water, energy and natural resources will grow rapidly as well.

This situation escalated with the beginning of the first quarter of 2011. Syrian refugees started to come into Jordan in response to the instability of their country in the wake of the Arab Spring and the following Syrian civil war. Throughout the two years that followed, their numbers doubled and had a clear impact on the bordering governorates, namely Mafraq and Irbid, which share a border with Syria extending some 375 kilometers and which host the largest portion of refugees. Official statistics estimated that at the end of 2013 there were around 600,000 refugees, of whom 170,881 and 124,624 were hosted by the local communities of Mafraq and Irbid, respectively. This means that the two governorates are hosting around half of the UNHCR-registered refugees in Jordan.

According to UNHCR website, Irbid currently host about 143,215 Syrian persons of whom 61% are children and 4% are elderly at the age 60+. The distribution of number of Syrians in Jordan by Basic Service Unit (BSU) as available from the UNHCR REACH Website is provided in **Figure 49**

5.3.1.3 Population Size and Density ss Per 2010 Survey

The total area of Irbid Governorate is estimated at about 1571.8 km^2 which accounts for 1.8% of Jordan's total geographic area. Due to its unique geographic location Irbid at the vicinity of the borders with Israel, Syria and the Palestinian territories, Irbid is considered one of the most important trading centers in Jordan, and is considered a major ground transportation hub between Amman, Syria to the north, and Mafraq to the east.

According to DOS website, the total population of Irbid Governorate as surveyed on year 2010 is 1,088,100, and the total area is 1571.8 km^2. The urban population of Irbid population is estimated to form 82.9% and accordingly rural population forms about 17.1% of the total population. Population density of Irbid is estimated by DOS to be 692.3 persons per km^2. (See **Figure 48)**

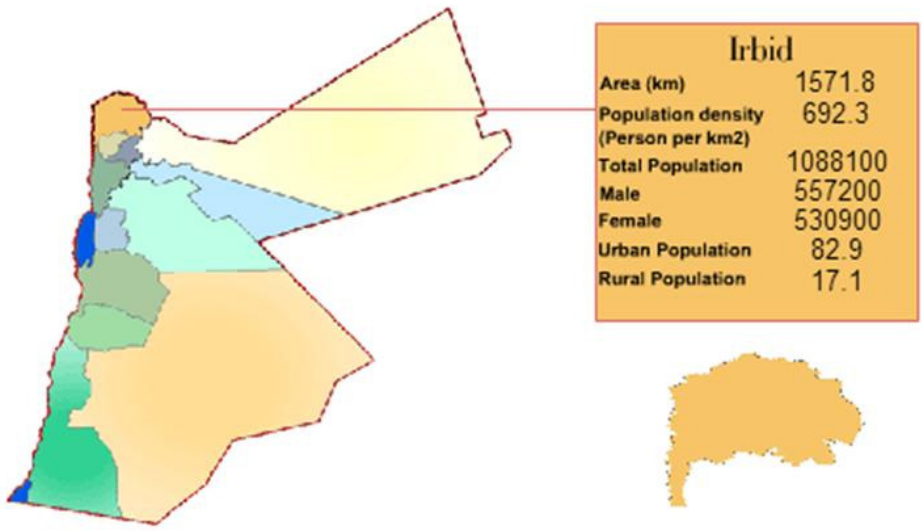


Figure 48: Basic Demographic Statistics for Irbid Governorate (2010) from DOS Website (accessed June 21st 2015)

5.3.1.4 Family Size and Composition

Previous surveys by the consultant within Al Yarmouk basin revealed that the average size of the families is 6.02 individuals. The gender ratio is 51.2 % males and 48.8 % females. As for age distribution, and provided in **Table 23**, 37.8% of the population are less than 15 years old, 58.9% are in the age range from 15 to 64, and only 3.4% are at the age 65+.

5.3.1.5 Housing Patterns

The communities are characterized as stable for reasons related to history, region environment and the nature of living for the population. Presence of a large percentage of population living in a Detached house (Dar) is a clear indicator for the communities' way of Villager life depending on farming and livestock.

According to the Department of Statistics (DOS) annual year book for the year 2012, about 78.2% owns their houses and only 17.2% rents houses (DOS, 2012).

Table 23: Distribution of Housing Units by Type of Tenure, Governorate (%)

Governorate	Total		Type of Tenure			
	%	No.	For free	For work	Rented	Owned
Irbid	100	194667	4.6	0.1	17.2	78.2
Kingdom	100	1134177	2.9	0.8	23.2	73.1

Source: DOS, 2012

5.3.1.6 Education and Literacy

Education is on the top of the national priorities in Jordan. In the targeted governorates there are many schools located within the districts area. The number of schools identified within Irbid Governorate is 1077 schools, of which 691 are mixed gender schools (mainly elementary, or

elementary for male students and high school for female students), 253 schools for male students, and 133 schools for female students.

Table 24: Summary of the Distribution of Schools in the Study Area (Source: MoE 2013)

Governorate	Elementary & Secondary (high school)		
	Male	Female	Mixed
Irbid Governorate			
Irbid Qasabah District	73	48	253
Ramtha District	25	16	74
Koorah District	33	15	93
Bani Kenanah District	36	14	64
AL - GhwarShamaliyah District	24	9	54
Bani Obeid District	20	7	80
MazarShamali District	17	6	36
Taybeh District	10	4	17
Ghour Irbid	16	11	5
Wastiyyah District	19	3	15
Sub-Total	253	133	691

Jordan education system and measures to combat illiteracy succeeded largely in controlling illiteracy. **Table 25** provides summary of indicators of education and illiteracy in Jordan (Source: UNICEF Website, accessed June 21st 2015).

Table 25: Statistical Indicators of Education and Illiteracy in Jordan

(Source: UNICEF Website, accessed June 21st 2015)

Indicator	Value
Youth (15-24 years) literacy rate (%) 2008-2012*, male	99.1
Youth (15-24 years) literacy rate (%) 2008-2012*, female	99.3
Number per 100 population 2012, mobile phones	139.1
Number per 100 population 2012, Internet users	41
Pre-primary school participation, Gross enrolment ratio (%) 2008 -2012*, male	33.4
Pre-primary school participation, Gross enrolment ratio (%) 2008 -2012*, female	31.4
Primary school participation, Gross enrolment ratio (%) 2008-2012*, male	92.2
Primary school participation, Gross enrolment ratio (%) 2008-2012*, female	91.8
Primary school participation, Net enrolment ratio (%) 2008-2012*, male	90.8

Indicator	Value
Primary school participation, Net enrolment ratio (%) 2008-2012*, female	90.7
Primary school participation, Net attendance ratio (%) 2008-2012*, male	98.7
Primary school participation, Net attendance ratio (%) 2008-2012*, female	99.1
Primary school participation, Survival rate to last primary grade (%) , 2008-2012*, admin. data	–
Primary school participation, Survival rate to last primary grade (%) , 2008-2012*, survey data	–
Secondary school participation, Net enrolment ratio (%) 2008-2012*, male	83.2
Secondary school participation, Net enrolment ratio (%) 2008-2012*, female	88.2
Secondary school participation, Net attendance ratio (%) 2008-2012*, male	85
Secondary school participation, Net attendance ratio (%) 2008-2012*, female	

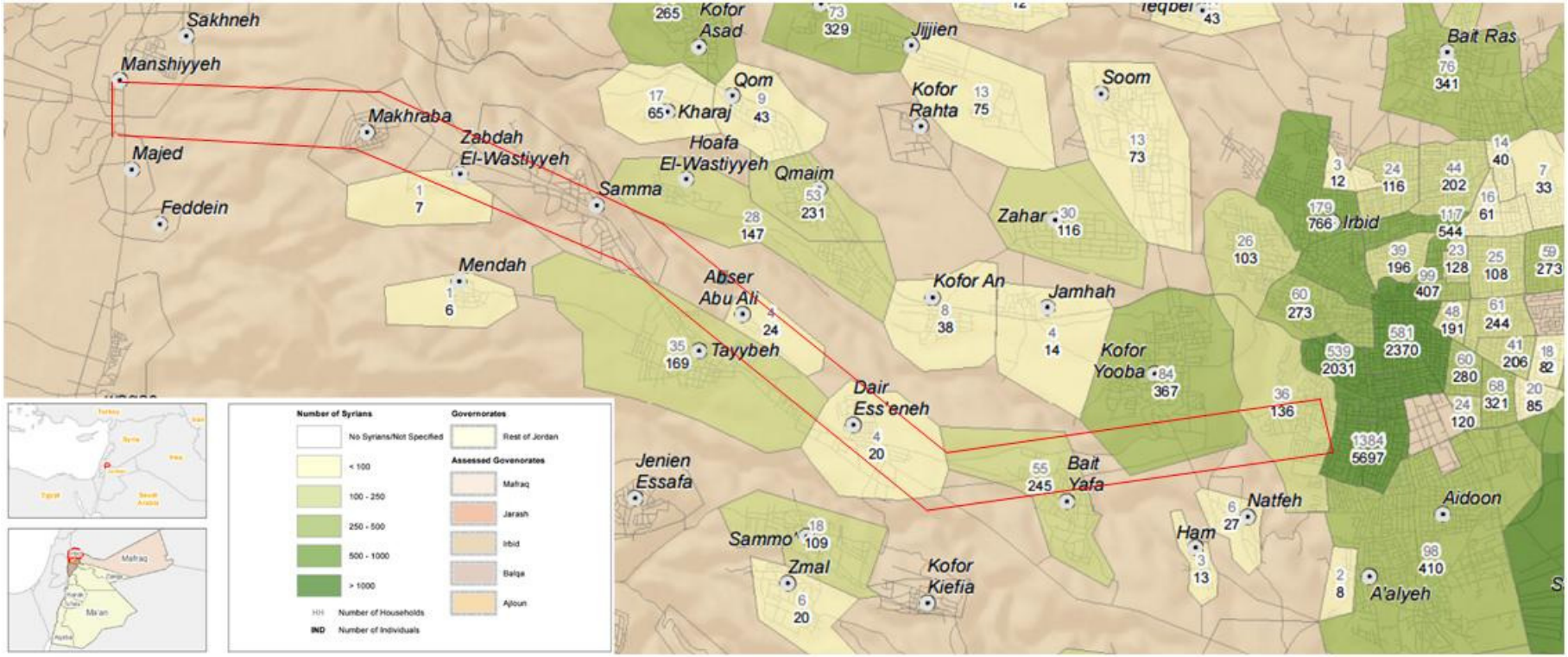


Figure 49: Number of Syrians in Jordan by Basic Service Unit (BSU)

5.3.1.7 Economics and Livelihoods

Employment

The official statistics about unemployment in Irbid shows that unemployment rate in Irbid reached 12.7% in year 2011 (10.7% among males and 22.8% among females) compared to Jordan 12.9% unemployment rate. (See **Figure 50**)

The number of Irbid workers who are currently employed is estimated at 221,269 in 2012 which accounts for 17.4% of Irbid's population, whereas the number of the unemployed is estimated at 29,809. About 34.4% of the Irbid labour force work in the fields of public administration, social security and related services, 14.7% in education, 4.7% in healthcare and social services, 13.2% in wholesale and retail trade as well as vehicle maintenance, 7.2% in transportation and warehousing, 1.7% in the tourism sector, and about 2.7% work in agriculture.

Foreign labour in Irbid has reached 30,043 workers, accounting for 10.7% of the total number of foreign labour in Jordan.

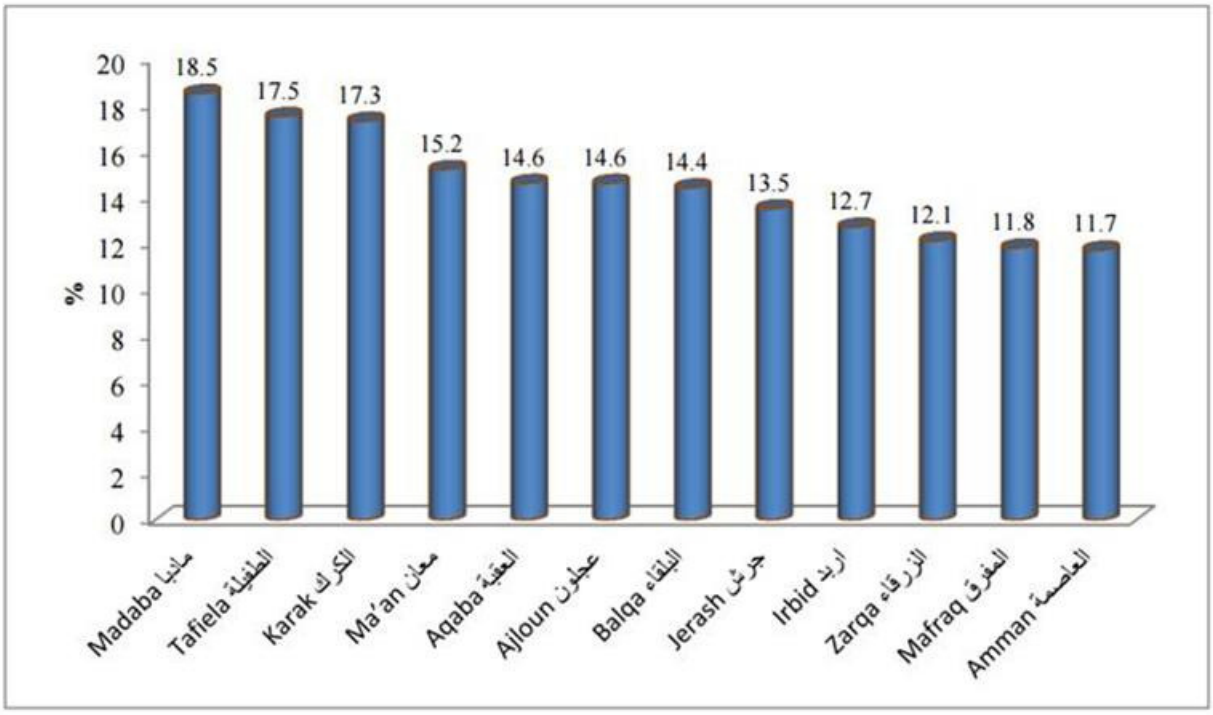


Figure 50: Unemployment Rates by Governorate (DOS, 2011)

Table 26 shows key economic and labour market statistics in Irbid (2012).

Table 26: Key Economic and Labour Market Statistics in Irbid

Indictors	Irbid Governorate	Kingdom-Level
No. of employed labour force	221,269	1,268,093
% of employed labour force	17.4%	
No. of the unemployed	29,809	175,470
% of the unemployed	17%	
No. of foreign workers	30,043	279,798
% of foreign workers	10.7%	
Participation in Economic Activity Rate	37.4	38.0
Unemployment rate	11.9	12.2
Inflation Rate	5.12	4.77
Average Annual Household income (JOD)	7877.2	8823.9
Average Annual Household Expenditure (JOD)	8638.6	9626.0
Average Annual per Capita Income (JOD)	1421.8	1660.2
Average Annual Per Capita Expenditure (JOD)	1535.2	1793.0
Poverty Ratio (2012)	15%	14.4%
% of Middle-Class Households (Families)(2008)	28.3	41.0

Source: Department of Statistices (2012)

5.3.1.8 Poverty in Irbid Governorate

Latest official statistics on poverty indicators published by the Department of Statistics, based on the Household Income and Expenditure Survey 2010, show that the poverty ratio in Irbid has reached 15% which is slightly higher than the Kingdom's average of 14.4%. The number of the 'poor' in Irbid Governorate is 163,933 people, accounting for 18.7% of the total number of the 'poor' in Jordan.

5.3.1.8 Agriculture in Irbid

Irbid is considered to be one of the most active regions of Jordan in terms of agricultural activities. The Governorate produces citrus, olives and grain, in addition to the production of honey and livestock. More on the distribution of production is provided in the following section. **Table 27** shows that Irbid Governorate accounts for 11% of total cultivated area in Jordan, with the governorate accounting for 8% of Jordan's total field crops cultivated area, 19% of Jordan's total fruit trees cultivated area, and 4% of Jordan's total vegetable cultivated area. This shows the relative importance of the governorate in terms of agricultural activity.

Table 27: Cultivated Area in Irbid Governorate

Indicator	Irbid Governorate	Kingdom-Level	Irbid Governorate's Percentage of Total Cultivated Area in Jordan
Field Crops cultivated area (ha)	8,538	112,904	8%
Fruit trees cultivated area (ha)	16,477	85,005	19%
Vegetables cultivated area(ha)	1,598	42,863	4%
Total Cultivated area (ha)	26,613	240,771	11%
Number of agricultural Cooperatives	32	284	11

Source: Department of Statistics, 2001

* Source: Jordan Cooperative Corporation

Olive cultivation and olive oil production industry is considered as the most important agri-business activity in Irbid and the main cultivated areas of Irbid where olives are produced include: Kfarat, Taybeh, Wasateyeh, Ramtha, and Bani Kinanah. ILO (2014) reported that the

cultivated areas are only 14,830 hectares out of 105,000 hectares suitable for cultivation in Irbid, which means that only 14% of suitable land for cultivation in Irbid is actually utilized.

As for livestock, the statistical information available from the Department of Statistics shows that Irbid sheep population reached 224,600 heads back in year 2011 forming 9.9% of Jordan total sheep population. For the same year, Irbid goats and cattle populations counted 63,000 and 11,200 heads respectively, forming respectively 8.4% and 16.6% of Jordan population of goats and cattle.

5.3.1.9 Environmental Statistics

According to Jordan Water Sector Facts and Figures 2013, the water supply for Irbid Governorate is 120 l/c/d, however the actual consumption is 77l/c/d with 33.59% Non Revenue Water (NRW).

According to Irbid plan website (http://www.irbidplan.gov.jo/the-environmental-footprint) Waste generation per capita is estimated at 0.6 kg per day (Irbid Governorate level). Solid waste arriving at Akaider landfill from Greater Irbid is 300 tonnes per day as well as a good quantity of liquid waste. The seven hospitals in Irbid generate 960 kg per day of hospital waste. Major environmental related problems are indoor sanitation, industrial waste, hazardous materials transported by road and gas/chemical household product

5.4 Archaeological Baseline Conditions

5.4.1 Methodology

In order to establish the archaeological baseline data for the environmental impact assessment study, archaeological survey was carried out by a team of specialists.

The methodology adopted for this study is based on literature review, field investigation and documentation, data analysis, report preparation and final report with recommendations

a) Field work survey

The study team investigated the project area and the surrounding zone. So the whole area along the water pipeline route was conducted by the study team. The investigations covered the whole area of the study from Zabda to Jordan Valley within the project corridor, which is 250-800 m from both sides of the proposed pipeline route.

The survey was conducted on foot, with survey members walking at a distance of 20-30 meters from each other

b) Literature survey

Most of the available sources and references that are related to the study and database and information were reviewed such as:

- Jordan Antiquities Database and Information System (Mega + JADIS).
- Department of Antiquities of Jordan Archives (DAJ).
- Library of American Center for Oriental Research (ACOR) and British Council for Research in Levant (BCRL).

c) Photographic Documentation

A photographic technique was used so as to document the recorded data. The sites were registered, mapped and properly dated and evaluated.

During the study the following activities was conducted:

1. Detailed Survey and investigation of the whole project area and the location of the possible service areas, camping locations, etc.
2. Registration of the surveyed sites (if found) on a suitable registration form.
3. Mapping of all sites (if found) on 1-25,000 map scale series k737 maps.
4. Definition of the mitigation measures necessary to avoid / minimize the project threats / impacts to the national / local archaeological and cultural resources.

5.4.2 Survey Results

The survey data includes descriptions of the essential information for each site found during field survey. The information includes the following:

- Site number assigned in the field
- Site location and UTM coordinates
- Modern Arabic name of site (if known)
- Brief descriptions of the discovered remains
- Recommended actions

The survey located 11 not directly threatened sites. The periods best represented are:

1. Chalcolithic-Early Bronze Ages 4200-3200BC
2. Classical (Roman +Byzantine) 64 B.C-336AD.
3. Modern or Undefined period

The unthreatened discovered archaeological sites fall under the following categories:

1. Settlement site, site No. 10/11
2. Sacred site, site No.6
3. Water System site, site No.9
4. Agriculture site No 2/3/4/5.

Description of archaeological sites and recommendations
The field survey and investigations revealed eleven archaeological sites, each site was briefly described and recommended actions were included in details so as to reduce the negative indirect impacts on the existed archaeological site.

The field investigations was conducted in accordance with the Antiquities Law No. 21 for the year 1988, as mentioned in article No. 31 (No permit should be granted for any construction project including buildings and fences, unless a distance of 5-50 meters is left between them and any antiquity according to directors decision).

The following section includes a map showing all sites with reference to project **(Figure 51**), and list of the eleven discovered archaeological sites during the field investigations.

Figure 51: Archeological sites discovered during investigation

Site No: 01		
Site name: Zabda Cairn		
Site location: Zabdah / Irbid		
Site Coordinates	E766066 N3603173	

SITE DESCRIPTION:

The site is located 100 meter close to the south western corner of Zabda reservoir on a flat area occupying one dunum approximately.

The site consist of large and medium megalithic undressed ashlars scattered all over the area, the site was partly affected during the construction of the nearby asphalt paved road. Some of the site remains (especially undressed ashlars) still scattered here and there close to the cairn, while the center area of the site was dug in recent times possibly as a result of robber activity.

Neither pottery sherds, flints or indication of any occupational phases were found on the surface of the site.

RECOMMENDATION:

There are no clear archaeological features in the area of the site; in addition to that the site is away from the projected area. No potential threats are expected from the construction of the water pipeline.

Site No: 02		
Site name: Megalithic Cairn		
Site location: Zabda		
Site Coordinates	E765621 N3603222	

SITE DESCRIPTION:

A large slabs of megalithic stones located on the middle slope of sloppy area located 50 meters to the right side of the water pipeline route. The slabs were investigated and properly evaluated in order to be sure that they are not related to any dolmen field or isolated tombs in the nearby area, it is reasonable to assume that these slabs were accumulated here as a result of field clearance during agricultural field activities by local farmers. There are no clear archaeological remains visible in the vicinity. Remains of a small heaps of stones were noticed close to the cairn and the slabs

The investigations revealed no Neolithic tools, artifacts, or even pottery sherds in and around the site.

RECOMMENDATION:

The site is without any archaeological significance and not directly or indirectly threatened by any construction activities, only protection measurements should be adopted during any construction, to avoid needless destruction if any remains found under the surface.

Site No:03		
Site name: Rujum Jabal Al-Kofahi		
Site location: Zabda		
Site Coordinates	E765337 N3603085	

SITE DESCRIPTION:

A medium sized circular structure situated 100 meters to the left side of the pipeline route , the diameter of the structure ranged between 8-10 meters, built of single rows of megalithic stones on a sloppy area, the internal space of the site was filled with small ashlars and chunks possibly as a result of field clearance, field investigation revealed the presence of no datable materiel neither pottery sherds or any clear datable materials, only limited small lithic tools noticed on the surface dated broadly to Chalcolithic Period .

RECOMMENDATION:

The sites are of low significance without clear any indication of archaeological features, nevertheless it should be protected from the indirect threats such as service road, dumping and or borrowing areas.

Site No: 4		
Site name: Wadi Al-Khafar Enclouser		
Site location: : Kafer Youba/Irbid		
Site Coordinates	E: 764745 N:3603022	

SITE DESCRIPTION:

A large size stone enclosure situated 50 meters on the left side of the pipeline route close to the bed of the valley, the site built of one single row of small undressed megalithic and limestone ashlars and still standing up to 1 meter height.

The enclosure nowadays still in use by local farmers for growing sheep's and goats, investigations revealed the presence of no features on the surface, few natural caves were visible in the surrounding area close to the enclosure but far away from the water pipeline route.

RECOMMENDATION:

The enclosure is not directly threatened by construction activity, and the contractor should not affect the enclosure or the caves in the surrounding zone by machinery movements.

Site No: 5		
Site name: Rujum Kafer Youba		
Site location: Kafer Youba / Irbid		
Site Coordinates	E: 762563 N:3602445	

SITE DESCRIPTION:

A medium sized circular structure situated 25 meters to the left side of the water pipeline route, the diameter of the structure ranged between 10-12 meters, and built of single rows of megalithic stones in slightly sloppy area, the internal space filled with small and medium chunks possibly as a result of field clearance, field assessment and investigation revealed the presence of no clear datable materiel neither pottery sherds but or one lithic tool possibly dated to chalcolithic period. The site possibly used as a hut for agricultural activities in antiquity.

RECOMMENDATION:

The site is not directly threatened by construction activity but some protection measurements should be adopted since the location of the site is close to dolmen field, the contractor should not affect the site and pay attention to the surrounding zone in close cooperation with representative of Dept of Antiquities.

Site No:6	
Site name: Kufer Youba Dolmens Field	
Site location: Kufer Youba / Irbid	
Site Coordinates	E: 762707 N:3602451

SITE DESCRIPTION:

Field dolmens located to the left side of the water pipeline route overlooking the nearby wadi and the surrounding zone.

The field consists of several still standing tombs (dolmens) while others were collapsed as a result of natural factors and ignorance during agricultural activities. Previous field activities in the area of the dolmen field such as construction of the previous water pipeline as well as construction of electricity towers, bulldozing for the dirt road, ploughing the land by the local farmers and urban development's resulted in demolishing major parts of the dolmens field.

Some slabs of the destroyed tombs were still scattered on both sides of the old and the proposed water pipeline route, while the rest of the tombs is situated further to the left side at distance ranged from 50-500 meters where over 30 dolmens scattered here and there

The area is important for archaeologists and some visitors due to its significance and the attractive surrounding environment. The field is under direct supervision of Dept of Antiquities / Irbid office.

RECOMMENDATION:

The dolmen field is not directly threatened by construction activity while previous works conducted in the area by water authority affected some dolmen tombs and finally destroyed others, the contractor should work very carefully in this area in close coordination with Dept of Antiquities representative in order to avoid needless destruction for the standing tombs and not affect the surrounding zone and its environment.

.

Site No:7		
Site name: Rujum Beit Yafa		
Site location: : Beit Yafa /Irbid		
Site Coordinates	E: 760337 N:3602058	

SITE DESCRIPTION:

A rectangular structure built of undressed megalithic stones located on the right side of the pipeline route, the structure is 50 meters away from the pipeline route and still standing up to 2 meters height.

Field assessment and investigation revealed the presence of no datable materiel neither pottery sherds nor lithic tools.

The site possibly used as a hut for agricultural activities in antiquity, the local farmers still used the site as dumping area for chunks and field clearance.

RECOMMENDATION:

The structure is not directly threatened by construction activity, and the contractor should not affect the site and the nearby zone.

Site No: 8		
Site name: Tell Hasaan/Haqel		
Site location: Deir Es-Saneh /Irbid		
Site Coordinates	E: 758647 N:3601482	

SITE DESCRIPTION:

A medium sized site situated approximately 600 meters to the left side of the pipeline route on top of hill overlooking the surrounding area, The site consist of caves, water installations, walls, pottery sherds scattered and well cut ashlars such as capitals, drums scattered all over 4 dunums of flat area. Modern buildings and urban development's negatively affected the subsurface structures, robber activities revealed some cisterns and water installations in the core of the site.

The site possibly used as watch tower and or military camp in antiquity, investigations revealed a lot of pottery sherds dated back to classical periods and possibly earlier period.

RECOMMENDATION:

The site is not directly threatened by construction activity, and the contractor should not affect the remains of the site specially the ashlars, the reservoir or its channels in the surrounding zone.

Site No: 9	
Site name: Wine Press	
Site location: Deir Es-Saneh / Irbid	
Site Coordinates	E: 7589051 N:3601861

SITE DESCRIPTION:

A small wine press dug in the natural limestone rock located more than 200 meters to the left side of the water pipeline, the site located in private property and suffering from ignorance.

The site is not threatened directly or indirectly by construction activity of the project.

RECOMMENDATION:

The site is not directly threatened by construction activity, and the contractor should not affect the reservoir or its channels in the surrounding zone.

Site No:10	
Site name: Tell Deir Es-Saneh	
Site location: Deir Es-Saneh Irbid	
Site Coordinates	E: 758601 N:36 02951

SITE DESCRIPTION:

Located to the right side of the pipeline route, 700 meter away from the water pipeline route, in a flat area near omar bin al-khatab mosque close to the modern cemetery of the village.

The site severely suffered from destruction caused by local farmers and local community activities, terraces of reused old ashlars were built in and around the site, pottery sherds were scattered on the surface of the site indicated classical periods.

RECOMMENDATION:

The site is not directly threatened by construction activity, and the contractor should not affect the site and the surrounding zone of the site.

Site No: 11	
Site name: Umm Aseideh/Al-Taybeh	
Site location: Al-Taybeh /Irbid	
Site Coordinates	E: 754776 N:3603348

SITE DESCRIPTION:

The site is located 800 meters approximately to the left side of the water pipeline, the remains consist of a village site which includes caves tombs, burial caves, cisterns, enclosures, and quarry areas, the remains suffered from major destruction caused by urban development of the village, modern cemetery and robbing activities conducted by treasures hunters.

RECOMMENDATION:

The site is away from the proposed route and not directly threatened by the construction activity, the contractor should not affect the area of the site as borrowing area or for dumping purposes.

6 ENVIRONMENTAL AND SOCIAL IMPACTS

6.1 Impact Assessment Methodology

This Environmental and social impact assessment is intended to help the design of effective and feasible Environmental and Social Management Plan. The assessment methodology applies qualitative and quantitative assessments of anticipated impacts for the aspects.

Identification of potential impacts takes into consideration the nature of the proposed project, its location, implementation area, activities and human resources. Identification information includes affected impact type, site of occurrence (foot print). Impact characterization include if the anticipated impact is positive or negative, direct or indirect consequence of the proposed project activities, magnitude significance (high, medium or low significance), impact duration (permanent or temporal), if cumulative or have residues.

Impacts are classified and grouped based on the phase of occurrence, i.e. construction and operation impacts. The following is an account of the main activities of each phase that can result in the impacts on environmental or social aspects:

1. **Construction phase: which is basically the preparations necessary for the commencement of the project which includes:**
    a. Mobilization of machineries, equipment's and staff.
    b. Construction activities constitutes the following:
        i. Preparation of construction contractor yard(s)
        ii. Land preparation, excavation and removal/disposal/management of excavated material, conventional open cut, etc.
        iii. Construction of facilities, mainly at the location designed for the WTP, intake pump station, PS 1, 2 & 3
        iv. Installation of intake pumps, transmission pumps and equipments – materials imported onsite or from temporary construction camp.
        v. Land works for installation of the transmission line (placement of bed material, pipe laying, backfilling and reinstating the surface with larger fractions of the excavated material as protection for the pipeline)
        vi. Development of ancillary structures:
            1. Substations
            2. Connection to power supply
            3. Control and communications facilities
        vii. Materials and stock pilling
2. **Operation phase: which is the operation process and the workers professional and domestic activities, and those activities include:**
    a. Operating the pumping and treatment facilities
    b. Monitoring, patrolling and surveillance
    c. Generation of domestic wastewater and solid waste
    d. Generation of hazardous waste (e.g. containers of water treatment chemicals, spills, etc.)

6.2 Impacts on the Physical Environment

6.2.1 Impacts on Natural Water Flow and Risks of Flash Floods

As the transmission main will pass through several wadis some of the construction are likely to cause impacts on natural water flow mainly from piling cut and construction materials within Wadi courses. In addition, construction during rainy seasons would hold risks of flash floods on the project, project workers and the locals.

6.2.1.1 Landscape Damage, Change of Natural Drainage System

The project area has multi-geomorphologic features including wadis, flat areas, in addition to hilly areas. These multi-geomorphologic features are very important from an environmental point of view and require conservation. The different construction activities associated with this phase and without considering the environmental conservation issue will operate on changing the local geomorphology along the proposed project corridor, which will be a major negative impact of this project.

Landscape damage, change of natural drainage and local geomorphology will result from three major actions during this phase. These are:

- Poorly planned construction activities (i.e., not taking the environment issues into consideration during planning the construction activities along the proposed pipe route), through the following actions:
    - The regular construction activities in order to install the proposed water pipeline along the project route from Shouneh to Zabda
    - Establishing the project offices and the workforce camps.
    - Establishing the material and equipment storage yards.
    - Establish the pumping and boosters stations.
- Unnecessary damage caused by activities, including damages outside the project route and outside the defined areas for operations.
- Also, after completing the construction activities, landscape damage and change in geomorphology might occur due to:
    - Presence of untreated borrows pit sites that are unsightly, potentially dangerous with uncontrolled access, and act as a potential breeding ground for insects.
    - Landscape scarring which might be a potential source of future erosion concerns.

Moreover, the temporary dislocation of the existing drainage patterns, is predictable during this phase as cut and fill operations take place. If proper care is not exercised to provide sufficient cross drainage, construction activities may lead to the following impacts:

- Formation of ponds associated with localized potential threats to the human health and potential damage to surrounding soils and vegetations.
- Localized rising of water tables associated with increased threat of pollution and the presence of localized surface water.
- Flooding with consequent damage to the nearby establishments.

6.2.1.2 Wadi Crossing

Construction sites can be a great source of sedimentation and any diversion of the main wadis could result in high flow disturbance and cause a great deal of erosion. Therefore, the Consultant highly recommends careful and well designed crossing structures with no disturbance of the nature of flow sections of the flanking wadis.

The nature of the flanking wadis is intermittent flow streams with dry sections for a long period at the dry season, which could be from the end of April to mid-October. The flow in the wet season is distributed among many sections created by the wadi during its lifetime. Braided channels are the main features of the flanking wadis. The wadi is divided into several channels, which continuously join and separate. This could explain the erosion capability of the wadis at such stage of wadi regime. However, the crossing plan should take into consideration the nature of the wadi at the crossing station.

The dry season is considered the best duration for executing such crossings without any danger of flooding.

6.2.2 Impacts on Air Quality

- **Construction**

Increased Dust Levels

The expected increases in dust levels during this phase, will result from site preparation, cut and fill operations, in addition to the movement of the construction machinery. These activities will have negative impacts on segments crossing the residential areas of the project corridor.

It is recommended to monitor ambient air quality downwind (southeast) of the proposed WTP project during the construction phase, in order to assess the impact of the associated activities on air quality and to verify the compliance with the applicable standards.

- **Operation**

Proposed project is not expected to cause significant impact to the air quality during the operational phase since there is no major source of emission in the processes that are intended to be used. However, the results of air quality measurements might be of great benefit to determine the future contribution of the proposed project to the existing baseline conditions of air quality.

6.2.3 Impacts on Noise Level

The proposed locations for the project facilities are generally experiencing a higher level of noise than the relevant Jordanian standard, although, the locations are within rural and farming areas. The existing practices of water pumping at WAJ stations or for irrigation at private farms, in addition to the higher domestic travel at day time, and high transporting of agriculture crops at night time is the reason.

The anticipated impacts of additional noise levels during construction and operation are minimal when the below proposed mitigation measures are implemented:

- To limit construction activity at night time as much as possible to reduce potential impacts on local community as well as the wildlife fauna that are mainly active at night.
- To provide construction workers with ear protection, such as ear muffs and defenders
- To limit the exposure of construction workers to the allowable limits as per the local regulations, or the recommended expose time at the risk assessment performed for that construction activity.
- To conduct quarterly monitoring for noise levels during construction to ensure that implemented control measures are adequate.
- To provide operation workers at the pumping activities with ear protection such as ear muffs and ear defenders.

6.2.4 Generated Solid Wastes from Construction Activities

Construction activities in such a large-scale project are anticipated to generate considerable quantities of solid wastes, including:

- (Construction Waste) Sand and rock fragments that will result from the site preparation activities and the cut operations for installing the pipe and the other related water "pumping/collection" facilities.
- Metals, wooden and plastic fragments resulting from the different construction activities
- The human solid wastes; the accumulation of such wastes will be concentrated at the project offices, camps and storage yard that will be constructed within the project corridor area.

Inadequate management practices regarding these issues will result in the following impacts:

- Threatening the public safety and health especially in the populated parts of the project.
- Changing the local geomorphology and local drainage system and impacting the biodiversity system in the project corridor.
- Threatening faunal elements along the waste disposal locations.

6.3 Impacts on the Biological Environment

The ecological characteristics as well as biodiversity in general will be affected by the construction activities and later during operation and maintenance activities. The impacts are foreseen as being insignificant along the pipeline alignment. Despite insignificant, a detailed description of such impacts and their significance are indicated below. Such impacts would affect particularly the habitats for local wildlife and on prevalent vegetation associations and species.

Ecological concerns include:

- Loss of habitats particularly.
- Maintenance operations
- The expected increase of accessibility to particular habitats in the higher Mediterranean habitat.
- Wildlife disturbance during the construction.

- Wildlife disturbance during the operation.
- Wildlife persecution and/or vegetation cover removal.

6.3.1 Construction Phase

During the construction phase, several temporal and permanent impacts are anticipated. These are mainly due to construction activities, increased accessibility and vehicle movement into some relatively remote areas, and human interference.

a) Temporary Impacts

The temporary impacts on biological conditions associated with the construction phase of the project include:

- Alteration of surface morphology and natural water runoffs schemes. This is important since vegetation cover at Irano-turanean habitat is confined to wadi where sufficient moisture is available for the plant growth.
- Removal of vegetation cover and tree stands. This necessitates the avoidance of unnecessary removal of vegetation cover and trees to maintain the natural vegetation cover as much as possible.
- Disturbance to wildlife especially at night due to machinery or resident staff.
- Accumulation of liquid and solid wastes mainly from machinery and staff residence, respectively.
- Accumulation of excavation materials and debris.

b) Permanent Impacts

The permanent impacts on biological conditions associated with the construction phase of the project include:

- Fragmentation of habitats;
- Increased human interference due to increased accessibility; especially with increased access to segment A.
- Increased accidental and deliberate persecution of wildlife.

6.3.2 Operation Phase

During the operation phase of the project, the following impacts are anticipated mainly due to accessibility for maintenance operations:

Temporary Impacts which include:

- Disturbance to breeding and migratory bird species.
- Increased accidental and deliberate persecution of wildlife.

Permanent Impacts which include:

- Increased human interference due to increased accessibility will accordingly lead to an increased accidental and deliberate persecution of wildlife.

6.4 Impacts on the Socio-Economic Conditions

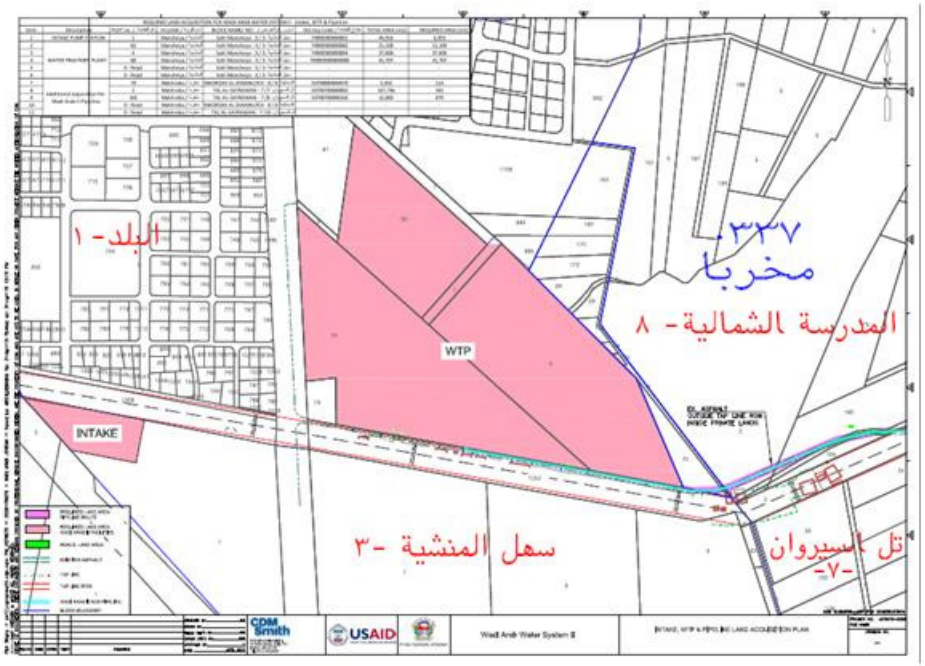
6.4.1 Identification of Socio-Economic Components and Receptors

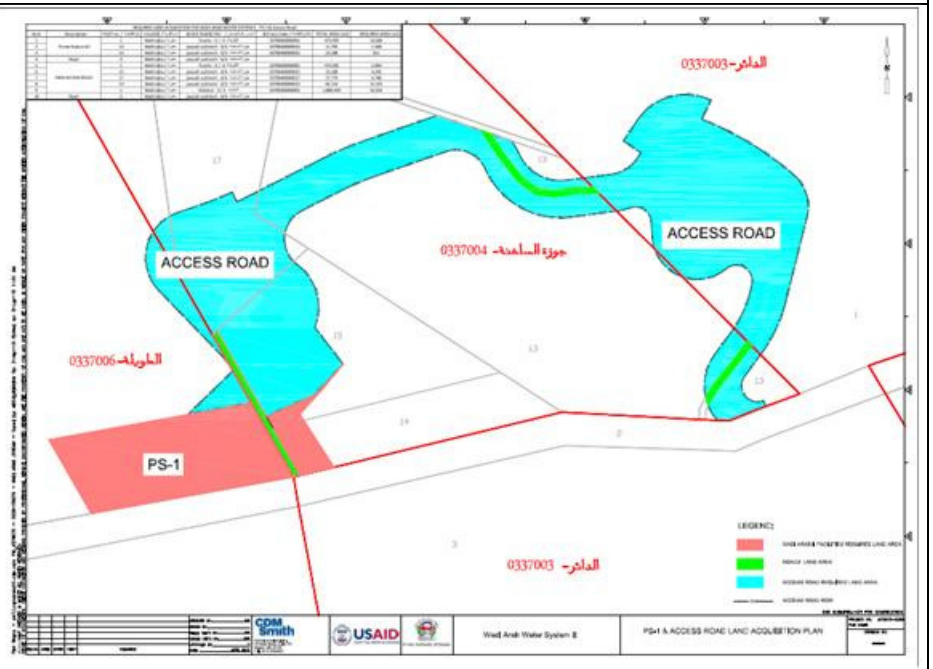
Eleven socio-economic components and receptors were identified based on the understanding of the proposed project and the socio-economic character of the study area and the local communities at question of anticipated impacts by the proposed project on the social valued components.

Table 28 identifies socio-economic components and receptors, and provides a brief explanatory comment for each.

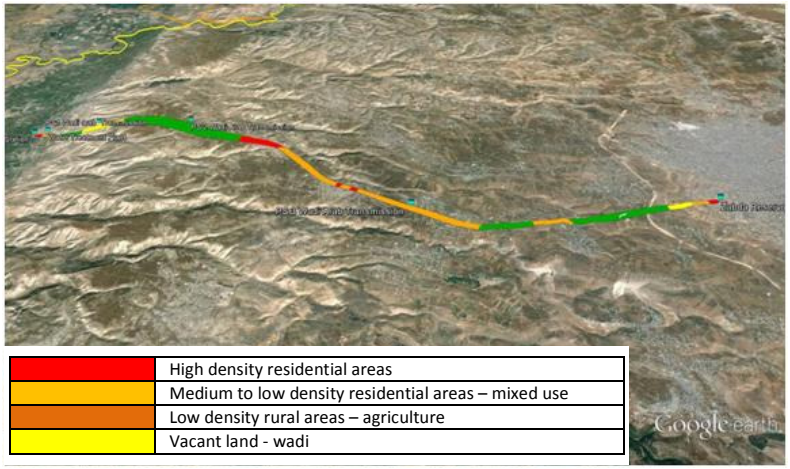
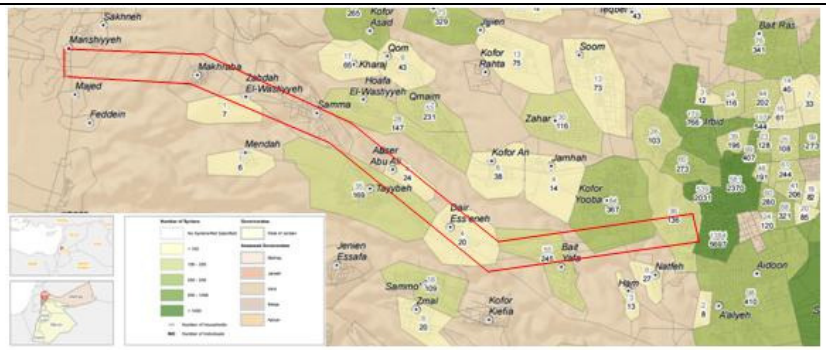
Table 28: Characteristics of Identified Socio-Economic Receptors

Component / receptor	CHARACTERIZATION AND ASSESSMENT REMARKS	
Land Use	The proposed project transmission line will be implemented within the right of way of existing roads in addition to a new road extension within army controlled zone. The intake pump station will be constructed in agricultural land parcel next to King Abdullah Canal sited on minor road and surrounded from the west and south by agricultural lands, from the north by high density residential area (mainly poor single or two story buildings), and from the east it is surrounded by the main road connecting Dair Alla with Shouneh. The treatment plant will be constructed within agricultural land next to the existing pump station sited on the main road, and it is currently surrounded from the north by the existing station/plant and agricultural land parcels, from the west by the main road, and from the east and south by agricultural land parcels.	

Component / receptor	CHARACTERIZATION AND ASSESSMENT REMARKS	
Involuntary Resettlement / Land Acquisition	As discussed above, acquisition of land is planned for the intake pump station, treatment plant and for the access road within Makhraba village. Total of 21 parcels are expected to be subject to acquisition for the intake and outside tap line ROW inside private lands (6 parcels), WTP (5 parcels), Pump station No. 1 (3 parcels), road (2 parcels) and the new access road (5 parcel). Seven parcels are governmental land and 14 parcels are privately owned. Two are planned to be partially acquisitioned for 13.48% and 2.96% respectively. The land parcel number one of Al Taweeleh land basin (no. 6) – Makhraba village is publically owned by the local community of Makhraba and is being managed on behalf of the community by the government. The process of acquisition needs to involve the representatives of the local community and require their approval of such decision. The acquisition process was commenced prior to the commencement of the EIA process and the to-date completed actions are: identification of land parcels which are needed to be acquisitioned for and by the proposed project in addition to the owners details,	

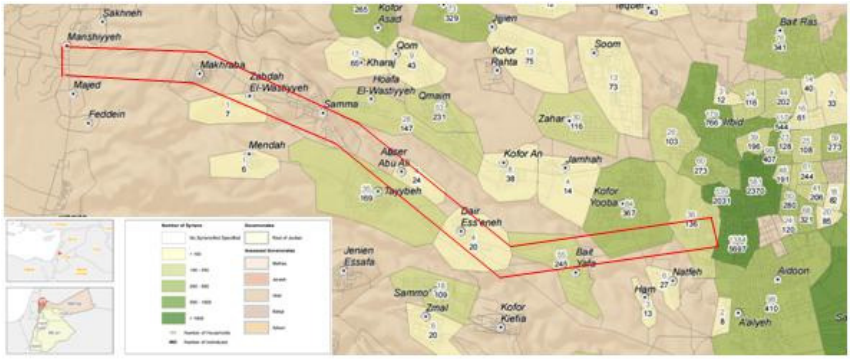
Component / receptor	CHARACTERIZATION AND ASSESSMENT REMARKS	
	filing the acquisition case to the Department of Land and Surveys for acquisition process, announcing the project intent of acquisition including the details of the to be acquisitioned land parcels and announcing cut-off date. The number of people likely to be directly affected (i.e. owners) is 104 persons. An Involuntary Resettlement Framework will be prepared and submitted in a separate report to identify loss of business and assess Involuntary Resettlement impacts.	 **Figure 52: Identified Land Parcels (Plots) Subject To Acquisition For the Purpose Of The Proposed Project**
Utilities and Infrastructure	The study area is served by network of roads, electricity network, water supply and waste water collection systems, telecommunication, etc. the quality and sufficiency of such utilities and infrastructures may vary from one village to the other. As discussed in the land use component, the alignment of the transmission line crosses residential areas, commercial areas (within mixed land use context), rural and agricultural areas. High tension power lines were also observed in many locations along the alignment. The use of public utilities (e.g. water networks, wastewater systems, and power supply) by the project team and for the sake of the project is expected to be significantly limited. However the impact on infrastructures by the project activities and workers remains a possibility especially noting that almost all utilities and services are installed within the roads right of way.	

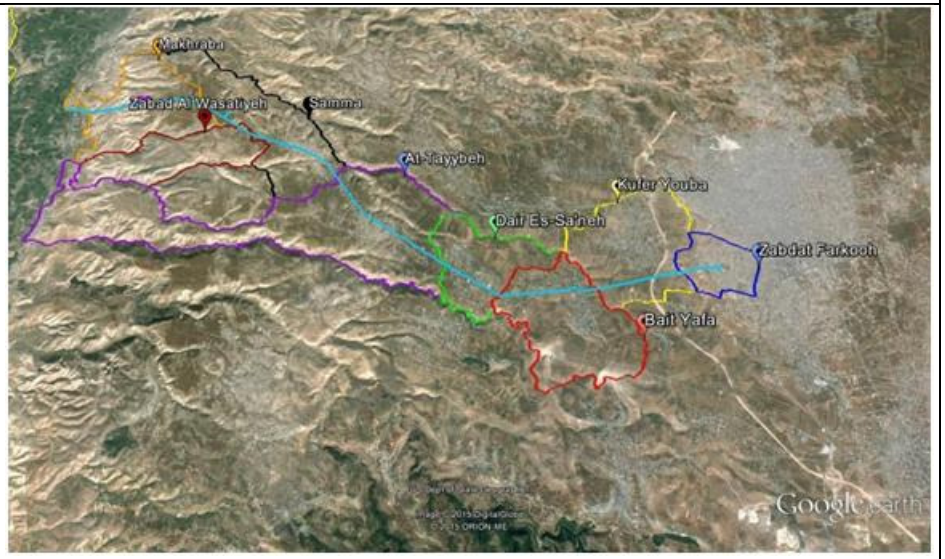
Component / receptor	CHARACTERIZATION AND ASSESSMENT REMARKS	
Roads and Transport	The project vehicles are expected to include many heavy machineries/trucks and few 4WD cars (SUV's or pick-ups). The heavy machineries/trucks are planned to stay at the proposed project location (i.e. distributed along the sections of the alignment) for the extended periods of the construction phase, while the few cars are expected to have few frequent trips to and from the sites per day. As such, road transport systems in the area are expected to be used heavily and the impact on traffic and on local's mobility and safety is recognizable. It should be noted that many of the minor roads are of limited width (perhaps three to four meters) and in some localities, like in Beit Yafa area, are surrounded from the two sides with houses which do not seem to have other access points (entrance/exits) other than these roads. Also the alignment crosses seven intersections and major roads connecting the villages in the area.	 **Figure 53: Major Roads (Yellow Line), Minor Roads (Orange Line), Intersections (Dark Box) and the Project Route (Blue Line)**

Component / receptor	CHARACTERIZATION AND ASSESSMENT REMARKS	
Resident and Nomadic Population Settlements	Based on the information available from the Client and from the locals during the consultation session, it is noted that the proposed project transmission line is a governmental land, and it is not expected to have disputes on land ownership. Herders currently use the wadis in the vicinity of the agricultural areas, and nomadic people were observed only within the alignment section from the Army control point in Makhraba down to King Adbullah Canal. An Involuntary Resettlement Framework will be prepared and submitted in a separate report to identify loss of business and assess Involuntary Resettlement impacts.	 **Figure 54: Indication of Population Settlement Density along the Project Alignment**
Syrian Refuges	According to the Syria Regional Refugee Response Inter-agency Information Sharing Portal (accessed June 16th 2015), the total number of Syrian refuges registered in Jordan is 628,160. The number of Syrian Refuges in Irbid reached on May 28th 2015 the total of 143,029 persons, forming 22.8% of all Syrian refuges in Jordan) are living in Irbid. About 72% of those refuges are originally from Dar'a; the Syrian borderer city to Jordan. Those refuges receive living assistance from UN and non-UN refuges assistance agencies. However male	 **Figure 55: Project alignment in relation to the presence of Syrian Refuges** Source of refuges distribution map: Syria Regional Refugee Response Inter-agency

Component / receptor	CHARACTERIZATION AND ASSESSMENT REMARKS	
	Syrian refugees are working informally in sectors not traditionally attractive to Jordanians, such as agriculture and construction. Child labour was also reported by ILO as an issue of concern among non-camp Syrian refuges in Irbid. Another vulnerability factor is the early marriage of girls (under the age of 18 years) which was investigated by Interagency Assessment on Gender–Based Violence and Child Protection Among Syrian Refugees in Jordan last year (2014).	Information Sharing Portal (REACH, accessed June 16th 2015)
Health & Safety	Workers and staff within the project boundaries could be subject to health/ safety risks including construction related risks (e.g. accidents, noise, dust, etc.), natural risks (heat strokes, poisonous animals like snakes and scorpions, feral dogs, etc.), and communicable and infectious diseases. Local residents in nearby the project boundaries could be subject to health/ safety issues mostly related to noise, dust and emissions to air, and accidents. The transmission line is also planned to cross wadis. This sensitive receptor require particular attention as affecting natural water flow is likely to cause safety risks to people lives and assets, especially herders, nomadic population and children.	 **Figure 56: Location of the Route Were it is Planned to Cross a Major Wadi**

Component / receptor	CHARACTERIZATION AND ASSESSMENT REMARKS	
Employment Opportunity	Creation of employment opportunities is expected during the construction phase to include construction workers, drivers and guards. During the operation phase to include technicians (for the new facilities) and guards. Indirect employment through purchasing goods and services from the area are expected to be minimal considering the number of workers in the construction sites along the alignment and the type of activities planned. It is expected that non-Jordanian workers, including Egyptians and non-camp Syrian refuges, are likely to form significant proportion of the construction workers.	
Labour and Working Conditions	The project owner has good reputation related to Labour and Working Conditions. The contractors who will be implementing the construction activities are yet to be identified. The Ministry of Labour is taking serious actions against violations of Jordanian labour regulations and codes; however violations such as exploitation, under-payment or lack of payment, forced labour, and child labour remains possible.	

Component / receptor	CHARACTERIZATION AND ASSESSMENT REMARKS	
Social Matrix	The social matrix of Irbid was influenced during the last few years by influx of Syrian refuges. Irbid is one of the main host communities for Syrian refuges and the impacts on the community are economic, social and environmental especially noting that Irbid original have very high population density and the influx of refugees negatively contributed to demand on natural and economic resource, and to generation of waste. Given the high rate of unemployment among locals, and given the availability of alternative handy workers who are available for lower cost, i.e. the Syrian immigrants, therefore the implementation of the project construction activities by contractors is likely to bring in Syrian workers from those living in the area, in addition to Egyptian workers. This situation is likely to receive negative reflections from the local community, in particular the unemployed workers.	 **Figure 57: Project Alignment in Relation to the Presence of Syrian Refuges** Source of refuges distribution map: Syria Regional Refugee Response Inter-agency Information Sharing Portal (REACH, accessed June 16th 2015)

Component / receptor	CHARACTERIZATION AND ASSESSMENT REMARKS	
Local Community Involvement, Community Liaising and Development	Involving local community is considered important, especially with regard to the management of anticipated environmental and social impacts. This also relates to acquisition of land in Makhraba noting that one of the identified parcels for acquisition is owned by the local community of Makhraba and being managed on their behalf by the government, and accordingly representatives of this community should be fully involved in the acquisition process and in the design of mitigation measures.	 **Figure 58: Towns and Villages Crossed by the Proposed Pipeline**

6.4.2 Stakeholder Identification

6.4.2.1 Stakeholder Analysis

Project stakeholders are identified as the persons, groups or organizations with an interest in the proposed project and who are likely to affect or be affected by its activities. Based on their mutual interest, stakeholders can be grouped into eight groups. **Table 29** lists identified stakeholders.

Table 29: Identified Project Stakeholders

Stakeholder Category	Interest	Stakeholders
National Government	Regulatory, law enforcement & project compliance with applicable national legislations (laws, regulations, guidelines & standards)	Ministry of Environment, Ministry of Energy, Natural Resources Authority, Ministry of Water & Irrigation, Ministry of Municipal Affairs, Ministry of Tourism and Antiquities, Ministry of Agriculture, Ministry of Health, Ministry of Public Works and Housing, Ministry of Social Development, Ministry of Labour, Department of Land & Survey
Local Government	Law enforcement,	Irbid Governorate, local government departments (health, agriculture, education, public works, development, etc.), local police
Local Municipality (Semi-governmental)	Land use planning and management, municipal services (waste management), licensing (within municipal boundaries)	Irbid Municipality
Community	Land ownership rights (private and tribal land), public health and safety, access to natural resources (water and rangeland), employment (direct and indirect), better living standards, possible traffic disturbance and disruption of services; Concern that some locals would stage protests and negative actions if health impacts occur, if foreign labourers are employed over local (this could cause conflict between locals and foreigners if jobs are scarce).	Community leaders (including Sheiks, school teachers, health workers, etc.), tribal leaders, local religious leaders, business owners (farms and livestock owners), male and female residents in the study area
Local Community Based Organizations (CBO's) and NGOs	Poverty alleviation, local community welfare, employment, education, women empowerment, human rights, childhood protection, traffic and services disruption	Local CBOs and NGOs
International Agencies	EIB environmental and social standards, Syrian refuges, labour right, human rights, human trafficking	EIB, UNHCR, United Nations Development Programme, UNIFEM, UNFPA, UNICEF, Better Work Jordan (International Labour Organization)
Media	Locals complains, environmental and social challenges, development progress, economy, politics, etc.	Press, broadcast, radio, journalists
Business	Possible economic loss from project construction activities and impacts (e.g. loss of access, dust, noise, etc.)	Olive tree farm, forage farms, livestock (cows) farms, livestock owners, small service and commercial shops

As far as this ESIA is concerned, local community stakeholders are the priority target, and those include local governmental organizations, local municipality (Semi-governmental), community population and CBO's. Further analysis of these **local community stake-holding groups** revealed the following:

I. Anticipated Groups to be Adversely Affected

a. Sheep/ goat herders using rural and farm areas for grazing probably use the forage resources (natural vegetation) in the wadis located in the nearby of the proposed project construction areas and on farms green waste, especially during spring season;

b. Some farms are close to the construction areas and as such can possibly be subject to dust impacts;

c. Host community has strong social and tribal relationships, however there are also Syrian refugees (non-camp) who live in the area and tend to compete with locals on employment opportunities. Main issues of concern are land ownership issues, jobs offerings, safety issues (especially air emissions / dust and waste management), noise and company/contractors social responsibility activities, etc.;

II. Vulnerable Groups

a. Nomadic sheep herders (least concern)

b. Anyone using land in or near where development is planned (e.g. farms, cows projects, service providers and small commercial shops)

c. Women, children, elderly and people with disabilities who may experience limited mobility due to increase of men in the area or due to construction works in nearby streets

d. Child workers/labour

e. Syrian non-camp refugees /workers who can be employed by the project for low compensation

f. Unskilled male and female labour in the host community not able to access jobs (least concern)

III. Stakeholders who can Provide Support to the Project (Project Supporters)

a. Governmental and semi-governmental organizations,

b. Local tribal representatives/tribal leaders (Sheikhs), religious leaders and CBOs' representatives can help liaison with local community and suggest ways for migrants and local population to harmonize.

IV. Stakeholders Opposing the Project

None

V. Stakeholders Critical to Engage with First

a. The Governor of Irbid, the Director of Irbid Municipality and local tribal leaders from Makhraba should be engaged at every stage and on an ongoing basis, while the community members should be engaged continuously through designed communication/awareness activities and through grievance procedures. Principals of schools located close to the construction corridor are important to be engaged immediately before the commencement of land works.

6.4.3 Potential Socio-Economic Impacts

This section of the report provides assessment of the anticipated positive and negative impacts likely to occur as a consequent of the proposed project. The assessment addresses all social aspects discussed above.

The assessment present and discuss anticipated impact expected during each phase of the Project for all identified social aspects/receptors.

6.4.3.1 Land Use

Changes in land use patterns are not expected along the transmission line, while change in land use within the areas surrounding the intake pump station and the treatment plant are expected to be minimal (if any).

The expected impact on land use in the area and its surroundings is expected to be absolutely minimum, direct, insignificant negative impact that is generally considered temporal with insignificant residual impact especially if appropriate mitigation measures are applied restoration of the site. This applies for the construction/preparation and operation phases.

6.4.3.2 Utilities and Infrastructure

The proposed Project is not planned or expected to utilize existing utilities and infrastructure in the area. However, accidental impacts on these utilities and services from construction activities are possible. As such the impact is considered of moderate significance for the construction/preparation phase and negligible for the operation phase.

6.4.3.3 Roads and Transport

The transmission line is proposed to be constructed within the right of way of roads connecting Zabadat Farkooh, Kufer Youba, Beit Yafa, Dair Es-Saeneh, At-Tayybeh, Samma, Zabad Al Wastiyah, Makhraba down the road to King Abdullah Canal near Manshyah. The proposed new facilities (intake pumps station, WTP and the three pump stations (will be constructed within land plots next to the road/transmission line).

The proposed alignment passes residential, mixed use, rural and agricultural areas. Within a radius of 1000 meter from the alignment there are schools, mosques, healthcare centers/hospitals and other public facilities (See **Figure 59**, **Figure 60** and **Figure 61**).

Given the magnitude and characteristics of the construction works within the mentioned alignment, the types and characteristics of the vehicles and machineries' movement to and within the site is expected to cause moderate to high significance impact on roads and transport.

As a summary, the impact expected is negative, direct and temporary (for the construction period) one; however it is expected to be of moderate to high significance and does not have cumulative or residual signs. The risks associated with this impact are limited to safety considerations during the mobilization of the heavy machineries' and equipment's in the construction/preparation phases which are discussed below.

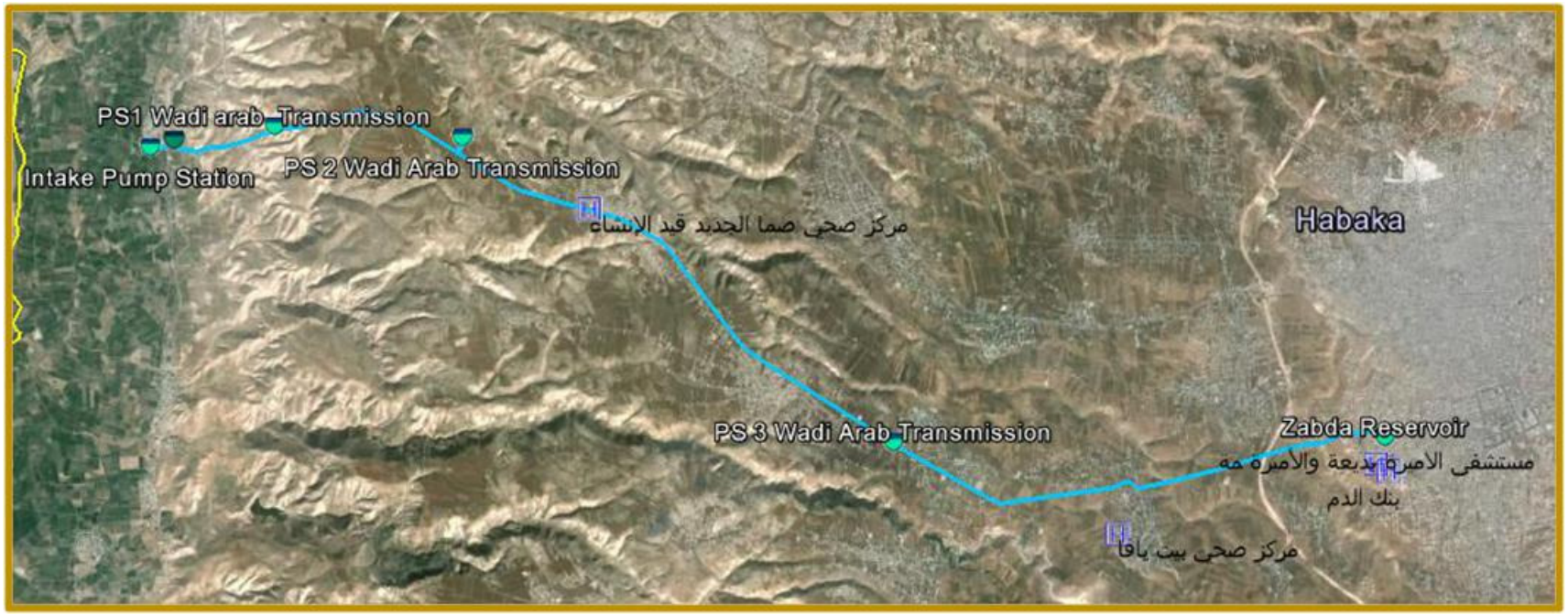


Figure 59: Project Facilities in Relation to Close Hospitals and Health Care Centers

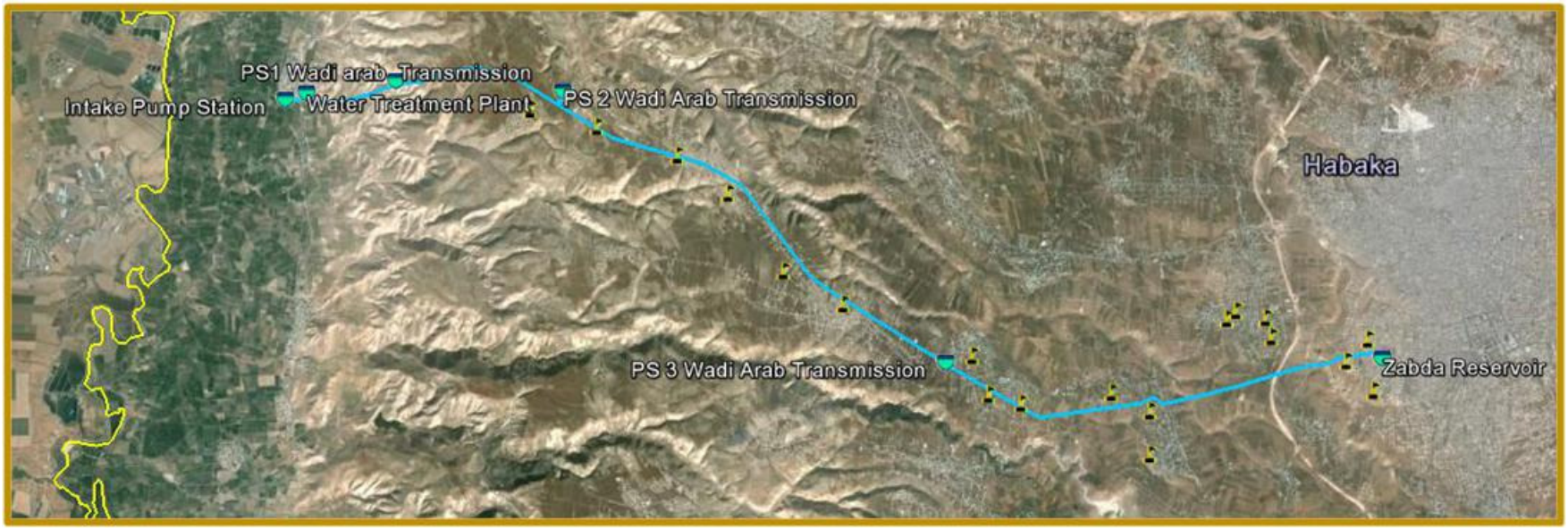


Figure 60: Project Alignment and Facilities in Relation to Schools

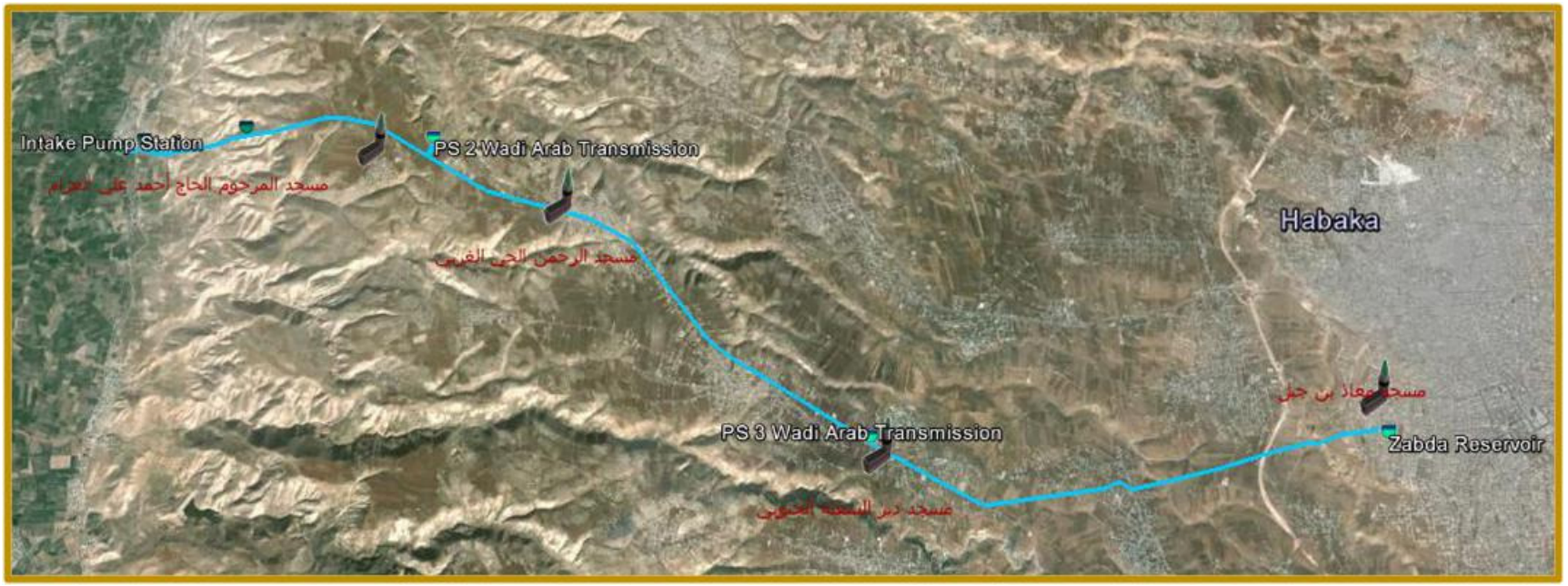


Figure 61: Project Alignment and Facilities in Relation to Nearby Mosques

6.4.3.4 Resident and Nomadic Population Settlements

Given the scale of the project, type of machineries and equipment to be used and the number of employees, the proposed project is expected to have moderate impact foot print and may possibly involve activities likely to cause involuntary resettlement of locals and resettlement a like activities. This includes:

1. The project will cause geographically limited impacts on accessibility along the alignment for the period of construction at the specific construction section/locality, which is not expected to cause further limitation of locals to natural resources, private or governmentally owned lands.
2. Direct acquisition of land parcels for the construction of the project main facilities and for the access road.
3. Noise levels are expected to be higher than the ambient condition, which is assumed to affect any residential or business areas during construction phase as discussed earlier in this report

As for nomadic population, those are expected to be close to wadis vegetated with palatable species, and to farming areas. The proposed project is expected to have no or extremely limited impact on their mobility.

As such, the expected impacts on nomadic and settled populations are negative, direct and temporal impact that is considered of low significance, non-cumulative. Also, involuntary resettlement relevant to this group of affected people is not expected.

6.4.3.5 Health & Safety

Health and safety issues concerns both workers and local populations, however; and given the size and type of activities of the proposed project, workers are considered moderate to high health and safety risks by the proposed project.

The main stressors generating health or safety risks to locals include:

1. Land works for the construction and installation of the pipeline within the right of way of existing roads.
2. Land works related to the movement of heavy machineries along the alignment.
3. Moderately deep and deep trenches for laying the pipeline.
4. Construction of the access road.
5. Piling of cut materials, construction materials and equipment's along the alignment.

Dusting and elevated noise levels during the preparation and construction phase are considered of moderate concern and are deemed negative and direct, but its scale and magnitude is low and as such related impacts to local communities health and safety are considered moderate to high especially if works continue during night shifts.

The main stressors generating health or safety risks to the Project workers and staff include:

1. Noise elevated levels due to project on-site activities (construction phase along the alignment and operation phase at the main facilities);
2. Waste and disease if domestic and organic wastes are mishandled or not controlled on site which can lead to serious infectious and chronic disease for workers and the public (construction and operation phases);
3. Accidental exposure to dust (construction);
4. Accidental exposure to nuisance emissions (operation);
5. Mishandling of chemicals by workers could result to inhalation or accidental ingestion leading to digestive track damage and hazards to eyes and skin (all phases);
6. Electrocution and other safety risks associated with the project activities which are possible if safety measures are not properly applied by the workers (all phases); and
7. Car accidents due to speeding (all phases).

Ensuring good project management procedures can significantly reduce health and safety impacts to residents and land users within or in the vicinity of the project areas. This can be done through training and proper supervision. Stringent management and mitigation measures need to be taken into consideration to assure the compliance with health and safety guidelines within the project vicinity during all phases of the project.

6.4.3.6 Employment Opportunity

Creation of employment opportunities is expected during the construction phase to include construction workers, drivers and guards. During the operation phase it will include technicians (for the new facilities) and guards.

Indirect employment through purchasing goods and services from the area are expected to be minimal considering the number of workers in the construction sites along the alignment and the type of activities planned.

It is expected that non-Jordanian workers, including Egyptians and non-camp Syrian refugees, are likely to form significant proportion of the construction workers.

6.4.3.7 Labour and Working Conditions

Labour conditions in such Projects and sites are considered to be quite difficult being outdoor and working under the heat of sun and subject to harsh environmental conditions like hot summer and cold winter.

Staff and labourers working on site are at moderate risks of being subject to labour code violations such as exploitation by the contractors, under-payment or lack of payment, forced labour, and child labour.

These impacts are expected to be localised, temporal and manageable especially if the company/contractor policy and national legislations related to this matter are applied efficiently.

6.4.3.8 Social Matrix

Assessment of the impacts on demography, social relationships and fabric recognizes that the number of project employees is estimated to be few, and that there will be no workers residence in the area. As such, impacts on the social matrix are considered negligible.

6.4.3.9 Local Community Involvement, Community Liaising and Development

Engaging and maintaining effective communication and liaising with nearby communities is significantly important. This is of particular importance for the acquisition of land parcel in Makhraba which is owned by the community of Makhraba and is being managed by the government on behalf of the community.

Establishing good communication and engagement of local community at such an early stage of the development; i.e. the construction stage, is considered a critical milestone since it will prepare the foundation of trust, mutual understanding, platform for resolution of any expected or unexpected conflicts in the future, and also maintain effective collaboration for the best interest of the developer and the community. Absence of such engagement and communication at such a stage is likely to create unnecessary misunderstandings which can develop into conflicts during the market production stage.

6.5 Impacts on the Archaeological Baseline Conditions

None of the eleven archaeological sites within is under direct threat by the proposed project activities. Still, precaution and management measures should be taken into consideration regarding the need to conserve any chance-found sites during construction activities. Minor and indirect impacts are expected on the above mentioned sites. The indirect impacts could be avoided by implementing the recommendations mentioned above.

The proposed mitigation plan will present means to reduce the negative impacts on the archaeological sites discovered during the course of the study by defining site-specific protective measures, and a management framework necessary to minimize project-related damage to the cultural resources located within project area for each specific site.

The discovered archaeological sites during walkover survey and field investigations could be classified under two categories.

- Major sites such as Field Dolmens (site No. 6)
- Minor sites such as the Cairns site (site No. 1-5 and No. 7-11)

Both types will not be threatened by construction activities but minor impacts might be expected. The minor anticipated impacts could be avoided by precaution and well done management for the field operations (construction activities), and early coordination between the related parties. The anticipated impacts could be summarized as follow:

a) Dust and air pollution:

The resulted dust and air-pollution from machinery and construction activities may have minor impacts on the archaeological or heritage sites as follow:

1. Change the colour of the ashlars of the archaeological remains, mostly from black to white or from white to black.
2. Oxidation of sulphur dioxide leads to sulphuric acid that can cause the deterioration of the stones.

b) Vibration:

Vibration caused by construction machineries and mining activities induces rapidly alternating tensile and compressive stresses in archaeological remains or sites. Vibration may cause serious damage or even collapse of buildings. The effects of vibration on the archaeological sites are limited and unexpected. Site No. 6 and 8 may have been affected by the nearby construction activities, so recommend actions are suggested in this study so as to reduce the minor negative impacts on the remains.

c) Looting:

The threat as an indirect impact on the archaeological sites is already exist since years ago. Some precautions is the responsibility of Department of Antiquities of Jordan such as fencing the sites and following effective control procedure may reduce the negative impacts. Nevertheless, most of the discovered archaeological sites are not threatened by this threat.

As a result, the eleven discovered sites are not threatened directly by the project construction activities, while indirect impacts are not expected on a high level for the sites.

7 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

Mitigation Strategy

The proposed mitigation strategy follows the logical order of environmental mitigation which is based on the following strategic choice in order of implementation priority:

I. Avoidance / Prevention of avoidable stressors which are expected to cause deleterious impacts (by applying alternative environmentally and socially sound approaches/activities);

II. Containing and minimizing the unavoidable impacts to ensure it is in the minimal possible;

III. Restoration and rehabilitation of the affected receptor;

IV. Compensating for receptors or damages that cannot be restored through offering equivalent, financial compensation, livelihood programmes or a combination of two or more of these measures whenever necessary to comply with the EIB requirements; and/or

V. Providing additional benefits to the recipient / host community through the company social responsibility programme.

Such a strategy should be combined with community engagement and communication programme, and effective and pro-active grievance mechanism thus to address locals and project affected people complaints.

7.1 Proposed Mitigation and Management plan for Construction Phase

7.1.1 Physical Environment

7.1.1.1 Wadi Crossing Mitigations

The contractor should:

- provide diversion to address flows in the wadi during rainy season
- Avoid lowering the pipeline to the bed of the wadi section during flood season. The contractor should plan for diverting the flood flow if construction is carried out in the rainy season and should define the location of the flow section(s) The contractor should consider and apply the following crossing mitigations:
  - Time executing crossing structures could be scheduled at dry period between May and October.
  - Stream development should be planed carefully with a comprehensive flood flow analysis.
  - The contractor should avoid any disturbance to main flow section unless a well design is considered to minimize erosion and sedimentation processes.
  - Spoil materials should be disposed away from the flow areas at sites with no potential of storm water flow in order to eliminate any sediment movement, which could end at the flow sections. These sediments could cause reduction in flow area and site flooding.

7.1.1.2 Air Quality

Dust Control

In order to reduce dust spreading due to the construction activities and its negative impacts on the residential areas, the Contractor should apply water to the construction surface and other piled materials such as sand as much as needed. Sometimes it may be required to spray water as needed especially in residential areas.

Noise Control

In order to control the expected high noise levels during the construction phase, working night shifts should be reduced as much as possible in populated areas. The Jordanian Regulation for ambient noise levels should be applied and should be a major tool in designing the construction activities schedule

7.1.1.3 Installing Appropriate Fluid Waste Collection System

During the preparation stage for this phase, the contracting company should construct an appropriate temporary fluid wastes collection system in each of the project main offices and in any temporary workstations along the project route. The recommended method is the holding tanks that will be emptied regularly and sent to the nearest fluid wastes treatment station. In selecting the site for the impermeable septic tanks, the hydrogeological conditions should be taken into consideration.

As for the expected fluid waste that might result from machines and vehicles maintenance, it should be listed in the construction contract that periodical maintenance for the machines is prohibited within the project site and that those machines and vehicles should be maintained in a specialized maintenance stations.

Whenever accidental leakage of fluid waste occur, the Contractor is responsible to clean the polluted area.

7.1.1.4 Applying Appropriate Solid Waste Collection System

Seeing that the quantity of cut materials will be a major source of solid wastes in this project, it is recommended to use these materials in the fill process. Also, during the construction phase, a specific area should be designated as a temporary solid waste dumping area. The generated solid wastes during the construction phase should be placed in that area, emptied on weekly basis and transferred to the defined appropriate solid waste dumping areas along the project corridor which is suitable for the generated wastes. Such dumping sites should comply with the stated criteria and should be approved from the related authorities including the Ministry of Water and Irrigation and the Ministry of Environment.

The municipal solid waste generated by the project employees should be collected properly and transferred to the closest municipal landfill. Such activity requires prior coordination with the related municipalities. The Contractor should ensure the efficiency of waste collection and transport system though no waste is being mismanaged or accumulated.

Precautionary approach is also needed to:

- Avoid unnecessary and prolonged solid waste accumulation.
- Avoid using runoffs, wadis as temporary solid waste storage ground as much as possible.
- Avoid accumulation of excavated material through synchronizing excavation and filling processes.
- Avoid as much as possible removal of green cover.

Restoration of the areas used as temporary storage grounds should be applied soon after finishing the use of each site.

7.1.1.5 Correct Selection of the Project Offices, Camps and Temporary Waste Disposal Sites

For a correct selection of the project offices, camp, and temporary waste disposal site(s), the following criteria should be applied:

- Located outside the heavily populated residential areas.
- Far from schools or any social establishment.
- Far from the ecologically sensitive habitats, wadi, runoff and wadi side banks.
- Avoiding vegetated areas.
- Easy access to the construction sites.
- Easy access to the existing primary roads.
- Easy access to existing infrastructure
- Located outside any known aquifer recharge zones (if possible).

Representatives from Ministry of Water and Irrigation and the local municipalities should participate in this selection. It should be taken into consideration, that returning the selected site to its original condition is a must, and that the Contractor should be responsible on achieving this issue.

7.1.1.6 Correct Selection for the Access Roads

Before starting the construction activities, a detailed survey should be conducted for selecting the temporary access roads to be used by small and medium sized vehicles during the construction phase. The consulting office in association with the Traffic Department should conduct this survey. In selection of temporary access roads, the maximum usage of the present access roads within the project areas should be considered.

Also, the temporary access routes should be selected carefully, especially where such roads traverse, or originate in residential areas in order to reduce noise levels, protect private properties, and reduce risks to public safety. Engineering specifications for these roads and the types of vehicles to use these accesses should be approved by the relevant governmental authorities.

The proposed service roads within should avoid to the extent possible the biological sensitive habitat and plant communities (Oak stands), especially the runoffs and pristine vegetation. It is highly recommended to follow the existing road tracks used by the locals within these areas whenever applicable.

Without knowledge of some of the details of the existing Wadi Arab transmission main design, it would be advisable to prohibit any heavy equipment travelling over or storing materials on or adjacent to the existing pipeline

7.1.2 Biological Environment

During the construction phase, the contractor should apply the maximum care not to inflict unnecessary damage to the local landscape and natural resources. Only, where the clearing is required for permanent works, for approved construction activities and for excavation operations, local geomorphology, natural drainage systems, all trees and natural vegetation must be conserved and protected from the damage that might result from the construction activities. Changing the geomorphology, the local drainage systems, in addition to flora demolition should be prohibited outside the proposed project corridor. Furthermore, dumping solid wastes in the wadi crossings should be prohibited.

Other avoidance activities include:

- Avoid unnecessary excavation processes and off road and utilize the existing roads instead of making new ones whenever applicable.
- Avoid accumulation of excavation piles during rainy season.
- Avoid as much as possible removal of green cover.
- Avoid accumulation of excavated material through synchronizing excavation and filling processes.
- Avoid accumulation of excavation materials and other solid wastes.
- Avoid as much as possible building of permanent facilities and instead consider the use of mobile residence facilities.
- Avoid planting or seeding of crops and exotic species.

Moreover, and after work completion, all work areas should be rehabilitated, smoothed and graded in a manner to confirm the natural appearance of the surrounding landscape. The restoration option is upon incidence of impact and mainly directed to:

- Restore as possible changing surface morphology to maintain natural water flow.
- Restore wadi side banks to maintain natural water flow and reduce erosion.

Also, the above listed mitigation measures should be applied and taken into consideration during the site selection and establishing the different project offices if planned.

Protection of Biological Diversity

In addition to what is stated above as mitigation measures, the following actions should be strictly adhered to in order to mitigate the project anticipated impacts on the biological environment.

These mitigation measures include:

Avoidance actions: Precautionary approach is often the most cost effective one. These include:

- Avoid the removal of the Oak trees community and translocation of those unavoidable ones in coordination with related authorities including the Ministry of Agriculture and the University of Science and Technology.
- Avoid as much as possible removal of green cover.
- Minimize night activities.
- Avoid wildlife persecution, hunting, animal and plant collection.
- Avoid unnecessary movement of project staff mainly at night.
- Avoid planting or seedling of crops and exotic species.
- Avoid unnecessary burning and accumulation.
- Avoid as much as possible building of permanent facilities and instead consider the use of mobile residence facilities.

7.1.3 Socio-Economic Conditions

7.1.3.1 Health & Safety

Given the nature of the proposed project activities being localized, health and safety mitigation measures specific to the project concerns particularly the project employees, however the risks to locals has also to be addressed. The suggested mitigation measures are:

1. Provide employees with health checkups prior and during the implementation of the project.
2. Integrate health training into regular employee training.
3. Communicate to affected communities type and magnitude of potential health, safety risks, and planned mitigation measures.
4. Provide a phone no. in all of the project signs for community members to report to project owner any health and safety violations.

7.1.3.2 Labour and Working Conditions

- **Working Conditions**

The below measures are designed in a way to mainstream acceptable working conditions under applicable national legislations and potential lenders roles. As such it applies for the proposed project as it applies for the company in general.

1. Adopt a human resources (HR) policy providing employees with information regarding their rights under national labour and employment law, including their rights related to wages and benefits; ensure policy is clear and understandable and is explained to each employee upon taking employment.
2. Include in HR policy a section on anti-discrimination policy requiring all contractors, sub-contractors, and suppliers to base employment on principle of equal opportunity and fair treatment, and prohibiting discrimination with respect to all aspects of the employment relationship (recruitment and hiring, compensation, working conditions, access to training, termination, and discipline); provide training to management staff, contractors, and employees at commencement of contract and at regular intervals.
3. Include in HR policy a section on gender equality requiring contractors, sub-contractors, and suppliers.
4. All work contracts must be written (at least one copy) in the language of the worker, and in the case of illiteracy workers must be verbally provided with terms of contract.
5. Set reasonable/ legal working hours complying with national law.
6. Overtime must be documented and signed by employee agreeing to paid overtime (documenting pay), and signed by neutral third party.
7. Contractually require contractors and management staff to allow for means for workers to express grievances and protect their rights regarding working conditions and terms of employment, and to engage with worker representatives.
8. Develop grievance mechanism for workers and representative organizations (if they exist), informing them of the mechanism at time of hire and made easily accessible to them. Mechanism should address concerns promptly, using an understandable process that provides feedback to those concerned, without any retribution.

- **Wages and Benefits**

The suggested mitigation measures encourage the company of maintaining this, and also suggest the following for application by the project.

1. At a minimum, set wages above prevailing national minimum wage (currently JOD 180 monthly to be increased to be JOD 200- 220), and ideally is set according to local labour market (decent living wage in area is at minimum JOD 300 monthly).
2. Provide fair benefit packages to employees that a minimum complies with national standards and ideally responds to local labour market, considering fair transport and health care provisions; fair leave for illness, maternity, vacation, holiday.

3. Document and communicate to all employees directly contracted by project owner and sub-contractors their working conditions and terms of employment, including their entitlement to wages and any benefits.

- **Forced Labour and Exploitation**

Though the number of employees and workers are expected to be few, however the following measures are suggested for adoption at the project level and as such to be implemented at the project level (construction contractors) for this project and for the operation phase.

1. Include in HR policy a section on trafficking, forced labour, and child labour adhering to national and international laws, addressing responsibilities of all contractors and sub-contractors in adhering to the policy; provide training to all contractors and sub-contractors at commencement of contract.
2. Include as a pre-qualification and qualification of all contractors and sub-contractors evidence of no past labour violations, including incidences or complaints against the contractor for forced labour or exploitation (grounds for disqualification).
3. Include in contract sub-clauses with contractors, sub-contractors, and suppliers requirements to prevent exploitation of workers, and termination clause if contractor engages in any form of exploitation or serious unmitigated national/ international labour violations.
4. Report any contractors in violation of national labour codes to proper national authorities and terminate contract if warranted.
5. Regularly document all work permits for migrant workers and require regular (quarterly) reporting from contractors and sub-contractors on status of work permits and situation of employed migrant workers.
6. Prohibit employment of children under the age of 18, particularly in dangerous or hazardous work conditions (except in a vocational training program for workers between the age of 16 and 18, where appropriate and free of hazardous conditions).
7. Develop and implement awareness training and outreach on rules, regulations, rights, and penalties related to exploitation/ forced labour (provided twice annually) to all management staff, employees, contractors, and sub-contractors, engaging with potential partners.
8. Provide employees at beginning of employment, and regularly, with third party emergency phone number (e.g., Ministry of Labour) and contact information, and post this contact information in labour camp and work spaces.

- **Employment of Locals**

1. Adopt, implement and contractually require contractors and sub-contractors to implement hiring preference for local community members, requiring filling of jobs with all qualified community members from Irbid area before advertising or filling positions from outside the local community.
2. Advertise job opportunities with the project locally on a regular basis and through mediums where locals receive information (Municipality, bulletins outside mosques, CBOs', etc.); and announce vacancies to community leaders, and community liaisons for disbursement.

7.1.3.3 Community Engagement

Community engagement for the whole development cycle is a dynamic and continues process which needs to be strategically adhered to by the company, and should be initiated during the experiment stage. Actual full-spectrum implementation of these measures is likely to be beyond the scope of the proposed project but is deemed priority for the next stage of the development (i.e. supply of water).

1. Develop a Community Engagement Plan, including establishment of community liaisons and grievance mechanism at this time pre-construction. Such a plan needs to incorporate actions for establishing and maintaining effective, bi-directional, communication with the local communities.
2. Hire one full-time local (Arab-speaking Jordanian) staff person to act as the project owner's representative to liaise with the community, and hire one male and one female community liaison (on a part-time basis) in the affected community for the construction phase.
3. Assist each community in developing one male and one female community advisory board with community-selected representatives from various demographics, including marginalized segments of the population. Consider encouraging each advisory board to initiate and mentor male and female youth advisory boards.
4. Engage with tribal leaders on an individual basis as needed, mainly related to land use and acquisition. Instruct the staff's community liaison to communicate regularly with tribal leaders on key issues of concern for affected communities.
5. Engage with Irbid municipality drawing upon the knowledge of municipal leaders and working closely with leaders for issues pertaining to local utility, infrastructure, and community development planning.
6. Avoid raising expectations or changing public messaging by developing a consistent message, providing realistic expectations, and delivering on promises.

7.1.3.4 Business Disruption

The Contractor should take all precautions to prevent damage to private properties during construction or infliction of harm to persons including disruption of work or business to individuals along the pipeline corridor. These precautions should be part and parcel of the contract. Therefore, the Contractor stands responsible for his action or behavior contrary to the provisions of the Contract.

The entities expected to be affected along the water transmission line have been surveyed and documented, in addition ARAP report has been prepared to discuss all issues related to damage or compensation; please refer to **Appendix 10** for full ARAP report.

Responsibility for damage of private property and business disruption however, can be divided into two parts:

- Negligence of the Contractor to the contract conditions and the instructions of the Consultant, his mischief or that of any of his employees, should be governed by the provisions of the employment contract

- If the Contractor abided strictly by the contract conditions, and followed the Consultant's instructions completely and correctly, any damage might occur to other persons or property shall be the responsibility of the Owner.

7.1.3.5 Reduce the Expected Traffic Disruption

In order to avoid and control the expected traffic disruption and the expected accidents that might result, in addition to control of the noise levels during the construction phase, the following mitigation measures should be applied:

- Avoid the closure of the main roads whenever possible.
- Carry out all construction activities that might require closure of some roads very rapidly and at one time though the disruption would be minimum
- Allocate and ensure alternative routes to serve the impacted traffic movement including loops, intersections or others. Such alternatives should be of sufficient capacity to cope with the disrupted traffic.
- Limit the movement of the construction machinery to the direct project area
- Prohibit the movement of this machinery outside the project area during peak traffic hours
- Limit the movement time for heavy trucks transporting equipments and materials to the project areas to non-peak traffic hours, and not allow them to use internal roads between residential areas close to the project site.
- Use covering for all vehicles transporting raw materials from/to the project site.
- Apply strong restriction for the allowable speed limits for all the project vehicles.
- Install all necessary signs and measures to facilitate safety and strict traffic control.

Arranging all the above listed issues should be through coordination with the Traffic Department for a proper traffic management.

7.1.3.6 Formulate Public Safety Program for the Locals and the Workers in the Project

In the project corridor and especially in the populated areas, and where the services establishments are located, access facilities should be located to provide a safe passage for the pedestrians crossing within the project areas. It is recommended that these facilities be in the form of protected pedestrian bridges.

During the course of the work, the contractor and under the project company (PC) supervision should be responsible for providing and properly maintaining all temporary roads and other work required including access to existing carriage, shops, building and the like. The PC duties include installing operating and maintaining all required temporary signing, signals, barriers and other safety measures that can assist in conserving the public and the workers safety.

The safety measures mentioned below (**point 7.1.3.7) Formulate Workers Health and Safety Program** are as valuable for protecting both public and work staff. These measures should be strictly adhered to.

7.1.3.7 Formulate Workers Health and Safety Program

The contractor should follow all the procedures that could prevent any possible dangers whether these dangers are electrical, mechanical, chemical, or related to site works, and this can be done by:

- Providing preventing barriers around machines dangerous parts to prevent the wrong access to these parts.
- Providing warning signs that make the workers aware of the dangers related to machines or site area.
- Following all the procedures that could prevent static or dynamic electrical dangers and provide any insulation or earthling systems required for workers safety.
- The contractor must provide scheduled maintenance to deferent machines used during the construction or the operation.
- The contractor also should maintain insurance policies issued by an insurer allowed by law to do business in Jordan that cover the following:
  - Workmen's compensation and all other social insurance in accordance with the statutory requirements of the country having jurisdiction over the contractor's employers.
  - Damages or compensation payable at law in consequence of any accident or injury to any workman or other person in the employment of the contractor or any subcontractor, save and except an accident or injury resulting from any act or default of the employer or his servants.
  - Injury which may occur to any person by arising out of the execution of project and caused by the contractor or his subcontractors.
  - Car bodily injury which shall include coverage for all owned, non-owned and hired vehicles used in the performance of the services.

7.1.4 Archaeological Conditions

This Mitigation Plan has four main components, each related to a further project phase:

- Design phase: the definition of the required site specific protective measures and a general plan of works necessary to minimize project related damage to the Cultural Resources of the Region.
- Tendering phase: Definition of tender requirements as they related to the implementation of the specified measures.
- A construction monitoring program.
- Post project monitoring

DESIGN PHASE

Mitigation works during the Detailed Design Phase of the project will comprise the bulk of the archaeologist. There are some elements were carried out during the study and as follows:

1. Further archaeological assessment of threatened sites and design review of all threatened sites.
2. Design review and definition of mitigation options.
3. Documentation of non-threatened sites.
4. Program review.
5. Development of site evaluation procedures.
6. Co-ordination with Ministry of Tourism and Antiquities (MOTA).
7. Consideration of indirect threats.

Further Assessment of the Discovered Sites

These sites (except site no 6) have been tentatively identified as low significance during this phase of the study. However, it is recognized that this assessment is applied only to sacrificial data and on the basis of the experience of archaeologists.. Nevertheless the assessment has served a function in characterizing the area, suggesting that the overall risk of the discovery of a major find is relatively low.

Design Review

A design review is proposed for each indirectly threatened site. It is intended that this be an interactive process between the design team and Cultural Resources (CR) archaeologist. The CR archaeologist will provide the designers with a site brief:

- Location of the site and description.
- Initial estimate of area covered by the site.
- Linkages with other sites if any.
- Any other information that may be useful to the design team.

Documentation of Non Threatened Sites

Once the final plans has been fixed and the extent of any earthworks and borrow pits is known, sites that remain classified as not threatened should be revisited and fully documented for record purposes.

Tendering

Pre Tender Conference

All pre-qualified contractors or (subcontractors) should be called to a pre-tender conference at which issues of Special interest or concern will be outlined. With regard to Cultural Resources the Contractors will be briefed on:

- Chance find procedures
- Exclusion areas
- Special procedures to be adopted in the vicinity of sites defined as requiring protection
- Penalties for non compliance
- Their coordination responsibilities with and to CRM monitoring groups

Bid Documents

To support the stipulations of the tender conference, contract bid documents should include a set of final engineering drawings on which archaeological sites within or immediately adjacent to the construction area is defined.

In addition, details of the site specific measures outlined in the previous section will be provided as instructions to the contractor.

a) Borrow Areas

The location of borrow areas, dumping, and quarry sites selected by the contractor should be approved by the Department of Antiquities, to prevent antiquities being damaged by quarrying or borrow excavation. Such inspection will not be unreasonably delayed.

b) Excavation and Observation of Construction

In areas where the Department of Antiquities knows or suspects the existence of remains under the surface, but where there is insufficient time for archaeological excavation (or the importance of the site does not warrant full scale investigation prior to construction), a representative of the Department should be present during the opening of any excavation or borrow pit to identify and record any archaeological remains found.

Additional Salvage Excavation

In areas where the Department has determined that further salvage excavation will be necessary, based on the information developed during the Final Design phase, this will be carried out at the beginning of the construction phase. Construction activities should be scheduled so as not to leave any such area until late in the construction process, and the archaeological excavation will thus not delay construction activities.

7.1.4.1 Construction Monitoring

Site Access

Regular and frequent site inspections will be required to permit effective monitoring of the performance of the contractor with regard to compliance with applicable guidelines, regulations and statutes, and contract specifications. For the proposed program monitoring to be effective therefore it

will be necessary, during the course of construction and operation, for authorized agents from Department of Antiquities to have guaranteed access to all sites, related to any project component, at all times.

Monitoring Program

Two forms of inspection will be required:

(i) Event Specific

These will be pre-programmed events such as the opening and demarcation of a borrow area and the opening of any site (area) deemed significant or at risk.

In addition, Cultural Recourses Manager (CRM) will carry out a walkover survey of all proposed access roads within the project area.

(ii) Random Inspections

Additional site inspections should be carried out on a regular basis but not necessarily to a structured pattern.

After each inspection during the construction phase, a report shall be compiled that is location and activity specific, and which identifies areas of contractor non-compliance with the mitigation plan and which provides guiding remarks on the actions to be taken. The significance of the non-compliance shall also be noted.

End of project Report

The CR archaeologist shall prepare an end of project report.

- **Review of Project Works**

This will be a typical end of project report. It will outline the background to the study and its objectives. Where possible, measurable criteria will be used to assess the relative success or failure of the project in meeting those objectives.

Specific sections will be required to review the effectiveness or otherwise of the project implementation procedures and processes and the potential lessons to be learned. This should be split into two sections:

Pre-Construction and monitoring

In general terms therefore the report should contain:

- Background to the project / Program / works
- Summary statements of methodologies adopted
- Summaries of findings
- A statement of lessons learned

- Recommendations for future works

The assessment should draw on the findings of the inspection reports prepared under the management program.

The findings of the archaeology program should be the subject of a report prepared for publication in the Technical press and potentially non-technical press. This will:

- Further extend knowledge of regional archaeology
- Demonstrate to the public the Non Governmental Organization (NGO) commitment to the preservation of National cultural heritage.

7.1.4.2 Archaeological Chance Find and Salvage Excavation

It shall be the responsibility of the Contractor to obtain all information available from the Supervisor of the Cultural Resources Management Office of the Department of Antiquities regarding the location of any known archaeological site in the construction area, and he shall make this information available to the Engineer's Representative as soon as he obtains it.

If any known sites will be threatened by construction, agreement must be reached with the Department of Antiquities in order to minimize damages to the sites. It shall also be the Contractor's responsibility to notify the supervisor of the Cultural resources Management Office of the Department of Antiquities are encountered in any era during construction, and Clause" V of the General Conditions of contract must be closely observed and also specifications set in articles 15 of the antiquities law No. 21. (1988).

If any site found during construction and will be damaged by construction activities, the Department of Antiquities will assess the discovered remains and may carry out an emergency salvage excavation. Salvage excavation means archaeological excavation conducted during construction phase. It should be conducted only when an archaeological site is found by accident (chance find) during construction. Given the short time available for a salvage excavation, this type of work should be avoided.

The available short time for salvage excavations cannot be considered an authorization to destroy the discovered remains or site. Since each site must be given proper consideration and analysis before its destruction can be authorize.

7.2 Proposed Mitigation and Management Plan for Operation and Maintenance Phase

7.2.1 Physical Environment

7.2.1.1 Water Quality and Quantity

The proposed project will increase the supply of high quality water by around 30 MCM/year, which will enhance the quality of life for all Irbid residents. The designer has ensured the water quality to meet the Jordanian standards by providing a full water quality lab at the WTP site and applying all required tests to guarantee the high water quality.

7.2.1.2 Waste and Sludge Management

Municipal Waste

The expected fluid and solid wastes that will result from the project facilities should be disposed of as follow:

- The domestic fluid wastes should be disposed to the wastewater collection system (where available) or to appropriate septic tanks, which will be designed to be compatible in volume with the expected number of workers in each station. These septic tanks should be pumped out on regular basis.
- The fluid wastes that are expected to result from the daily work activities or from the regular maintenance activities should be collected in holding tanks and transported on monthly bases to the nearest suitable and approved treatment/dumping site.
- The resulting solid waste should be collected on a weekly basis and sent to the nearest approved dumping site.

Sludge Management

At present, there are no Jordanian Standards for sludge produced at Water Treatment Plants similar to the Jordanian Standard for sludge produced from WWTP's treating domestic wastewater.

The estimated average Sludge Quantities is 21,700 kg/day. The material will be sand, silt clay and some organic material with high iron content due to the use of ferric sulfate as the coagulant.

Similar project at Zai water treatment plant is currently utilizing the dried sludge as fertilizers after it passes the Royal Scientific Society laboratory tests. In case of any excess quantities, these shall be disposed in municipal landfills according to the best international practices in this field. Below is brief description of the existing landfill in the area, and suggested route for sludge disposal.

There are three formal landfill sites in the north of Jordan that are identified as follows:

1. Al Ekaidar Landfill site located approximately 60 km north of Amman on the Syrian border,
2. North Jordan Valley Landfill site located approximately 2 km south of the Village of Manshyeh, and
3. Middle Jordan Valley Landfill site located approximately 30 km south of the Village of Manshyeh.

The location of the 3 sites is shown on **Figure 62.**

The closest of these landfill sites to the proposed WTP for the new Manshyeh to Zabda Water System is the North Jordan Valley Landfill site. **Figure 63** identifies the location of the proposed WTP near the village of Manshyeh, the location of the North Jordan Valley Landfill site, and a suitable travel route from the proposed WTP to the landfill site.

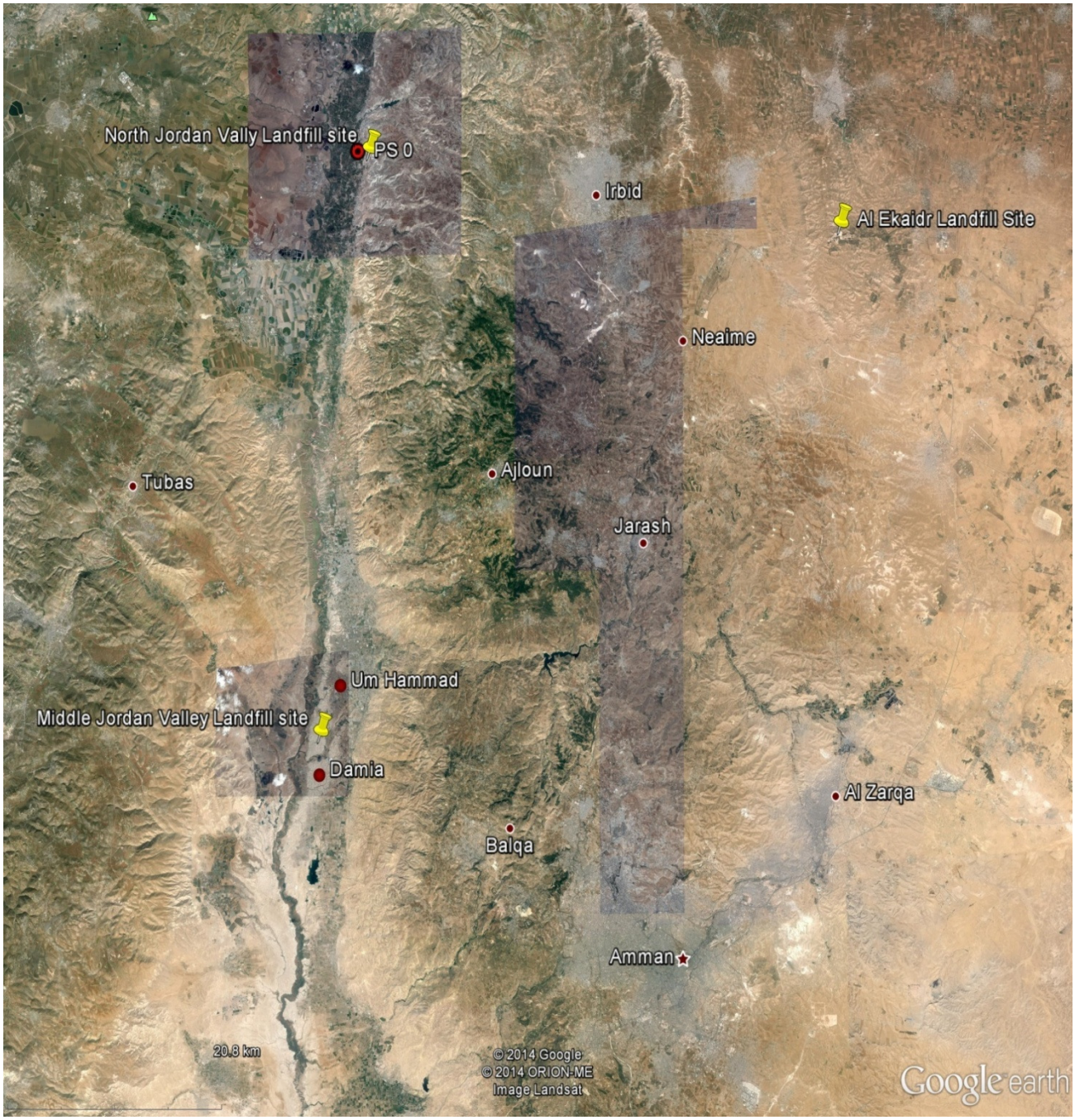


Figure 62: Location of 3 Landfill Sites in North Jordan

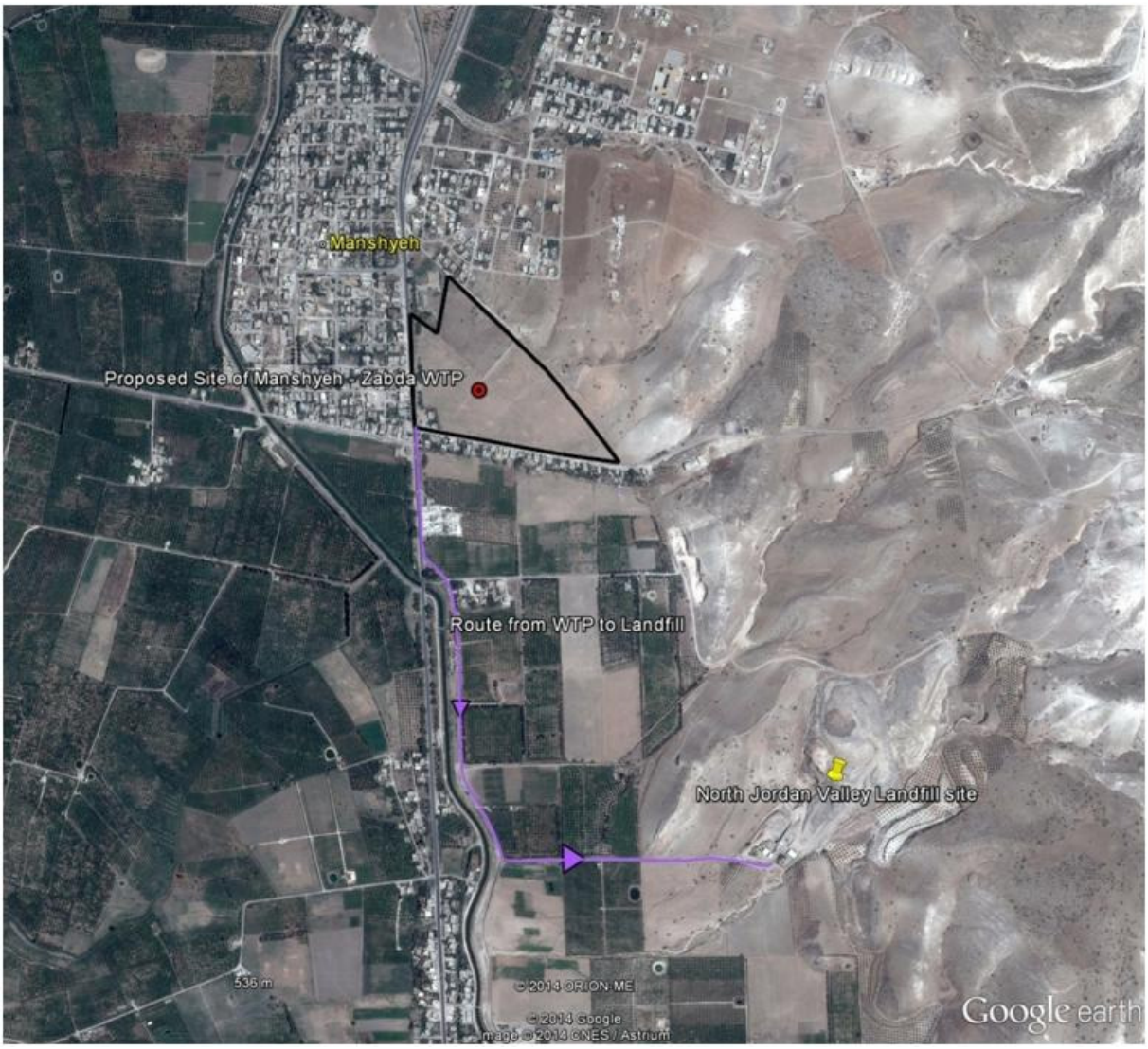


Figure 63: Location of Proposed Manshyeh-Zabda WTP, North Jordan Valley Landfill Site, and Route from WTP to Landfill

7.2.1.3 Chlorine Storage

This section describes what you must and must not do when storing chlorine.

Location

- Use signs to clearly identify all areas where chlorine is used or stored. Only qualified personnel are permitted to enter these areas.
- Store chlorine cylinders and containers in a cool, dry, and relatively isolated area, protected from weather and extreme temperatures.

- If storing cylinders and containers outside, shield them from direct sunlight, unless they are specifically designed for unshaded, outdoor storage.
- Never apply heat to pipes, containers, or container valves unless they have been thoroughly purged of chlorine.
- When storing chlorine containers inside, store the containers in a well ventilated building, away from any heat sources, such as steam pipes.
- Store chlorine containers on the lowest working level but not below grade.
- Do not store chlorine near busy roadways or anywhere else where vehicles operate. Chlorine reacts with carbon monoxide to produce phosgene, an extremely poisonous gas.
- Store cylinders upright and secure them against falling. Cylinders will discharge vapour when upright and discharge liquid when upside-down.
- Store ton containers on their sides, on steel or concrete supports. The supports should be equipped with trunnion wheels so that, if chlorine leaks from the bottom valve, the container can be quickly rotated with the leak at the top to minimize leakage. Discharge ton containers while they are horizontal, with the two valves in a vertical line (vapour from the top valve, liquid from the bottom).

Handling Chlorine

This section describes what you must and must not do when handling chlorine.

Moving Containers

- Handle containers with care while moving or storing them. Do not allow containers to strike objects and do not drop containers.
- Do not use slings or magnetic devices to move chlorine containers.
- Use new gaskets as recommended by the chlorine supplier each time a cylinder or container is connected.
- Follow the chlorine supplier's recommended disposal procedures for leaking containers.
- Do not modify, alter, or repair containers and valves. Only the supplier should carry out these tasks.

7.2.1.4 Noise Level

In order to control expected elevated noise levels during the operation phase of this project, the Jordanian Regulation for ambient noise levels presented should be applied. The pumping stations should be placed inside a sound insulating (enclosure) to contain the generated noise. The design specifications of these enclosures should ensure that the walls are massive and air tight enough to contain noise and that absorbent lining on the interior surfaces of the enclosure will reduce the reverberant build up noise within it.

7.2.2 Socio-Economic Conditions

The mitigation measures required during the operation phase relate only to the application of appropriate public safety measures for both the workers and the local communities located close to these stations. All pumping stations along the project route should be fenced and have daily guarding system. In addition to that, the local communities should understand through the public media and the local schools within the project corridor, the importance of conserving all of the project facilities.

Moreover, all the workers in these stations should wear safety equipment such as safety helmets and shoes during their work shifts and should get a specialized public safety course related to such facilities.

Supervising the implementation of the above listed mitigation measure should be the responsibility of the environment department in WAJ in association with the local municipalities at Irbid Governorate

7.3 Environmental and Social Management Plan Matrix

The Environmental and Social Management Plan for the Proposed Project is presented in **Table 30**, which describes the measures that the contractor and the operator are responsible for the construction / operation of Wadi Arab Water System II will take to mitigate the potential negative impacts and capitalize on the positive outcomes of the project on the environment and on local communities.

The objective of the ESMP is to ensure that all steps are taken to address the potential impacts of the project. The ESMP:

- Draws together the measures proposed to mitigate negative, and to maximize positive, environmental and social impacts.
- Defines the specific actions required, roles and responsibilities for these actions.
- Describes capacity building and training requirements for the implementation of the ESMP.
- The measures in the ESMP are based on the assessment of potential impacts as stated in this ESIA document and are summarized below.

A separate report has been developed to cover land acquisition issues related to the project. **Appendix 10** (Volume 2 of the ESIA Report) provides survey for Project Affected People (PAPs), suggested compensation plan, in addition to grievance and redress mechanisms to solve any issue related to acquisition or loss of business.

It is recommended to settle land acquisition issues before construction to avoid any problem during construction.

Table 30: Environmental and Social Management Plan (ESMP)

Construction Phase							
Environmental Components	**Expected Impact**	**Significance**	**Mitigation Measures**	**Location**	**Monitoring**	**Frequency**	**Responsible Party**
Physical Environment							
Water quality and Quantity	No expected impacts during construction	Negligible					
Wadi Crossing	Natural Water flow and risks of flash flood	Significant (-ve)	Avoid construction on winter season	Wadis within the corridor	schedule of construction	Weekly	Contractor & Supervisor
Air Quality	Dust due to different construction activities, may affect agricultural crops in the surrounding farms and residential areas. .	Significant(-ve)	Cover construction materials during storage. Spray with water whenever needed. Establish a barrier between WTP and surrounding residential area and farms .	Construction site and surroundings	Check the cover of stored material Check spraying of water whenever needed	daily	Contractor & Supervisor
	Dust during material transfer	Minor(-ve)	Cover construction material during transfer.	Access road	Check all project trucks to have a cover while transporting	daily	Contractor & Supervisor
	Emission from construction equipments.	Minor(-ve)	Regular maintenance of the Equipments. Emission control on equipment shall be maintained along with engine mufflers.	Construction site	Check record of maintenance	Weekly	Contractor & Supervisor

Construction Phase							
Environmental Components	**Expected Impact**	**Significance**	**Mitigation Measures**	**Location**	**Monitoring**	**Frequency**	**Responsible Party**
Noise	Increase the noise level to the residential area surrounding the working site	Moderate(-ve)	Construction activities should be limited to day time and working weekdays. Where applicable, use equipment with less noise levels.	Construction site	Check the working hours	Weekly	Contractor &Supervisor
Waste management **Municipal waste**	Accumulation of liquid and solid wastes mainly from machinery and staff residence	Moderate(-ve)	Installation of holding tanks.	At working site (camp if any)	Empty the holding tank on regular basis	Weekly or monthly; According to no. of workers	Contractor & Supervisor
Construction waste	Accumulation of excavation materials and debris	Moderate(-ve)	Designate a specific area as a temporary solid waste dumping area	Designated area	Check the surrounding area for any illegal dumping	daily	Contractor & Supervisor
	Oil and lubricants of the equipment	Moderate(-ve)	All maintenance and oil change of construction equipment should be done in a specified area. Collected and stored on-site, in a banded tank. Transported Off-site by a licensed regulated waste transporter, to a licensed facility for recycling.	Surrounding corridor	Check the surroundings for any spoiled oil or its package	weekly	Contractor & supervisor
Biological Environment							

Construction Phase							
Environmental Components	**Expected Impact**	**Significance**	**Mitigation Measures**	**Location**	**Monitoring**	**Frequency**	**Responsible Party**
Flora	Removal of vegetation cover and tree stands.	Minor(-ve)	Avoidance of unnecessary removal of vegetation cover and trees.	Corridor of the transmission main	Check the corridor for any unnecessary removal of trees and vegetation	Weekly	Contractor & Supervisor
Fauna	Disturbance to wildlife especially at night due to machinery or resident staff.	Minor(-ve)	Avoid working night's shifts.	Corridor of the transmission main			Contractor& supervisor
	Fragmentation of habitats		Provide access for species to move easily	Corridor of the transmission main	Check existence of the access	daily	Contractor& supervisor
	Increased accidental and deliberate persecution of wildlife		Orientation of all workers at the beginning of the project to avoid wildlife persecution and hunting	Corridor of the transmission main			
Socio-Economic							
Occupational Health and safety	Dusting	Moderate to high (-ve)	Provide employees with health checkups		Site inspection and auditing.	Every six months	Contractor& supervisor
	-Elevated noise levels	Moderate to high (-ve)	-Integrating health training into regular employee training - All workers should use Personal Protection equipment.	Construction site	-Site supervisor daily reports	Daily	Contractor& supervisor

Construction Phase							
Environmental Components	**Expected Impact**	**Significance**	**Mitigation Measures**	**Location**	**Monitoring**	**Frequency**	**Responsible Party**
	- Accidents, injuries Risk of accidental Injuries during the project construction and/or due to vehicular traffic	Moderate to high (-ve)	-Keep unauthorized persons away from dangerous work zones • Put warning signs (written in Arabic and English) at strategic site	Construction site	Site supervisor daily reports	Daily	Contractor & supervisor
Public Health and Safety	Dusting	Moderate to high (-ve)	Spray working area with water Cover stockpiles Shield trucks of construction	Construction site	Site inspection and auditing.	Daily	Contractor & supervisor
	Elevated noise level	Moderate(-ve)	Construction activities should be limited to day time and working weekdays. Where applicable, use equipment with less noise levels.	Construction site	Check the working hours	Weekly	Contractor & Supervisor
	Loss of access	Moderate to high significance (-ve)	Communicate with residents before beginning of construction. Provide temporary access to residents especially close to public places such as schools, and mosque	Construction site	Site inspection and auditing	Weekly	Contractor & supervisor
Utilities and infrastructure	Accidental impacts on the services, or interruption of any utilities.	moderate significance (-ve)	Coordinate with related authorities to avoid , minimize, or fix any interruption of services	Construction site	Regular reporting on risks and incidents	Weekly	Contractor & supervisor

Construction Phase							
Environmental Components	**Expected Impact**	**Significance**	**Mitigation Measures**	**Location**	**Monitoring**	**Frequency**	**Responsible Party**
Road and transport	Safety considerations during the mobilization of the heavy machineries	Moderate e (-ve)		Access roads	-	Weekly	Contractor & supervisor
Employment opportunity	Staff and labourers working on site being subject to labour code violations	Moderate (-ve)	Provide employee with information regarding their rights. Set wages above prevailing national minimum wage.	Construction site	-Application of HR policy on terms of employments -Annual auditing	Twice a year	Contractor & Supervisor
	Create new job opportunities for locals	Significant(+ve)	Priority should be given to local residents for any job opportunity. Make sure of the availability of all specialties required for this project.	Construction site	Regular reporting on number of locals vs. non-locals hired	Monthly	Contractor & supervisor
Involuntary resettlement And business disruption	Loss of business	Moderate (-ve)	ARAP report has been developed (refer to Appendix 10)	Construction site	Monitor the implementation of land acquisition and compensation plan	Before and during Construction	WAJ Contractor & supervisor
Local community involvement	Objection of the residents	Minor (-ve)	Establishing good communication and engagement of local community at early stage of the development		-Documentation of outreach efforts	Before and During Construction	Contractor & supervisor
Archaeological sites							

Construction Phase							
Environmental Components	**Expected Impact**	**Significance**	**Mitigation Measures**	**Location**	**Monitoring**	**Frequency**	**Responsible Party**
Archaeological sites	Impact on already known sites	Minor (-ve)	-Coordinate with Supervisor of the Cultural Resources Management Office of the Department of Antiquities regarding the location of any known archaeological site in the construction area. - If any known sites will be threatened by construction, agreement must be reached with the Department of Antiquities in order to minimize damages to the sites	Construction site	Site inspection and Auditing	Weekly	Contractor & supervisor Ministry of Antiquities
	Impact on new discovered sites during construction	Minor (-ve)	carry out an emergency salvage excavation	Construction site		Weekly	Contractor & supervisor Ministry of Antiquities

Operation Phase							
Environmental Components	**Expected Impact**	**Significance**	**Mitigation Measures**	**Location**	**Monitoring**	**Frequency**	**Responsible Party**
Physical Environment							
Water quality and Quantity	Increase on supply high quality drinking water for Irbid Governorate.	Significant (+ve)			Water Quality to meet Jordanian standards	Daily	WAJ/ Yarmouk water Company
Waste Management **Municipal Waste**	Increase in domestic waste	Minor(-ve)	Connect to wastewater collection system (if any) Or, to appropriate holding tank	WTP & Pump stations	Emptying the holding tank	Monthly	WAJ/ Yarmouk water Company
Sludge Management	Production of Sludge	Moderate (-ve)	Coordinate with Royal scientific society for the quality of waste If possible use as fertilizer. Otherwise coordinate with related authority to dispose in the municipal landfill	WTP	Disposal record	Weekly	WAJ/ Yarmouk water Company
Chlorine storage and handling	**Causing irritation or injury**	Moderate(-ve)	**Follow proper Storing and handling procedure**	WTP	Check storage and handling situation	Monthly	WAJ/ Yarmouk water Company

Operation Phase							
Environmental Components	**Expected Impact**	**Significance**	**Mitigation Measures**	**Location**	**Monitoring**	**Frequency**	**Responsible Party**
Socio-Economic							
Health and safety	Noise elevated levels due to project on-site activities at the main facilities.	Minor (-ve)	Provide employees with health checkups	WTP and PSs	Site supervisor daily reports	Daily	WAJ/ Yarmouk water Company
	Accidental exposure to nuisance emissions	Moderate (-ve)	Ensuring good project management procedures	WTP and PSs	Site inspection and auditing.	Weekly	WAJ/ Yarmouk water Company
	inhalation or accidental ingestion due Mishandling of chemicals by workers	Moderate (-ve)	Training and proper supervision.	WTP and PSs	Site supervisor daily reports	Daily report	WAJ/ Yarmouk water Company
Economy	Create new job opportunities for treatment plant operation and maintenance.	Significant(+ve)	Priority should be given to local residents for any job opportunity	WTP and PSs	Regular reporting on number of locals vs. non-locals hired	WTP and PSs	WAJ/ Yarmouk water Company

8 CONCLUSION RECOMMENDATION

Assessment and analysis of the site conditions and proposed impacts of the project showed that all anticipated impacts of the proposed project can be mitigated through coordination with relevant authorities, or applying mitigation measures specified for each aspect and phase of the project.

Wadi Arab Water System II project is essential as it will enhance the living standards at Irbid Governorate by providing additional 30 MCM to Irbid residents; especially with the unplanned increase in the population due to Syrian refugees.

All the potential impacts arising from the project activities have been well assessed and evaluated. The project will create positive impacts on the local society, culture and economy such as creating job opportunities for the local labour during the construction phase and land-take or business loss involved to the project will be limited to the location of intake, WTP, PS0, and PS1 and pipeline and will be addressed in the Abbreviated Resettlement Action Plan Report (ARAP), which is a standalone report..

Concurrently, adequate mitigation measures have been taken to eliminate, when possible, or reduce the negative impacts due to construction of the transmission main and WTP on the environment. These measures include maintaining of the air quality, the historical environment, and preserving the flora and fauna existing in the surrounding environment.

The project company should be committed to implement an environmental and social management and monitoring plan which will ensure that the construction and the operation of the Wadi Arab Water System II involves full implementation of all proposed mitigation measures and complies with high environmental standards.

Recommendation

- Coordinate with related authority such as Irbid Governorates, traffic department, municipalities, Ministry of Antiquities... etc. before the beginning of the project
- Contractor should comply with all mitigation measures in order to minimize impacts of the project on the Environment.
- Establish good communication plan with local people especially tribal leaders, and communicate regularly on key issues of concern for affected communities
- Avoid raising expectations or changing public messaging by developing a consistent message, providing realistic expectations, and delivering on promises.

APPENDIX 1: LIST OF INVITEES

Draft List of Invitees		
Category	**Name**	**Expected No.**
Ministries & Gov. Institutions	Ministry of Water and Irrigation	1
	Water Authority Jordan (WAJ)	1
	Jordan Valley Authority	1
	Ministry of Agriculture	1
	Ministry of Labor	1
	Ministry of Tourism and Antiquities	1
	Ministry of Health	1
	Ministry of Interior	1
	Royal Department for Environment Protection (Rangers)	1
	Civil Defense	1
	Central Traffic Department	1
	Ministry of Public Work and Housing	1
	Ministry of Municipal Affairs	1
	Grater Irbid Municipality	1
Utility providers	Al Yarmouk Water Company	1
	Electric Distribution Company	1
NGOs	Jordan Environment Society	1
	Royal Society for the Conservation of Nature	1
	Friends of Environment Society	1
Academic Institutions	Jordan University of Science and Technology	1
	Al Yarmouk University	1
	University of Jordan/ Water and Energy Research Center	1
	Hashemite University	1
Locals from villages in the area	Samma Village صما	2
	Mekhraba Villageمخربا	2
	Zabda AL wasteyehزبدة الوسطية	2
	Al Taybeh village الطيبة	2
	Kufr Youba Villageكفر يوبا	2
	Deir Al Se'neh Villageدير السعنه	2
	Zabda Farkouhزبدة فركوح	2
	Beit Yafa Villageبيت يافا	2
Client	WAJ	2
Donors for Similar Projects	USAID	1
	EIB/ AFD	1
	GIZ	1
	EU	1
	KFW	1
Organizer	MOE	3
	CDM smith/ Consolidated Consultant	6
	Total	**55**

APPENDIX 2: LIST OF PARTICIPANTS

الثلاثاء 24 آذار 2015
Preparation of Environmental and Social Assessment Studies (ESIA) for WADI ARAB WATER SYSTEM II

مشروع تزويد مياه وادي العرب - 2 / مشروع البنية التحتية
Tuesday, 24th March 2015

التوقيع Signature	رقم الهاتف/الايميل Phone no./e-mail	الجهة الممثلة Organization	الوظيفة Position	الاسم Name	الرقم No.
	٠٧٩٧٤٩٤٤٠٠	جمعية السلطان	موظف	خلدون العزام	1
	٠٧٩٥٤٦١٢٤٢	مديرية الشؤون البلدية - محافظة اربد	مهندس مدني	م. سعيد البوكر	2
	٠٧٩٩٠٥٠٦٨٧	[illegible]	[illegible]	سامر [illegible]	3
	٠٧٨٨٢٥٨٩٩٢٩	CDM	Env	مروان مرعي	4
	٠٧٧٧٦٣٠١٤٦	وزارة البيئة مديرية بيئة اربد	مهندسة	م. حنان محمد	5
	٠٧٩٨٢٠٧١٤٨	سلطة وادي الأردن	مهندس	م. زكي نمراوي	6
	٠٧٧٧٢٠٢٩٤٥	وزارة الزراعة [illegible]	مهندس	م. كمال شطناوي	7
	٠٧٨٨١٢٤٦٢٢	وزارة الأشغال العامة والإسكان	مهندس	م. عبدالله عبابنة	8
	٠٧٧٢٢٨٤١٧٥	وزارة الزراعة	مهندسة	م. نسرين حماشا	9
					10

الثلاثاء 24 آذار 2015
Preparation of Environmental and Social Assessment Studies (ESIA) for WADI ARAB WATER SYSTEM II

مشروع تزويد مياه وادي العرب - 2 / مشروع البنية التحتية
Tuesday, 24th March 2015

الرقم No.	الاسم Name	الوظيفة Position	الجهة الممثلة Organization	رقم الهاتف/الايميل Phone no./e-mail	التوقيع Signature
1					
2				mohd_Abadi_Dyab@...	
3				ali@mem.gov.jo	
4				٠٧٧٥١٣١٢٨٥	
5				majedalsajer@yahoo.com	
6				halarawad1965@y... ٠٧٩٥٨١٢٨٢٤	
7					
8					
9					
10					

الثلاثاء 24 آذار 2015
Preparation of Environmental and Social Assessment Studies (ESIA) for WADI ARAB WATER SYSTEM II

مشروع تزويد مياه وادي العرب - 2 / مشروع البنية التحتية
Tuesday, 24th March 2015

الرقم No.	الاسم Name	الوظيفة Position	الجهة الممثلة Organization	رقم الهاتف/الايميل Phone no./e-mail	التوقيع Signature
1	غازية حسن العبيدات			٠٧٨٠٤٧٧١٩٦	
2	م. منذر سالم العمري	-	مديرية الدفاع المدني/	٠٧٩٥٩٧٧٨٠٣	
3	Rick Munkvold	CDM PM	CDM	079 899 7904	
4	رفاد محمد عبد السلام	فني	وزارة المياه	٠٧٨٠٣٠٥٥٦١	
5	م. سلطان مشاقبة	مدير شاريه	سلطة المياه	٠٧٧٤٣٤٥٥٨	
6	العقيد عبد الحق	رئيس مكتب سير الرتب	ادارة السير	٠٧٧٧٤٠٤١٩٠	
7	النسيب ماهر العمري	مساعد مدير	ادارة السير	٠٧٩٠١٩٠٩٧٤	
8	الرائد محمد شريف	أمن F.M		٠٧٧٢٨٥١٦٥	
9	أكرم عبد النبي	USAID			
10					

الثلاثاء 24 آذار 2015
Preparation of Environmental and Social Assessment Studies (ESIA) for WADI ARAB WATER SYSTEM II

مشروع تزويد مياه وادي العرب - 2 / مشروع البنية التحتية
Tuesday, 24th March 2015

الرقم No.	الاسم Name	الوظيفة Position	الجهة الممثلة Organization	رقم الهاتف/الايميل Phone no./e-mail	التوقيع Signature
1			USAID		
2					
3					
4					
5					
6					
7					
8			YWC		
9					
10					

الثلاثاء 24 آذار 2015
Preparation of Environmental and Social Assessment Studies (ESIA) for WADI ARAB WATER SYSTEM II

مشروع تزويد مياه وادي العرب - 2 / مشروع البنية التحتية
Tuesday, 24th March 2015

التوقيع Signature	رقم الهاتف/الايميل Phone no./e-mail	الجهة الممثلة Organization	الوظيفة Position	الاسم Name	الرقم No.
	0798867535	مياه اليرموك	رئيس قسم مجلات	م. رائد سالم الطلاح	1
	0798209855	اسلام	امتحان ام	[illegible]	2
					3
					4
					5
					6
					7
					8
					9
					10

Translation of List of Attendees

التوقيع **Signature**	رقم الهاتف/الايميل **Phone no./e-mail**	الجهة الممثلة **Organization**	الوظيفة **Position**	الاسم **Name**	الرقم **No.**
	0797494455	Cancer Society	Employee	Khaldoun Al Azam	1
	0795461243	Director of Municipal Affairs Irbid Governorate	Civil Engineer	Samir Abu Bakr	2
	0799050687	Irbid Governorate	Assistant Governor of Irbid	Bassam Freihat	3
	0798299929	CDM	Engineer	Mehran Merselian	4
	077635146	The Ministry of Environment Directorate of Irbid	Engineer	Hanan Hamad	5
	0798207148	Jordan Valley Authority	Engineer	Ruba Numeirat	6
	0777203948	The Ministry of Public Works and Housing	Engineer	Kamal Shehabat	7
	0788124633	The Ministry of Public Works and Housing	Engineer	Abdullah Ababneh	8
	0772284175	Ministry of Agriculture	Engineer	Nesreen Hamasha	9
	Mohd_abadi@yahoo.com	Ministry of Health	Department sources and networks	Mohammed al Abadi	10

التوقيع **Signature**	رقم الهاتف/الايميل **Phone no./e-mail**	الجهة الممثلة **Organization**	الوظيفة **Position**	الاسم **Name**	الرقم **No.**
	ali@memr.gove.jo	Department of Energy	Engineer	Ali Khawaldeh	1
	0772131285	Public security	Amen F.M	Mohammed al Omari	2
	Majed sajee@yahoo.com	Irbid Municipality	Office manager	Majid Sajee	3
		Yarmouk Water Company	Assistant General Manager of Yarmouk water	Hasan Awad	4
	0795812837	Greater Irbid Municipality	Assistant to the President for Planning	Munther Al-Attar	5
	078477196	Muath Eben Jabal Municipality	Deputy Mayor Muath Eben Jabal	Ghazi Anumeirat	6
	0795366823	The civil defense	Lieutenant	Ghadeer Omari	7
	0798997904	CDM	CDM PM	Rick Minkwitz	8
	0785322561	The Ministry of Environment		Wafa Abdulsalam	9
	0777462541	Ministry of Water	Project Manager	Sultan Mashaqba	10

التوقيع **Signature**	رقم الهاتف/الايميل **Phone no./e-mail**	الجهة الممثلة **Organization**	الوظيفة **Position**	الاسم **Name**	الرقم **No.**
	0777404190	Irbid Governorate	Chairman Sir section	Eaid Al Kherisha	1
	0790190974	administration	Assistant Head of the Department	Maher al Qurom	2
	0772385165		امن	Hamad Al-Sharif	3
			USAID	Akram Ali Al Fahidi	4
		USAID		Bader Kassab	5
		Royal Environmental Protection Administration	Environmental police in Irbid	Samer Al-Momani	6
			Environment	Khalid al Duhnee	7
		Ministry of Irrigation	Ministry of Irrigation r	Ayman Jaber	8
		Ministry of Health		Monther bane Fayyad	9
		West Irbid	Mayor West Irbid	Issam Al Shlool	10

التوقيع **Signature**	رقم الهاتف/الايميل **Phone no./e-mail**	الجهة الممثلة **Organization**	الوظيفة **Position**	الاسم **Name**	الرقم **No.**
	0795759750	Energy Regulatory Commission (TRC) and minerals	Engineer	Ayman Al Quraan	1
	0799601971	YWC	YWC	Isra Batayneh	2
	0798867535	YWC	Head of the Department of stations	Rani Salem Abu Al Haj	3
	0798209255	Media		Khouloud Ali	4

APPENDIX 3: WORKSHOP AGENDA

ورشة تشاوريه الخاصة بدراسة تقييم الأثر البيئي والاجتماعي
مشروع تزويد مياه وادي العرب - 2 / مشروع البنية التحتية

Scoping Session for Environmental and Social Assessment Studies (ESIA)
WADI ARAB WATER SYSTEM II /WIP

برنامج الورشة
Workshop Agenda

Location: Irbid Municipality — **الموقع: قاعه بلديه اربد**
Date: Tuesday, 24th March 2015 — **التاريخ: الثلاثاء 24 اذار 2015**

Time الوقت	Topic الموضوع
9:30 – 10:00 am	Participants Registration تسجيل الحضور
10:00 – 10:20am	Welcome Speech: WAJ / MoE / USAID/EIB كلمة ترحيبية: سلطة المياه / وزارة البيئة / الوكالة الأمريكية للتنمية الدولية/ البنك الأوروبي للاستثمار
10:20 - 10:30 am	Introduction to Workshop Objectives and Proceedings CDM Smith/Consolidated Consultant Group (CCG) مقدمة عن الورشة وأهدافها CDM Smith/CCG
10:30 - 10:50 am	Project Background, Objectives, Location, Components…etc. نبذة عن المشروع، أهدافه، الموقع، والمكونات، ...الخ
10:50 - 11:10 am	Q&A أسئلة حول المشروع وإجابات
11:10 - 11:30 am	Coffee Break استراحة
11:30 - 11:40 am	Presentation about Valued Environmental Components (VEC's) الموضوعات والتأثيرات المتوقعة للمشروع
11:40– 1:10pm	[Discussion of (VESC's) and Concerns مناقشة الموضوعات والتأثيرات المتوقعة للمشروع
1:10 - 1:25 pm	Presentation Of Main Outcomes عرض النتائج
1:25 - 1:30 pm	Wrap-up, Closing, and Workshop Evaluation ختام الورشة وتقييم ورشة العمل
1:30 - 2:30 pm	Lunch Break استراحة الغداء

APPENDIX 4: PRESENTATIONS

Water/Wastewater Infrastructure Project

Wadi Arab Water System II

Scoping and TORs Session

March, 2015

INNOVATIVE SOLUTIONS... PROVEN EXCELLENCE

Outlines

- Introduction to Workshop
  - Workshop Agenda
  - Objectives of The Session
  - Current Situation
  - Project Background and Rationale
- Project Description
  - Project Components
  - WTP and WTP Intake Location
  - WTP Components
  - Water Transmission Main
  - Pump Stations

Introduction to Workshop

Workshop Agenda

Time الوقت	Topic الموضوع
9:30 – 10:00 am	Participants Registration تسجيل الحضور
10:00 – 10:30am	Welcome Speech: WAJ / MoH / USAID/HII كلمة ترحيبية: سلطة المياه / وزارة الصحة / الوكالة الأمريكية للتنمية الدولية/ المعهد الأمريكي للاستثمار
10:30 - 10:40 am	Introduction to Workshop Objectives and Proceedings CDM Smith/Consolidated Consultant Group (CCG) مقدمة عن ورشة وأهدافها CDM Smith/CCG
10:30 - 10:50 am	Project Background, Objectives, Location, Components...etc. نبذة عن المشروع، أهدافه، الموقع، والمكونات ...الخ
10:50 - 11:10 am	Q&A أسئلة وتعليقات حول المشروع وإجابات
11:10 - 11:30 am	Coffee Break استراحة
11:30 - 11:40 am	Presentation about Valued Environmental Components (VECs) عرض موجز حول ماهية المكونات المهمة للمشروع
11:40 - 1:10pm	Discussion of (VECs) and Concerns مناقشة الموضوعات والمخاوف المتعلقة بالمشروع
1:10 - 1:25pm	Presentation Of Main Outcomes عرض النتائج
1:25 - 1:30pm	Wrap-up, Closing, and Workshop Evaluation إختتام الورشة وتقييم ورشة العمل
1:30 - 2:30 pm	Lunch Break استراحة الغداء

Objectives of The Session

- Inform the public and stakeholders about the Project and its components
- Identify the main environmental and social issues of concerns to be taken into consideration during the ESIA Study

Current Situation

- Irbid is the second largest of Jordan's 12 Governorates with a population of over 1 million
- Irbid faces declining in per capita water supply
- Population Growth *(according to DOS projections)*:
  - Year 2010: 1.16 million *
  - Year 2035: 1.70-2.00 million *

* Excluding Syrian Refuges

Current Situation

- Estimated Water Demand according to FIB Report
  - Yearly Demand 2015: 57 MCM
  - Maximum Available for Supply 2015: 32 MCM
  - Current Deficit: 25 (44% of the demand)
- Estimated Water Demand according to MWI Report

Yearly Demand MCM	2001	2015	2020	2025	2030	2035
Irbid	51.1	58.6	65.6	72.1	79.2	87.0

- The current water supply for Irbid governorate reaches 23.7 MCM according to MWI

Project Background and Rationale

- The project will provide additional water quantities to Yarmouk Water Company service area
- The Project will increase the water supply to Irbid governorate by 30 MCM
- This is the result of the proposed implementation of Red Sea-Dead Sea/Phase I swap agreement

Project Background and Rationale (Cont.)

- The water is intended for Irbid governorate and any surplus water could potentially be transferred to neighboring governorates
- The proposed Project will help to improve the continuity of water supply and to meet the future water demand of Irbid Governorate
- The proposed project will bring additional jobs in different technical levels

Project Description

Project Components

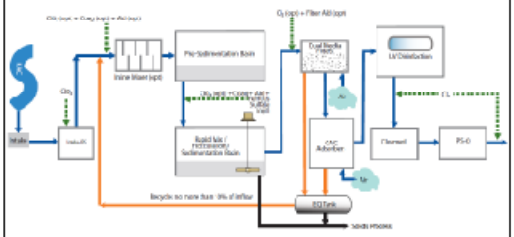
- The project consists of the following components:
  - New raw water intake from the King Abdullah Canal (KAC) and Intake Pump Station;
  - Four (4) pumping stations - the first pump station (PS0) is located on the WTP site;
  - A 30 MCM/yr Water Treatment Plant (WTP); and
  - Potable water transmission main Diameter: 1000mm, Length: 25.6 Km.

Location of Intake Pump Station on KAC and WTP

WTP Components

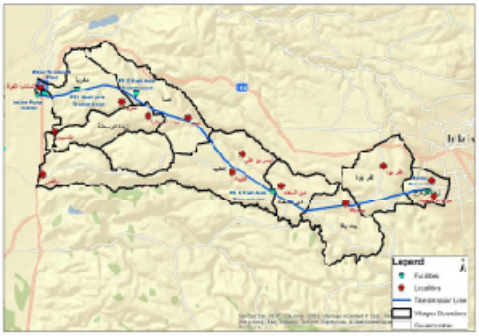
- The WTP comprise the following components:
  - Chlorine Dioxide at Intake PS
  - Coagulant and Aids
  - Pre sedimentation Basin
  - Chlorine Dioxide
  - Ferrous sulfate
  - Rapid Mix, Flocculation, and Sedimentation Basin
  - Chlorine
  - Dual Media Filters
  - GAC Adsorbers
  - UV Disinfection
  - Clearwell and Chlorine
  - Post Chlorine
  - Drying Beds
  - Mechanical Dewatering

WTP Schematic Diagram



Water Transmission Main

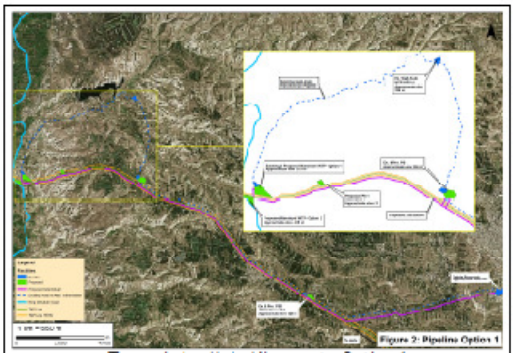
- (Length: 25.6 Km Diameter 1000mm) will pass through several villages namely:
  - Mekhraba,
  - Zabda Al Wasteyeh,
  - Samma,
  - Al Taybeh,
  - Deir Al Se'neh,
  - Deir Yafa,
  - Kufr Youba and
  - Zabda Farkouh.



Potable Water Transmission Main

Water Transmission Main

- PS0 to PS1
  - The pipeline follows the TAP line ROW up to the proposed PS1 site
- PS1 to PS2
  - The pipeline follows the TAP-ROW up to the existing PS2 site
- PS2 to PS3
  - The pipeline follows the TAP-ROW and it runs parallel to the existing Wadi Arab 800 mm transmission pipeline up to the existing PS3 site
- PS3 to Zabda Reservoir
  - The pipeline follows the TAP-ROW and it runs parallel to the existing Wadi Arab 800 mm transmission pipeline up to the point where it turns to the northeast to follow the existing Wadi Arab pipeline 15 meter ROW



Transmission Main Alignment - Option 1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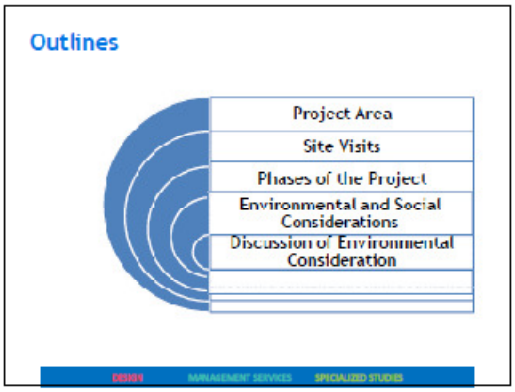
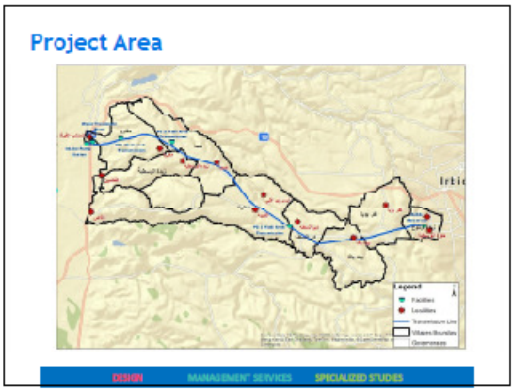
Valuable Environmental Components
VECs
DESIGN MANAGEMENT SERVICES SPECIALIZED STUDIES

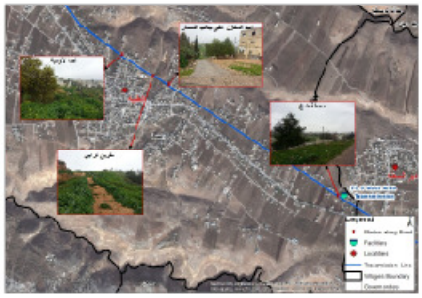

Outlines
Project Area
Site Visits
Phases of the Project
Environmental and Social Considerations
Discussion of Environmental Consideration
DESIGN MANAGEMENT SERVICES SPECIALIZED STUDIES


Project Area
DESIGN MANAGEMENT SERVICES SPECIALIZED STUDIES


Site Visits
Visit 1: 4 March, 2015
Visit 2: 15 March, 2015
The study team investigated the project area and the surrounding zone. So the whole area of the project and the proposed pump stations locations were visited
The quick investigation was conducted on foot.
DESIGN MANAGEMENT SERVICES SPECIALIZED STUDIES

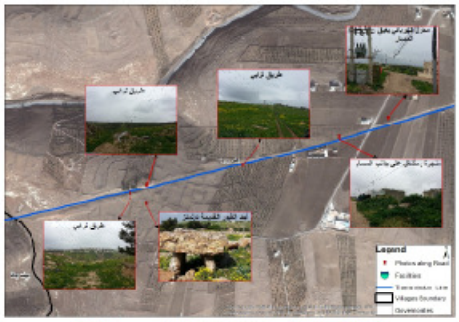

Photos along the Route
DESIGN MANAGEMENT SERVICES SPECIALIZED STUDIES

Photos along the Route

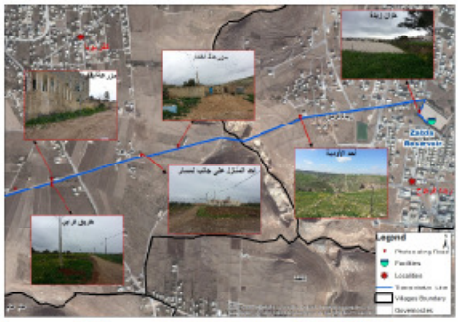


Photos along the Route

Photos along the Route



Photos along the Route



Project Phases

- The Environmental Impact Assessment will consider the following phases of the project
  - Construction Phase
  - Operation Phase

Construction Phase

- **Main Inputs:**
  - Typical civil work materials including cement, sand stones, metal and electrical cables, as well as workforce.
  - Equipment required for the construction of the WTP, PS and pipelines
- **Main Outputs:**
  - The new facilities.
  - Typical Construction waste
  - Municipal waste from workers camp (if any)

Operation Phase

- Main Inputs:
  - Water from KAC
  - Electricity: The electrical design will comply with applicable chapters of the International Code Council (ICC), and the Authority Having Jurisdiction (AHJ).
  - Chemicals; such as Chlorine Cl_2, Chlorine Dioxide ClO_2 , Coagulants, and precipitation agents
  - Human Resources: different level of technical employees, and workers
- Main Outputs:
  - Treated water
  - Dried WTP Sludge

Environmental And Social Concerns

Construction Phase

Socio-economic

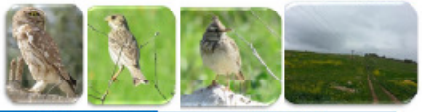
- Disturbance to lively hood and businesses along the transmission pipeline
- Disturbance to traffic
- Health and safety of workers and the general public
- Land acquisition for the Intake Pump Station, WTP and Pump Station No. 0 (PS0), and Pump Station no. 1 (PS1) and for the access road to PS1 will be required
- Create new opportunities for employment.

Environmental And Social Concerns

Construction Phase

Terrestrial Ecology

The proposed route for the pipeline does not overlap with any biodiversity designated areas of Jordan i.e. Protected Areas, Important Bird Area, and Special Conservation Areas



Environmental And Social Concerns

Construction Phase

Archeology and Historical Building

- Kafer Youba field Dolmen has been noticed close to the route
- The field investigations was conducted in accordance with the Antiquities Law No. 21 for the year 1988

Environmental And Social Concerns

Construction Phase

Waste Management

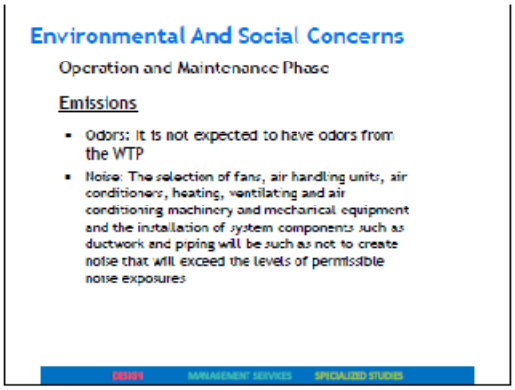
- Construction Waste
- Municipal waste of Camps (if any)
- Waste management will be discussed in details and disposal sites will be identified

Environmental And Social Concerns

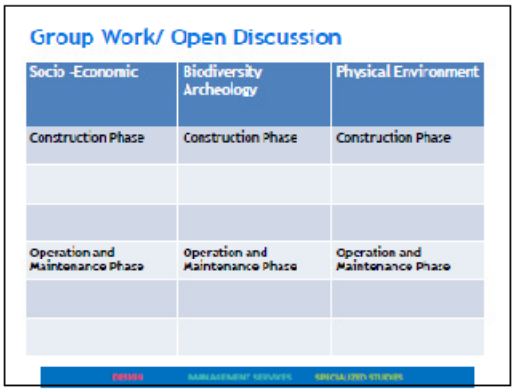
Operation and Maintenance Phase

Wastes

- Dried Sludge of the Water Treatment Plant WTP
  - Might be used as fertilizers and,
  - Excess quantities of sludge shall be disposed in municipal landfills according to the best international practices in this field.
- Used oil and office wastes are negligible and will be managed according to Jordanian regulation


Environmental And Social Concerns
Operation and Maintenance Phase
Emissions
Odors: It is not expected to have odors from the WTP
Noise: The selection of fans, air handling units, air conditioners, heating, ventilating and air conditioning machinery and mechanical equipment and the installation of system components such as ductwork and piping will be such as not to create noise that will exceed the levels of permissible noise exposures


Environmental And Social Concerns
Operation and Maintenance Phase
Socio-Economic
Enhance Water Supply for Irbid Governorate
Create New Job Opportunities in the Area


Group Work/ Open Discussion
Socio -Economic
Biodiversity Archeology
Physical Environment
Construction Phase
Construction Phase
Construction Phase
Operation and Maintenance Phase
Operation and Maintenance Phase
Operation and Maintenance Phase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APPENDIX 5: ARABIC DISCUSSION

الورشة التشاورية الخاصة بالدراسة البيئية لمشروع وادي العرب -2

الافتتاحية

- الافتتاح من قبل م. سلطان المشاقبة / وزارة المياه
- م. حنان حمد / مديرية بلدية اربد بالنيابة عن د. شحادة القرعان
- كلمة م. بدر كساب ممثل USAID- تعريف بالمنظمة وانها تمول المشروع لغرض زيادة كميات المياة المزودة لمحافظة اربد

عرض تقديمي للمشروع

قام المهندس محمد الحوري/ من شركة اتحاد المستشارين بتقديم لوصف المشروع ومكوناته

الأسئلة والأجوبة حول المشروع:

س1. هل هناك أي تأثير من مكب النفايات في المنشية على المشروع

ج يبعد 3 كم ولا يؤثر على المحطة

س2. ما الاحتياطات البيئية لمحطة تنقية دوقرة (م.عصام / رئيس بلدية اربد)

ج. مصادر المياه هي من سد الوحدة/بحيرة طبريا/والابار.

س3 هناك مشروع تأثرت منه بلدية معاذ يرجى إعادة الطرق إلى وضعها الأصلي حيث لا زالت مفتوحة.

هذا مشروع اخر والمشروع الذي تتحدث عنة تقوم شركة حسين عطية بتنفيذه وهي المسؤولة عن اعادة الطرق لوضعها

اي تاثير من تنفيذ المشاريع بشكل عام يتم تسويتة قبل التسليم حيث لا يتم الاستلام حتى يتم إعادة الأوضاع إلى ما هي عليه /

س4. مدى تاثير نقل المياه من KAC على القطاع الزراعي (السيدغازي سميرات-نائب)

كميات المياه التي سحبتها محطة التنقية هي مياه اضافية عن الموجودة حالياً تؤخذ من طبريا ويتم تبادلها مع المياه التي سيتم اعطاؤها من العقبة

س5 هناك نقص حالياً من المياه للزراعة بالإضافة إلى كونها ملوثة

م. سلطان: المياه من طبريا صالحه للشرب (ومن غير المؤكد أنها ملوثة) ولا توافق الحكومة الاردنية عليها غير ذلك. ولن يتأثر المزارعين، حيث لا يتم اخذ حصة الزراعة

- نحن نتحقق من سلامة المياه ونراعي المواطنين والمياه التي تؤخذ من طبريا صالحة 100% حسب فحوصاتنا (م. محمد عبادي- وزارة الصحة)
- نؤكد على ان مياه KAC صالحة للشرب ومديرية التحكم تراقب المياه (م. ربى النمرات/ سلطة وادي الاردن)

س6 الاستملاكات هل تم العمل عليها

معظم مسار الخط مستملك إما بموازاة خط الـTab Line والباقي في مسار خط طبقة فحل ووداي العرب والذي هوملك للسلطة . المحطات في نفس المواقع الموجودة للمحطات والإستملاك هو فقط لمحطة التنقية، محطة المأخذ، والمحطة رقم 1 ومسار طريق 1.2 كم

عرض تقديمي لأهم الاعتبارات الاجتماعية والبيئية

وقد قامت المهندسة رانية العمري من شركة اتحاد المستشارين بعرض تقديمي لأهم الاعتبارات البيئية والاجتماعية المتوقعة للمشروع VEC's

نقاش مفتوح حول الاعتبارات البيئية والاجتماعية

وقد أدار النقاش السيد مجدي سلامه من شركة اتحاد المستشارين

س اثناء الجولة هل هناك اعتداءات على الخط المقترح

ج المسار لا يتعارض مع اي بناء على طول الخط عدا عن الحفر امامهم

س ما هي كميات المواد الكيماوية الخطرة

ج الكلورين هو المادة الوحيدة وستنقل في اسطوانات وحسب المواصفات الاردنية

كلورين دايوكاسيد وينتج في الموقع وينتهي مفعوله ويتطاير بعد فترة وهو يقضي على الطحالب ويمنع تكاثرها

وايضاهناك حمايات لتسريب الكلورين –Scrubber حيث يتم سحبه وعمل معادلة له من خلال التصميم

س طريقة عرض المشروع مقتضبة واهمها الصحة المهنية والصحة العامة (د. منذر /الصحة المائية)

ج المقصود أن يكون العرض مقتضب بحيث يوفر معلومات مبسطة لفتح حوار يدير تفاصيله المشاركين وأصحاب العلاقة بالمشروع

س نوعية الهواء هل سيتم قياسها

ج تم الاتفاق من قبل المشاركين بان نوعية الهواء يجب قياسها في موقع محطة التنقية لمقارنتها بالقراءات ما بعد التشغيل، اما على مسار الخط فلا داعي لذلك حيث أن التأثير مؤقت. حيث سيمتد العمل لمسافة بسيطة بوجود أربعة الى خمس اليات على طول المسافة وهي لا تؤثر على المدى الطويل.

س لم يتم الإشارة إلى عدد العاملين المتوقع خلال، التنفيذ والفحوصات للعاملين،وسائل التخزين للكلورين، الصحة العامة

ج هناك خطة عمل للدراسة البيئية يتم وضعها في وثائق العطاء يلتزم بها المقاول وسيكون فيها كل التفاصيل

س *ما هي مدة التنفيذ ، ونعتقد أن في مرحلة البناء نوعية الهواء في المحطة تؤثر على السكان

ج مدة التنفيذ هي سنتين، وسيتم قياس نوعية الهواء ووضع خطة بيئية لتلافي أي اضرار

س المشروع ايجابي من ناحية تزويد المياه والتي تساعد على تحسين الصحة العامة والنظافة (م. سمير ابو بكر-مدير الشؤون البلدية) ولا يوجد ضرورة لقياس نوعية الهواء (اليوم) ؟ هل هناك ضرورة

ج نعم لموقع المحطة

يجب ان يتم اجراء القياس في موقع محطة التنقية لاجل مقارنتها في المستقبل (م. ايمن قرعان-هيئة تنظيم قطاع الطاقة

س - بالنسبة للحمأة المجففة هل هناك معرفة بكمية الحمأة وهل هناك راسة لاستخدامها في الزراعة كسماد وهل تعتبر ملوثات اذا اخذت الى مكب النفايات

* د. عامر الحمود/USAID – هل سيتم مناقشة الحمأة وأين يتم وضعها مع الاستشاري حيث لا يمكن استخدامها كسماد بسبب الميثان المهجن

ج الكميات ليست ضخمة وتقدر بالأمتار وليس عشرات الأمتار ومعظم الحمأة هي رواسب طينية مع بعض الطحالب وبعض المخثرات ولا يتوقع ان يكون هناك وجود للميثان المهجن.

نفس الحماة سيكون هناك تجفيف ميكانيكي وطبيعي وسيتم استخدامهم حسب الحاجة

هناك قيمة اقتصادية للحمأة لانها مواد عضوية وهناك ممارسات للاستفادة منها في مشاريع سابقة

س * هل تم عمل دراسات جيولوجية وهيدرولوجية لموقع المشروع

ج نعم تم عمل هذه الدراسات وتقدر بـ 30% بسبب الموسم الزراعي وسيتم استكمالها في اثناء التنفيذ. وقد تم حساب كمية التصريف الناتج عن الامطار

س هل تم دراسة المنطقة من ناحية زلازل

ج الأردن مقسم إلى Zones وبالنسبة للاغوار هي اعلى من غيرها وتم اخذه في الاعتبار في التصميم الانشائي

ستكون ضمن المواصفات الاردنية ونحقق مواصفات المياه الاردنية للشرب

س هل سيتم دراسة Traffic Management أثناء التنفيذ

ج * سيتم دراسة تسهيل حركة المرور ضمن خطة الإدارة البيئية

س - تهتم وزارة البيئة بالاستدامة وليس فقط بعمل الدراسة البيئية مثل نوعية الأنابيب والاستمرار بفحص المياه قبل وصولها الى خزان زبدة

ج * الخط من مادة الـSteel وهو مشابه للخط القائم وعمره قد يصل الى 50 سنة ، اما المراقبة فهناك عدة جهات تراقب نوعية المياه

- المياه مراقبة من بداية النفق لمعرفة نوعية المياه في KAC وكلها مياه صالحة للشرب

س - هل سيتم تقسيم العطاء الى حزم وهل سيكون العمل في عدة اجزاء

ج * العطاء سيكون دولي وبرنامج عمل المقاول يمكن دراسته قبل التنفيذ

س - هل هناك خطة لحماية الخط

ج نعم هناك خطة والخط عمقه يكون حوالي 2.5م
* المسافة بين الخط الجديد وخط وادي العرب هي حوالي 4.0 م

س هل تؤثر الزيوت في المحطة على البيئة وكيفية التعامل معها
ج *كمية الزيوت بسيطة ومع ذلك سيتم ادخالها في الخطة البيئية

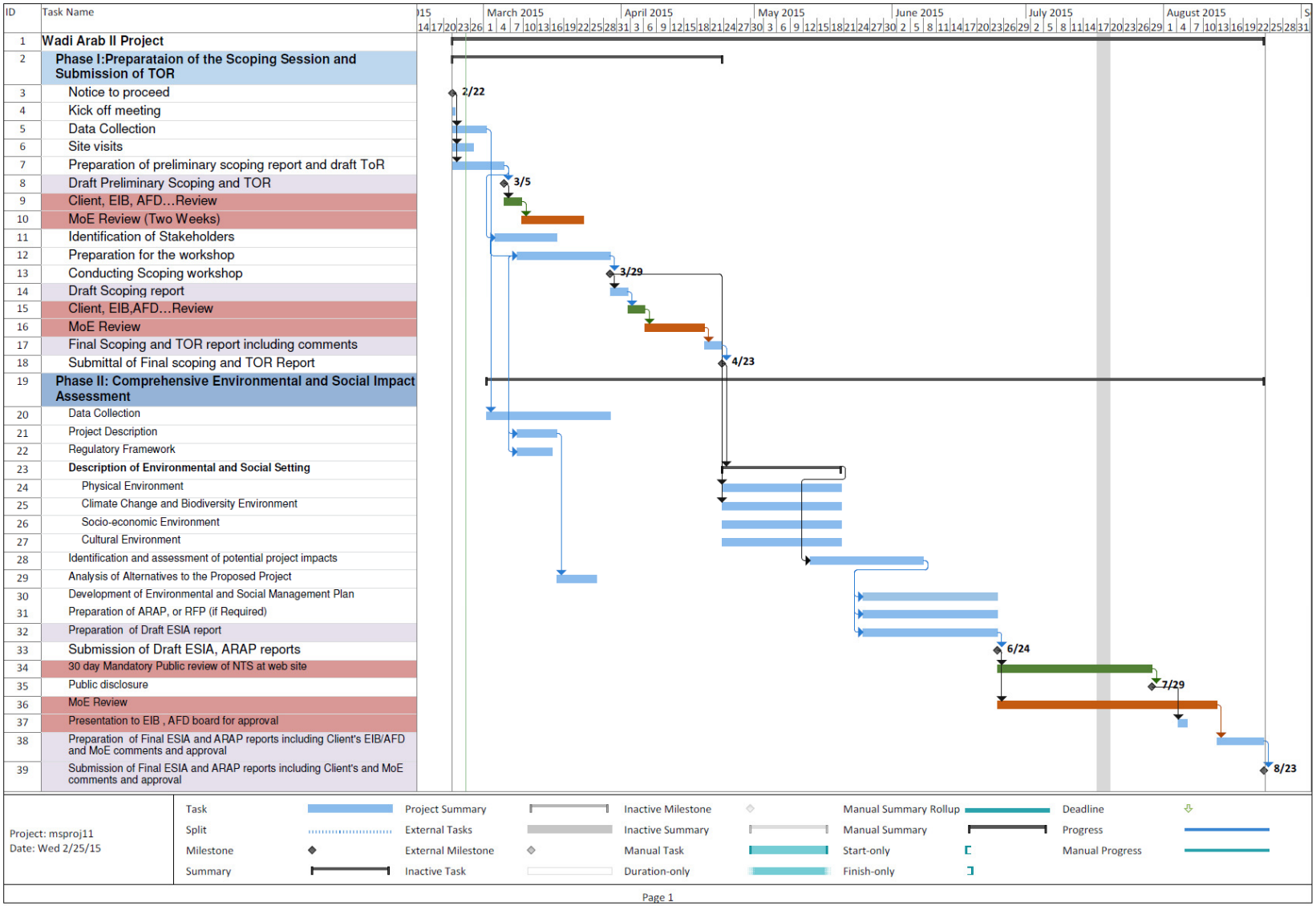
س - م. رامي الحاج/ هل تم الاتصال مع شركة الكهرباء لغرض تزويد الكمية اللازمة
ج * نعم تم الاتصال وسيتم تزويدنا بالكلفة قريباً \خطوط الكهرباء ستكون تحت الأرض وليست هوائية
*توصية بزرع أشجار حرجية لتنقية التلوث في الهواء

ختام الورشة والاتفاق على المخرجات

تم الاتفاق على دراسة المواضيع التالية:

- طرق تخزين مادة الكلورين والأمان اللازمة
- الضجيج خلال مرحلة الإنشاء
- الانبعاثات ونوعية الهواء في موقع محطة التنقية
- الصحة والسلامة العامة للسكان والعمال
- الحماة المجففة وطرق الاستفادة او التخلص منها
- الاستملاكات اللازمة للمشروع
- التأكد من توافق التصميم مع خطر الزلازل
- إجراءات تسهيل حركة السير خلال مرحلة البناء
- إجراءات التعامل مع أي موجودات أثرية خلال الحفر
- دراسة البيئة الحيوية
- وضع خطة مراقبة خلال التشغيل
- دراسة تنفيذ أعمال المشروع في الأودية وخطر السيول

APPENDIX 6: ESIA STUDY SCHEDULE


ID
Task Name
March 2015
April 2015
May 2015
June 2015
July 2015
August 2015
1 Wadi Arab II Project
2 Phase I:Preparataion of the Scoping Session and Submission of TOR
3 Notice to proceed
4 Kick off meeting
5 Data Collection
6 Site visits
7 Preparation of preliminary scoping report and draft ToR
8 Draft Preliminary Scoping and TOR
9 Client, EIB, AFD…Review
10 MoE Review (Two Weeks)
11 Identification of Stakeholders
12 Preparation for the workshop
13 Conducting Scoping workshop
14 Draft Scoping report
15 Client, EIB,AFD…Review
16 MoE Review
17 Final Scoping and TOR report including comments
18 Submittal of Final scoping and TOR Report
19 Phase II: Comprehensive Environmental and Social Impact Assessment
20 Data Collection
21 Project Description
22 Regulatory Framework
23 Description of Environmental and Social Setting
24 Physical Environment
25 Climate Change and Biodiversity Environment
26 Socio-economic Environment
27 Cultural Environment
28 Identification and assessment of potential project impacts
29 Analysis of Alternatives to the Proposed Project
30 Development of Environmental and Social Management Plan
31 Preparation of ARAP, or RFP (if Required)
32 Preparation of Draft ESIA report
33 Submission of Draft ESIA, ARAP reports
34 30 day Mandatory Public review of NTS at web site
35 Public disclosure
36 MoE Review
37 Presentation to EIB , AFD board for approval
38 Preparation of Final ESIA and ARAP reports including Client's EIB/AFD and MoE comments and approval
39 Submission of Final ESIA and ARAP reports including Client's and MoE comments and approval
2/22
3/5
3/29
4/23
6/24
7/29
8/23
Project: msproj11
Date: Wed 2/25/15
Task
Split
Milestone
Summary
Project Summary
External Tasks
External Milestone
Inactive Task
Inactive Milestone
Inactive Summary
Manual Task
Duration-only
Manual Summary Rollup
Manual Summary
Start-only
Finish-only
Deadline
Progress
Manual Progress
Page 1

APPENDIX 6: JORDAN RIVER FLOW AGREEMENT

Jordan Valley 17.8.15

H.E. Eng. Saad Abu-Hammour

Secretary Genera

Jordan Valley Authority

Jordan

Dear Eng. Abu-Hammour,

Further to our last meeting and conversations, here are the major steps taken by the Government of Israel and other public agencies in order to rehabilitate the Lower Jorden River:

a. A master plan – the Lower Jordan River Rehabilitation Authority is finalizing these days a comprehensive master plan for the river and the region along the international border with Jordan. The master plan was developed to a long list of projects which are now in different stages of budget allocation and implementation.
b. Removal of pollutants – the local authorities of the northern region of the Jordan Valley finalized the building and start operating of 2 large WWTP which covers almost all municipal waste in the region. They are in the last stages of building the collection systems.
c. Streaming of fresh water – In 2013 Israel Water Authority in view of the need to rehabilitate the Lower Jordan River decided to add to the river's stream around 9 MCM/Y of fresh water. By this decision it wishes to demonstrate actual steps are inevitable. The quantity is subject to a yearly decision and depends on the overall conditions in the Israeli water sector at a given time. Any further allocation in the coming years (up to 25 MCM/Y) depends on the availability of substitute quantities of present usage.

As agreed the rehabilitation activities are coordinated closely with the Jordanian JVA and issues connected to water are also dealt with by the JWC.

With best wishes

Ramon Benari

Director General, Lower Jordan River Rehabilitation Authority

APPENDIX 7: METEOROLOGICAL PARAMETER RECORDS (JUNE 12 – 14, 2015)

Table A-1: Hourly Average Records for Meteorological Parameters near The Proposed Project Site at Wadi Al-Arab, June 12 - 14, 2015

Time	WS (m/sec)	WD (°)	WD	Temp (°C)	RH (%)	Press (mBar)
12/06/2015 01:00	1.1	270.0	W	22.5	73	1033.7
12/06/2015 02:00	1.3	270.0	W	21.9	70	1033.9
12/06/2015 03:00	1.5	270.0	W	21.9	70	1034.2
12/06/2015 04:00	2.0	270.0	W	21.0	70	1034.6
12/06/2015 05:00	2.1	292.5	WNW	19.2	73	1034.9
12/06/2015 06:00	2.2	315.0	NW	20.3	71	1034.8
12/06/2015 07:00	2.7	315.0	NW	22.6	58	1034.4
12/06/2015 08:00	3.1	315.0	NW	23.9	51	1034.9
12/06/2015 09:00	3.1	315.0	NW	25.1	46	1034.4
12/06/2015 10:00	3.1	315.0	NW	25.5	44	1033.8
12/06/2015 11:00	2.7	315.0	NW	27.6	36	1033.2
12/06/2015 12:00	2.7	315.0	NW	27.7	36	1032.6
12/06/2015 13:00	3.1	315.0	NW	28.1	41	1032.1
12/06/2015 14:00	3.6	315.0	NW	28.4	41	1032.0
12/06/2015 15:00	3.6	315.0	NW	28.4	38	1031.9
12/06/2015 16:00	3.6	315.0	NW	29.0	48	1032.0
12/06/2015 17:00	2.7	292.5	WNW	29.9	56	1032.4
12/06/2015 18:00	2.2	292.5	WNW	29.2	63	1032.8
12/06/2015 19:00	1.3	292.5	WNW	29.3	45	1032.1
12/06/2015 20:00	0.9	270.0	W	27.0	56	1032.7
12/06/2015 21:00	0.4	292.5	WNW	25.7	61	1033.4
12/06/2015 22:00	0.4	247.5	WSW	24.9	63	1034.0
12/06/2015 23:00	0.4	270.0	W	24.4	65	1034.4
13/06/2015 00:00	0.4	292.5	WNW	23.6	69	1034.4
13/06/2015 01:00	0.9	360.0	N	22.8	71	1034.2
13/06/2015 02:00	1.4	360.0	N	22.7	73	1034.0
13/06/2015 03:00	1.1	360.0	N	22.7	74	1034.0
13/06/2015 04:00	0.9	360.0	N	22.3	76	1033.7
13/06/2015 05:00	0.6	360.0	N	21.8	78	1033.8
13/06/2015 06:00	0.8	360.0	N	21.5	79	1034.1
13/06/2015 07:00	1.2	360.0	N	23.6	73	1034.2
13/06/2015 08:00	1.4	360.0	N	26.4	63	1034.5
13/06/2015 09:00	2.4	292.5	WNW	29.0	53	1034.3
13/06/2015 10:00	3.3	112.5	ESE	30.4	49	1034.0
13/06/2015 11:00	3.9	112.5	ESE	32.4	42	1033.6
13/06/2015 12:00	4.2	270.0	W	33.6	36	1032.6
13/06/2015 13:00	4.5	315.0	NW	34.7	33	1031.8
13/06/2015 14:00	4.7	292.5	WNW	35.1	35	1031.1
13/06/2015 15:00	4.6	292.5	WNW	34.5	35	1031.0
13/06/2015 16:00	4.4	292.5	WNW	33.9	33	1031.0
13/06/2015 17:00	4.2	292.5	WNW	32.5	39	1031.0
13/06/2015 18:00	3.2	292.5	WNW	31.3	42	1031.0
13/06/2015 19:00	2.1	292.5	WNW	28.8	47	1031.3
13/06/2015 20:00	1.8	270.0	W	26.9	55	1031.9
13/06/2015 21:00	1.4	247.5	WSW	25.8	58	1032.5
13/06/2015 22:00	1.3	247.5	WSW	24.9	64	1032.9
13/06/2015 23:00	1.1	180.0	S	24.2	67	1033.2
14/06/2015 00:00	1.1	90.0	E	23.5	71	1033.2

Table A-1: Continued

Time	WS (m/sec)	WD (°)	WD	Temp (°C)	RH (%)	Press (mBar)
14/06/2015 01:00	1.2	90.0	E	23.3	71	1033.1
14/06/2015 02:00	1.0	90.0	E	23.1	72	1033.1
14/06/2015 03:00	0.9	90.0	E	22.9	74	1032.7
14/06/2015 04:00	0.8	90.0	E	22.8	74	1032.2
14/06/2015 05:00	0.7	90.0	E	22.5	75	1032.1
14/06/2015 06:00	1.3	90.0	E	22.3	75	1032.2
14/06/2015 07:00	1.5	90.0	E	24.3	70	1032.3
14/06/2015 08:00	1.7	90.0	E	26.8	62	1032.4
14/06/2015 09:00	2.4	247.5	WSW	28.9	54	1032.3
14/06/2015 10:00	3.2	315.0	NW	29.8	48	1032.1
14/06/2015 11:00	3.7	270.0	W	31.6	44	1031.7
14/06/2015 12:00	4.3	247.5	WSW	32.2	40	1031.4
14/06/2015 13:00	4.5	270.0	W	32.6	42	1031.1
14/06/2015 14:00	4.9	292.5	WNW	32.4	40	1030.7
14/06/2015 15:00	4.6	270.0	W	33.4	40	1030.2
14/06/2015 16:00	4.3	292.5	WNW	34.0	38	1029.7
14/06/2015 17:00	4.1	292.5	WNW	33.3	40	1029.4
14/06/2015 18:00	1.9	292.5	WNW	31.8	45	1029.6
14/06/2015 19:00	1.6	292.5	WNW	29.1	53	1030.0
14/06/2015 20:00	1.3	292.5	WNW	27.3	58	1030.5
14/06/2015 21:00	0.9	22.5	NNE	26.2	63	1031.2
14/06/2015 22:00	0.8	292.5	WNW	25.6	66	1031.8
14/06/2015 23:00	0.8	247.5	WSW	24.8	69	1031.8
15/06/2015 00:00	0.7	247.5	WSW	24.3	73	1031.6
Minimum	0.40	---	---	19.2	33	1029
Maximum	4.90	---	---	35.1	79	1035
Average	2.22	297	WNW	26.9	57	1033

APPENDIX 8: AIR QUALITY MEASUREMENTS RESULTS (JUNE 12 – 14, 2015)

Table A-2: Hourly Average Concentrations Of Air Pollutants Near The Proposed Project Site At Wadi Al-Arab, June 12 - 14, 2015

Date	SO_2 (ppb)	NOx (ppb)	NO (ppb)	NO_2 (ppb)	CO (ppm)	CO-8hr (ppm)	CO_2 (ppm)
12/06/2015 01:00	0.008	0.004	0.000	0.004	0.012	0.055	324.5
12/06/2015 02:00	0.009	0.006	0.001	0.006	0.062	0.054	347.3
12/06/2015 03:00	0.008	0.004	0.000	0.004	0.032	0.048	355.5
12/06/2015 04:00	0.008	0.004	0.001	0.003	0.010	0.038	358.3
12/06/2015 05:00	0.007	0.006	0.001	0.005	0.024	0.032	381.1
12/06/2015 06:00	0.007	0.008	0.001	0.008	0.115	0.039	380.2
12/06/2015 07:00	0.007	0.005	0.000	0.004	0.226	0.008	374.7
12/06/2015 08:00	0.007	0.004	0.001	0.003	0.012	0.008	372.9
12/06/2015 09:00	0.006	0.003	0.001	0.002	0.016	0.008	383.0
12/06/2015 10:00	0.005	0.002	0.000	0.002	0.119	0.007	365.6
12/06/2015 11:00	0.003	0.002	0.000	0.002	0.143	0.007	363.8
12/06/2015 12:00	0.006	0.005	0.002	0.004	0.215	0.006	365.6
12/06/2015 13:00	0.007	0.005	0.001	0.004	0.189	0.006	367.4
12/06/2015 14:00	0.006	0.006	0.002	0.004	0.173	0.006	370.2
12/06/2015 15:00	0.007	0.006	0.002	0.004	0.208	0.006	372.1
12/06/2015 16:00	0.004	0.016	0.005	0.011	0.294	0.006	365.6
12/06/2015 17:00	0.007	0.023	0.010	0.013	0.706	0.006	376.6
12/06/2015 18:00	0.005	0.006	0.002	0.004	0.468	0.006	390.6
12/06/2015 19:00	0.006	0.008	0.003	0.005	0.365	0.006	393.8
12/06/2015 20:00	0.008	0.011	0.003	0.008	0.305	0.007	383.9
12/06/2015 21:00	0.007	0.010	0.002	0.007	0.147	0.007	365.6
12/06/2015 22:00	0.007	0.008	0.002	0.006	0.159	0.007	338.2
12/06/2015 23:00	0.008	0.008	0.002	0.006	0.089	0.007	329.9
13/06/2015 00:00	0.006	0.007	0.002	0.005	0.104	0.007	334.5
13/06/2015 01:00	0.003	0.005	0.001	0.004	0.052	0.007	344.6
13/06/2015 02:00	0.002	0.002	0.000	0.002	0.077	0.006	329.0
13/06/2015 03:00	0.002	0.001	0.000	0.001	0.044	0.006	331.8
13/06/2015 04:00	0.002	0.001	0.000	0.001	0.075	0.005	334.5
13/06/2015 05:00	0.002	0.001	0.000	0.001	0.065	0.004	337.3
13/06/2015 06:00	0.003	0.005	0.001	0.005	0.102	0.004	340.6
13/06/2015 07:00	0.001	0.002	0.000	0.002	0.027	0.003	344.6
13/06/2015 08:00	0.001	0.003	0.000	0.002	0.041	0.002	347.3
13/06/2015 09:00	0.002	0.002	0.001	0.002	0.080	0.002	358.3
13/06/2015 10:00	0.002	0.003	0.001	0.002	0.085	0.002	365.6
13/06/2015 11:00	0.002	0.003	0.001	0.002	0.253	0.002	374.7
13/06/2015 12:00	0.009	0.007	0.002	0.004	0.305	0.003	366.5
13/06/2015 13:00	0.012	0.015	0.009	0.006	0.476	0.004	365.6
13/06/2015 14:00	0.010	0.009	0.005	0.004	0.334	0.005	370.2
13/06/2015 15:00	0.009	0.008	0.003	0.004	0.282	0.006	376.6
13/06/2015 16:00	0.008	0.006	0.003	0.003	0.138	0.007	357.4
13/06/2015 17:00	0.007	0.005	0.002	0.003	0.075	0.008	365.6
13/06/2015 18:00	0.008	0.006	0.002	0.004	0.058	0.008	385.7
13/06/2015 19:00	0.009	0.007	0.002	0.005	0.211	0.009	370.2
13/06/2015 20:00	0.010	0.010	0.003	0.007	0.343	0.009	383.9
13/06/2015 21:00	0.008	0.007	0.002	0.005	0.357	0.009	367.4
13/06/2015 22:00	0.007	0.006	0.001	0.005	0.253	0.009	344.6
13/06/2015 23:00	0.002	0.002	0.000	0.002	0.201	0.008	321.7
14/06/2015 00:00	0.002	0.002	0.000	0.002	0.169	0.007	321.7

Table A-2: Continued

Date	SO_2 (ppb)	NOx (ppb)	NO (ppb)	NO_2 (ppb)	CO (ppm)	CO-8hr (ppm)	CO_2 (ppm)
14/06/2015 01:00	0.002	0.001	0.000	0.001	0.090	0.006	319.9
14/06/2015 02:00	0.002	0.002	0.000	0.002	0.075	0.005	319.9
14/06/2015 03:00	0.002	0.001	0.000	0.001	0.103	0.005	320.8
14/06/2015 04:00	0.001	0.001	0.000	0.001	0.125	0.003	330.9
14/06/2015 05:00	0.001	0.001	0.000	0.001	0.080	0.002	329.8
14/06/2015 06:00	0.002	0.002	0.000	0.002	0.065	0.002	337.3
14/06/2015 07:00	0.003	0.005	0.001	0.004	0.079	0.002	337.3
14/06/2015 08:00	0.005	0.007	0.002	0.005	0.162	0.002	338.2
14/06/2015 09:00	0.003	0.005	0.001	0.004	0.238	0.002	364.7
14/06/2015 10:00	0.006	0.008	0.003	0.005	0.134	0.003	354.6
14/06/2015 11:00	0.005	0.006	0.002	0.004	0.077	0.003	329.4
14/06/2015 12:00	0.005	0.007	0.002	0.005	0.039	0.004	334.5
14/06/2015 13:00	0.006	0.008	0.002	0.005	0.126	0.005	338.2
14/06/2015 14:00	0.007	0.008	0.003	0.006	0.441	0.005	374.7
14/06/2015 15:00	0.006	0.007	0.002	0.005	0.355	0.006	364.7
14/06/2015 16:00	0.008	0.008	0.003	0.005	0.161	0.006	338.2
14/06/2015 17:00	0.007	0.007	0.002	0.004	0.077	0.007	340.3
14/06/2015 18:00	0.008	0.007	0.003	0.004	0.088	0.007	334.5
14/06/2015 19:00	0.006	0.006	0.002	0.004	0.134	0.007	340.9
14/06/2015 20:00	0.007	0.008	0.002	0.005	0.179	0.007	330.9
14/06/2015 21:00	0.004	0.006	0.001	0.005	0.213	0.007	324.5
14/06/2015 22:00	0.008	0.008	0.002	0.006	0.177	0.007	324.5
14/06/2015 23:00	0.005	0.005	0.001	0.004	0.093	0.007	329.2
15/06/2015 00:00	0.005	0.005	0.001	0.004	0.064	0.007	320.8
Minimum	0.001	0.001	0.000	0.001	0.010	0.002	319.9
Maximum	0.012	0.023	0.010	0.013	0.706	0.055	393.8
Average	0.006	0.006	0.002	0.004	0.162	0.009	352.0

Table A-3: Daily Average Concentrations Of Air Pollutants Near The Proposed Project Site At Wadi Al-Arab, June 12 - 14, 2015

Date	SO_2 (ppb)	NOx (ppb)	NO (ppb)	NO_2 (ppb)	CO (ppm)	CO-8hr (ppm)	CO_2 (ppm)
June 12, 2015	0.007	0.007	0.002	0.005	0.175	0.016	365.0
June 13, 2015	0.005	0.005	0.002	0.003	0.171	0.006	354.4
June 14, 2015	0.005	0.005	0.001	0.004	0.141	0.005	336.6
Minimum	0.005	0.005	0.001	0.003	0.141	0.005	336.6
Maximum	0.007	0.007	0.002	0.005	0.175	0.016	365.0
Average	0.006	0.006	0.002	0.004	0.162	0.009	352.0

APPENDIX 9: NOISE MEASUREMENT RESULTS (JUNE 12 – 14, 2015)

Day 1: 11.6.2015

Intake Pump Station			
6/11/2015			
22:09	63	18:05	62
22:10	62	18:06	69
22:11	64	18:07	63
22:12	66	18:08	70
22:13	77	18:09	69
22:14	62	18:10	63
22:15	62	18:11	66
22:16	62	18:12	66
22:17	62	18:13	72
22:18	62	18:14	71
22:19	63	18:15	68
22:20	61	18:16	68
22:21	64	18:17	72
22:22	61	18:18	69
22:23	62	18:19	67
MIN	**61**		**62**
MAX	**77**		**72**
AVE	**64**		**68**

Water Treatment Plant			
6/11/2015			
22:28	63	18:25	54
22:29	63	18:26	66
22:30	60	18:27	62
22:31	61	18:28	64
22:32	64	18:29	58
22:33	61	18:30	64
22:34	62	18:31	67
22:35	64	18:32	72
22:36	64	18:33	80
22:37	64	18:34	77
22:38	65	18:35	63
22:39	64	18:36	63
22:40	62	18:37	66
22:41	61	18:38	63
22:42	64	18:39	63
MIN	**60**		**54**
MAX	**65**		**80**
AVE	**63**		**65**

PS1			
6/11/2015			
22:52	42	17:05	55
22:53	42	17:06	53
22:54	42	17:07	49
22:55	49	17:08	49
22:56	43	17:09	62
22:57	42	17:10	53
22:58	54	17:11	55
22:59	43	17:12	61
23:00	43	17:13	59
23:01	44	17:14	59
23:02	43	17:15	57
23:03	43	17:16	52
23:04	42	17:17	50
23:05	42	17:18	55
23:06	44	17:19	50
MIN	**42**	**MIN**	**49**
MAX	**54**	**MAX**	**62**
AVE	**44**		**55**

Day 1: 11.6.2015 (Cont'd)

PS2			
6/11/2015			
23:15	46	17:30	55
23:16	45	17:31	73
23:17	45	17:32	62
23:18	45	17:33	58
23:19	54	17:34	58
23:20	58	17:35	58
23:21	61	17:36	60
23:22	49	17:37	57
23:23	55	17:38	57
23:24	68	17:39	57
23:25	67	17:40	55
23:26	53	17:41	73
23:27	68	17:42	68
23:28	67	17:43	68
23:29	53	17:44	68
MIN	**45**		**55**
MAX	**68**		**73**
AVE	**56**		**62**

PS3			
6/11/2015			
21:00	37	15:35	46
21:01	38	15:36	48
21:02	37	15:37	45
21:03	42	15:38	44
21:04	38	15:39	57
21:05	37	15:40	48
21:06	49	15:41	49
21:07	38	15:42	55
21:08	39	15:43	54
21:09	39	15:44	53
21:10	38	15:45	52
21:11	37	15:46	48
21:12	38	15:47	45
21:13	37	15:48	50
21:14	39	15:49	44
MIN	**37**		**44**
MAX	**49**		**57**
AVE	**39**		**49**

Day 2: 12.6.2015

Intake Pump Station			
6/12/2015			
10:05	68	21:06	78
10:06	66	21:07	74
10:07	64	21:08	54
10:08	68	21:09	71
10:09	68	21:10	79
10:10	72	21:11	77
10:11	70	21:12	53
10:12	62	21:13	62
10:13	70	21:14	52
10:14	64	21:15	62
10:15	67	21:16	67
10:16	60	21:17	70
10:17	62	21:18	50
10:18	64	21:19	69
10:19	65	21:20	60
MIN	**60**		**50**
MAX	**72**		**79**
AVE	**66**		**65**

Water Treatment Plant			
6/12/2015			
10:27	65	21:37	59
10:28	79	21:38	61
10:29	73	21:39	60
10:30	51	21:40	72
10:31	72	21:41	82
10:32	76	21:42	63
10:33	72	21:43	55
10:34	52	21:44	61
10:35	52	21:45	57
10:36	63	21:46	53
10:37	60	21:47	59
10:38	59	21:48	68
10:39	57	21:49	60
10:40	59	21:50	60
10:41	63	21:51	58
MIN	**51**		**53**
MAX	**79**		**82**
AVE	**64**		**62**

PS1			
6/12/2015			
11:21	51	20:47	70
11:22	67	20:48	69
11:23	57	20:49	68
11:24	37	20:50	68
11:25	42	20:51	70
11:26	49	20:52	68
11:27	50	20:53	69
11:28	51	20:54	54
11:29	52	20:55	55
11:30	56	20:56	47
11:31	75	20:57	39
11:32	54	20:58	43
11:33	55	20:59	38
11:34	48	21:00	37
11:35	50	21:01	37
MIN	**37**	**MIN**	**37**
MAX	**75**	**MAX**	**70**
AVE	**53**		**55**

Day 2: 12.6.2015 (Cont'd)

PS2			
6/12/2015			
11:45	34	20:05	75
11:46	38	20:06	75
11:47	35	20:07	69
11:48	33	20:08	67
11:49	34	20:09	69
11:50	31	20:10	76
11:51	35	20:11	76
11:52	32	20:12	73
11:53	32	20:13	67
11:54	48	20:14	57
11:55	35	20:15	50
11:56	35	20:16	55
11:57	34	20:17	52
11:58	38	20:18	53
11:59	37	20:19	57
MIN	**31**		**50**
MAX	**48**		**76**
AVE	**35**		**65**

PS3			
6/12/2015			
22:15	34	9:12	65
22:16	37	9:13	70
22:17	35	9:14	64
22:18	33	9:15	63
22:19	35	9:16	64
22:20	32	9:17	71
22:21	35	9:18	70
22:22	32	9:19	68
22:23	31	9:20	67
22:24	48	9:21	53
22:25	35	9:22	45
22:26	37	9:23	49
22:27	34	9:24	47
22:28	38	9:25	49
22:29	38	9:26	52
MIN	**31**		**45**
MAX	**48**		**71**
AVE	**36**		**60**

Day3: 14.6.2015

Intake Pump Station			
6/14/2015			
13:05	65	21:28	65
13:06	57	21:29	66
13:07	56	21:30	63
13:08	58	21:31	59
13:09	51	21:32	62
13:10	54	21:33	60
13:11	70	21:34	56
13:12	75	21:35	59
13:13	78	21:36	58
13:14	72	21:37	62
13:15	76	21:38	57
13:16	54	21:39	54
13:17	73	21:40	57
13:18	53	21:41	51
13:19	51	21:42	55
MIN	**51**		**51**
MAX	**78**		**66**
AVE	**63**		**59**

Water Treatment Plant			
6/14/2015			
13:33	68	21:58	73
13:34	53	21:59	66
13:35	67	22:00	57
13:36	67	22:01	65
13:37	67	22:02	50
13:38	68	22:03	58
13:39	73	22:04	51
13:40	73	22:05	62
13:41	68	22:06	60
13:42	62	22:07	60
13:43	38	22:08	59
13:44	41	22:09	61
13:45	34	22:10	60
13:46	36	22:11	58
13:47	34	22:12	59
MIN	**34**		**50**
MAX	**73**		**73**
AVE	**57**		**60**

PS1			
6/14/2015			
12:30	48	20:36	57
12:31	60	20:37	55
12:32	51	20:38	61
12:33	46	20:39	54
12:34	47	20:40	57
12:35	51	20:41	60
12:36	44	20:42	57
12:37	44	20:43	54
12:38	43	20:44	66
12:39	67	20:45	64
12:40	71	20:46	54
12:41	53	20:47	73
12:42	53	20:48	65
12:43	61	20:49	71
12:44	58	20:50	64
MIN	**43**	**MIN**	**54**
MAX	**71**	**MAX**	**73**
AVE	**53**		**61**

Day3: 14.6.2015 (Cont'd)

PS2			
6/14/2015			
11:58	64	20:15	57
11:59	59	20:16	66
12:00	58	20:17	65
12:01	41	20:18	69
12:02	60	20:19	62
12:03	66	20:20	62
12:04	69	20:21	57
12:05	51	20:22	65
12:06	54	20:23	56
12:07	55	20:24	66
12:08	54	20:25	62
12:09	60	20:26	65
12:10	63	20:27	62
12:11	64	20:28	61
12:12	66	20:29	74
MIN	**41**		**56**
MAX	**69**		**74**
AVE	**59**		**63**

PS3			
6/14/2015			
11:58	64	22:30	51
11:59	59	22:31	60
12:00	58	22:32	59
12:01	41	22:33	64
12:02	60	22:34	56
12:03	66	22:35	57
12:04	69	22:36	53
12:05	51	22:37	60
12:06	54	22:38	51
12:07	55	22:39	59
12:08	54	22:40	57
12:09	60	22:41	59
12:10	63	22:42	57
12:11	64	22:43	54
12:12	66	22:44	69
MIN	**41**		**51**
MAX	**69**		**69**
AVE	**59**		**58**

VOLUME 2 - APPENDIX 10: ARAP REPORT

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