THE HASHEMITE KINGDOM OF JORDAN
MINISTRY OF WATER AND IRRIGATION (MWI)
WATER AUTHORITY OF JORDAN (WAJ)

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR THE IMPROVEMENT AND EXPANSION OF WATER DISTRIBUTION NETWORK IN BALQA
IN
THE HASHEMITE KINGDOM OF JORDAN

MARCH 2014

JAPAN INTERNATIONAL COOPERATION AGENCY

TEC INTERNATIONAL CO., LTD.

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to TEC International Co., Ltd.

The survey team held a series of discussions with the officials concerned of the Government of the Hashemite Kingdom of Jordan, and conducted field investigations. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Hashemite Kingdom of Jordan for their close cooperation extended to the survey team.

March, 2014

Masami Fuwa
Director General,
Global Environment Department
Japan International Cooperation Agency

SUMMARY

1. Overview of the Country

The Hashemite Kingdom of Jordan (hereinafter referred to as “Jordan”) has a population of 6.32 million people (as of 2012) and land area of 89,316 km^2. It is surrounded by West Bank, Palestinian Interim Self-Government Authority and Israel in the west, Syria in the north, Iraq in the east, and Saudi Arabia in the southeast. Western area of the Kingdom has a narrow valley, known as Jordan Valley, which spreads from Jordan River through the Dead Sea (which is 400m below sea level) and to the Gulf of Aqaba in the Red Sea. The east side of Jordan Valley is a plateau area of 600 ~ 1,500 m above sea level, and on the east of the plateau area is a desert area which covers around 75 % of the national land. Most of the rainfall occurs during winter. The amount rainfall varies, reaching an average of up to around 660 mm in the northeast plateau and only around 120 mm in the desert area.

The per capita Gross National Income (GNI) of Jordan is 4,670 US dollars in 2012, and the tertiary industries including tourism has the highest share of GDP accounting for 68.8 %, followed by secondary industries accounting for 30.1 %, and primary industries accounting for 3.1 % (as of year 2008). Currently the economic growth is stagnant (2.7 % as of year 2012) under the influence of the global financial crisis of 2008. In addition, economy of Jordan has the structural problems such as income disparities between urban and rural areas, high poverty ratio, high unemployment rate, and chronic financial deficit, and is influenced by the foreign financial support, security situations within the country, and capital inflow from the abroad.

Jordan has the high population growth rate, 2.2 % in 2012. The population of 2012 is 6.32 million and is increased seven times more compared with the population (0.89 million) of 1961 due to the increase of refugees from Palestine and Iraq. Two third of the population is Palestinian and 1.98 million is the registered Palestinian refugees (as of year 2012). In recent years, inflow of refugees from the neighboring countries is increasing, especially by the civil war of Syria. The total inflow of about 0.58 million refugees from Syria at the end of February in 2012 are estimated by Office of the United Nations High Commissioner for Refugees; about 0.1 million in the largest refugee camps and the rest in the Jordan community. The water demand is rapidly increasing by those situations.

The project area is Ain Al Basha and Deir Alla of Balqa Governorate located in the north-west of Jordan. Ain Al Basha is closely located to the capital city Amman, its elevation is ranging from 500 m to 900 m. Deir Alla is located in the bottom of Jordan Valley and its elevation is ranging from -30 to -350 m. The urban area is developed along the main road which runs parallel to Jordan River. The east side of main road is skirts of the mountain and the west side is agricultural area with the fertile land by the flood of Jordan River.

Balqa Governorate is located in the area of semi-arid or the Mediterranean climate, with the precipitation of 300 mm-600 mm. The rainy season is winter and dry season is from June to September. The average temperature of Ain Al Basha is around 17°C, maximum is round 25°C in August, minimum around 5°C in January, and the precipitation is around 500 mm per annum. The average temperature of Deir Alla is 23.5°C, the maximum is 38.6°C in July, minimum is 10.6°C in January, and the precipitation is 280 mm per annum.

The refugee camp is located in Al Baqa'a in Ain Al Basha. The population of the camp is about 100,000 (UNRWA) in 2012, out of which 77,000 resides in Al Baqa'a area (DOS estimation). More than half of the population of Ain Al Basha resides in a small area. The population density of Al Baqa'a district is high and the living environment is not developed so that the improvement of living environment of this district is the urgent problem. The poverty level of Deir Alla is high in Jordan. This district is important agricultural area with large fertile land between Jordan River and the mountains. The population is 57 thousand.

2. Background of the Project

Jordan belongs to the desert area, 75 % of the land has the precipitation less than 200 mm and the average water resource per capita is extremely low, 145 m^3 comparing with the world average 8,000 m^3. The scarce of water resource is the serious problem in Jordan. The water supply hour is 50 hours per week in Amman, 24-30 hours in Jordan Valley and less than 10 hours in some small villages.

Water Authority of Jordan (WAJ) enhances the establishment of water authority to improve the sustainability of water supply business and the water companies were established in the governorates of Amman, Madaba, four northern Governorates and Aqaba. In other governorates WAJ is trying to improve the operation of water supply by the rehabilitation of old facilities with the financial supports from foreign donors. However, the support to Balqa Governorate is limited, especially for Deir Alla and Ain Al Basha. In those area, the rehabilitation of transmission and distribution main system is not implemented for 25 years so that high NRW ratio (more than 50 %), excess electricity consumption due to the improper water distribution by pumps, and water quality deterioration by the worn-out and corrode pipelines are the serious problems.

In addition to the circumstances such as scarce water resource and necessity of improvement of aged water supply facilities and operation, the necessity to expand the water supply facilities due to the population increase by the explosion of refugees from Syria (0.6 million as of August 2013) is increasing. In Balqa Governorate, the refugees are influx from the border and urban area where the prices of land and commodity are escalating. Especially in the Deir Alla, more refugee influx is expected because of the poverty area. As the Palestinian refugees who lived in Syria are moving into

the Palestinian refugee camp in the Jordan, the population of Ain Al Basha where the largest Palestinian refugee camp is located is increasing and the immediate action to improve the living environment is required.

Under such circumstances, the Government of Jordan had requested for grant aid project to Government of Japan in August 2009, for the purpose of improving the water supply service in Balqa Governorate by construction of new reservoirs and rehabilitation of old distribution networks. The components of the project requested are shown below. In response to this request, a preparatory survey was implemented.

Components of the Project requested by the Jordan side

Component	Deir Alla district	Ain Al Basha district
1. Construction of new reservoirs	2 nos. [New Ma'adi High reservoir] Q=2,500 m^3, 1 No. [New Rajeb Upper Tank] Q=6,000 m^3, 1 No	5 nos. [Baqaa] Q=8,000 m^3, 1 No. [Safout] Q=2,000 m^3, 1 No [New Eskandanavian] Q=2,000 m^3, 1 No. [New Abu Nussair 1] Q=1,000 m^3, 1 No [New Abu Nussair 2] Q=1,000 m^3, 1 No.
2. Rehabilitation of booster pumping station	[Ma'adi Pumping Station] Boosting pump Q=200m^3/hr, Head=140m, 2 nos. [New Rajeb Pumping Station] Boosting pumps Q=500m^3/hr, Head=52m, 2 nos.	None
3. Rehabilitation of transmission and distribution pipeline	Ductile pipes, L=24.6km Dia.150mm×7,000m Dia.200mm×13,000m Dia.250mm×2,800m Dia.300mm×1,300m Dia.400mm×500m	Ductile pipes, L=27.2km Dia.100mm×3,500m Dia.150mm×2,700m Dia.200mm×7,000m Dia.400mm×2,500m
4. Soft Component	The request includes technical assistance on strengthening of WAJ's staff in distribution management including non-revenue water countermeasure.	

3. Overall Goal

Jordan established the "National Agenda 2006-2015" as a comprehensive national strategy, which presents the issues and measures that Jordan must address. Here, issues in the water-related field are pointed out, such as insufficient renewable water resource, depletion of groundwater, inefficient water distribution, inappropriate water charge, and insufficient sewage treatment capacity. "Streamlining of operation, maintenance, and management, and reduction of non-revenue water" was put forward as one of the measures. In addition, the Government of Jordan set up the following main objectives in the "Water for Life: Jordan's Water Strategy, 2008-2022".

1) Provision of adequate, safe and secure drinking water supply;
2) Promoting greater understanding and more effective management of groundwater and surface water;
3) Healthy aquatic ecosystems;

4) Sustainable use of water resources;
5) Fair, affordable and cost-reflective water charges; and
6) Timely adaptation to increased population growth and economic development across the water sector and water users.

4. Current Situation and Problems of the Sector

In the Project area, the water is supplied from the surface water treatment plant, desalinated water and wells through reservoirs by the gravity flow and pumping system, but due to high non-revenue (NRW) ratio and insufficient supply capacity, the water supply hour is limited and the estimated amount of accounted-for water per capita is low (51 liters in Ain Al Basha, 71 liters in Deir Alla). NRW ratio is around 60 % in 2012; rather high ratio compared with the average of 40 % in the country and it is caused by the aged pipelines, leakage due to high pressure, meter inaccuracy, and illegal connection.

The Project area is the undulating landscape and the difference of water supply pressure is very large but pressure reducing facilities are not installed or distribution zones are not clearly delineated to maintain the proper water pressure in the supply area. As a result, the area with low elevation is high pressure and the high elevation area is low pressure, and it causes the leakage and poor water flow. In addition, due to insufficient reservoirs and old pumps with improper capacity, the adequate amount of water cannot be supplied to the residents and supply days are 1 to 3 days per week which influence the life of the residents.

5. Outline of the Study Results and Project Contents

JICA dispatched TEC International Co., Ltd. to the site from February to June in 2013. The Survey Team made a series of discussions with the relevant governmental officials in Jordan and carried out a field survey. The survey results are outlined as below.

(1) Purpose of the Project

Under the overall goal, this project aims at upgrading water supply service by control of water pressure, extension of water service time, improvement of water quality, reduction of non-revenue water and optimization of electricity consumption through improvement of transmission and distribution network. Furthermore, through this improvement, the project aims at improving the shortage of water due to Syrian refugees flowing into the northern Jordan.

(2) Target Areas

It is ideal to maintain all required water transmission and distribution main facilities in both areas as the project components in order to improve the water supply system in total. However, the

components of the project need to be narrowed down based on the project budget. The original components are construction of distribution reservoir, laying transmission pipelines up to distribution reservoirs, and laying distribution mains from distribution reservoirs. However, components with higher benefits, that is, with high contributory effects to project targets will be selected as criteria for selecting the components or facilities.

(3) Design Policy

The project is planned to construct transmission and distribution pipeline, reservoirs and pumping stations in Ain Al Basha and Deir Alla to improve the high NRW ratio, inadequate water supply and inequitable water supply, and conduct soft-components activities for effective operation and management of distribution management. This project is planned based upon the following policies.

① The planned areas for facility construction in the project target are Abu Nussair 1 Distribution Zone (DZ), Abu Nussair 2 DZ, Al Baqa'a DZ in Ain Al Basha area and Ma'adi Distribution Zone in Deir Alla area. The target area was determined based upon the served population, saving effects of electricity consumption and so on.

② Target year of the project is set at 2020.

③ The stepwise construction is applied to the construction of reservoirs but it is not applicable to the future construction of pumping stations and distribution pipeline. Thus the target year of construction for pumping stations and distribution pipeline is set at 2025.

④ Based upon population projection by the national statistical department in Jordan and past censuses, the served population in the project area; Al Baqa'a and Ain Al Basha, and the population in the facility construction areas is assumed to be 261,600 persons and 167,100 persons respectively.

⑤ Planned average daily water consumption per capita is taken as 100 L for urban areas and 80L for rural areas. Planned non-revenue water ratio and leakage ratio of the project is 40 % and 20 % respectively.

⑥ The design policies for the facilities are follows:

a. Water transmission system and water distribution system shall be separated, and appropriate water distribution zone shall be set for effective NRW management and water distribution management.

b. Reservoirs shall be constructed, and water supply method shall be changed from pumping system to gravity flow method from reservoir.

c. With regard to Ain Al Basha, water is supplied with residual pressure from the transmission pipeline between Zai water treatment plant and Dabouq reservoir. Since water flow in the transmission pipeline to Amman is not able to be stopped, technology of non-suspension of water will be adopted to branch off from the Zai - Dabouq transmission pipeline.

d. Reservoirs shall be built at a location where environmental and social impacts are the least, and is hydrologically adequate. In addition, a spread foundation is adopted since the planned construction site has sufficient soil bearing capacity

e. Pumping station and water transmission pipes shall be developed for the separation of distribution system from transmission system, construction of reservoirs, and change of water distribution method.

f. The existing distribution pipeline system is utilized for water supply, thus distribution mains between proposed reservoirs and the existing distribution pipeline is planned to be constructed and upgraded.

g. Pressure reducing valves shall be installed to the water distribution network in order to maintain water distribution pressure in an appropriate range.

h. Flow meters and pressure gauges shall be installed to the reservoirs, pumping station, and water distribution zones, in order to manage the distribution volume of each distribution zone.

i. It is planned that demolishing the existing pumping station can contribute to reduction of power consumption and CO_2.

j. Since it is not allowed to use the open cut method for the work of laying pipelines of main trunk roads under the jurisdiction of Ministry of Public Works and Housing, the trenchless method is applied

⑦ Since the capacity of the WAJ Balqa staff for water distribution management is insufficient, it is planned for capacity building regarding management and utilization of the data of water distributed amount and non-revenue water through soft-components.

Based upon the above design policies, the outline of the target facilities of the project is shown as below.

The project is planned to implement the detailed design and bidding for approximately 8 months and the construction works for approximately 19.5 months. The estimated project costs of the Jordan portion are JPY32.5 million.

Target Facility of the Project

District	Items		Unit	Quantity
Ain Al Basha	Pipeline	100mm DI	m	350
		150mm DI	m	5,740
		200mm DI	m	4,700
		250mm DI	m	540
		300mm DI	m	8,750
		Sub-total	m	20,080
	Reservoir	Abu Nussair 1	m^3	900
		Abu Nussair 2	m^3	1,100
		Sub-total	m^3	2,000
	Pressure reducing valve		location	5
	Flow meter		location	7
Deir Alla	Pipeline	150mm DI	m	1,090
		250mm DI	m	4,450
		300mm DI	m	9,620
		Sub-total	m	15,160
	Reservoir	Ma'adi	m^3	3,300
	Pumping station	Ma'adi	location	1
	Pressure reducing valve		location	6
	Flow meter		location	11
Total	Pipeline	100mm DI	m	350
		150mm DI	m	6,830
		200mm DI	m	4,700
		250mm DI	m	4,990
		300mm DI	m	18,370
		Total	m	35,240
	Reservoir		location	3
	Pumping station		location	1
	Pressure reducing valve		location	11
	Flow meter		location	18

Note: DI (Ductile iron pipe), DMA (District metered area)

6. Project Evaluation

(1) Relevance

1) Beneficiaries and population

The water service for the approximately167,000 residents in 2020 of the project area in Baqa'a which is one of the less developed governorates of Jordan shall be improved by implementing the project. The benefits of water service will be expected also for the residents living both in Palestinian refugee camp and other refugee camps in Baqa'a having the influx from Syria.

2) Project objective and BHN

The water supply time of the project area is 1~3 days/week, and the average daily revenue water per capita is only 51L for Ain Al Basha and 71L for Deir Alla, therefore the residents are forced to have inconvenient lives. The implementation of the project can lead to appropriate water supply pressure, reduce the leakage ratio, resulting in increase of water consumption, or enable water supply to more

population in the future from the same water resource volume. Additionally, water supply time will be increased. The project enables to upgrade the water supply service to a certain level required for minimum standard of life and can contribute to satisfy the basic human needs (BHN).

3) Improvement of residents' lives and stabilization of standard of life

The project contributes to improving the residents' lives through improvement of water supply service and decreasing of the frequency of purchasing expensive water from water venders. The project area includes refugee camp and thus the project contributes to improvement of the welfare and the stabilization of people's livelihood in the camp.

4) Improvement of financial situation

The project enables to contribute to reduction of NRW, increase of water supply amount and of efficiency of pump operation and to supply water by using residual pressure from Zai water treatment plant. Thus increase of revenue and reduction of electricity costs are expected to improve financial situation of WAJ Baqa'a office.

5) Facilities that are easily operated and maintained

By setting up of water distribution zones, and restructuring the trunk transmission and distribution system, water supply facilities that can easily be operated and maintained will be developed. As a result, amount of work for operation and maintenance, and thus reduction of related costs are expected. Additionally, the reduced work will be utilized for implementing the activities for planned NRW management.

6) Contribution to mid-to-long term development plan

In the policy of the mid-to-long term plan of Jordan, the "National Water Strategy", the limited water resource shall be effectively used as much as possible. This project contributes to achieving the objective of the mid-to-long term plan through reducing leakages and NRW.

7) Utilization of prominent Japanese technology and products

For the project, prominent Japanese products of ductile cast iron pipe (DCIP), pressure reducing valve (PRV), and pumps, etc. and prominent Japanese technology for pipe connection method of under-pressure connection / branching works and trenchless construction method are applicable.

8) Contribution to measures for environment and climate change

The project enables to reduce leakage, use efficient pump operation, and use residual pressure, which will contribute to reducing the power consumption, resulting in reducing CO_2. Japan is addressing assistance for projects that settle the environmental and climate change issues including global warming, thus, the project matches the aid policy of Japan.

(2) Effectiveness

1) Quantitative Outcomes

Implementation of this project is expected to yield the quantitative outcome as shown in the table below, in which the conditions of the base year in 2012 and the outcomes are estimated in 2020 by area.

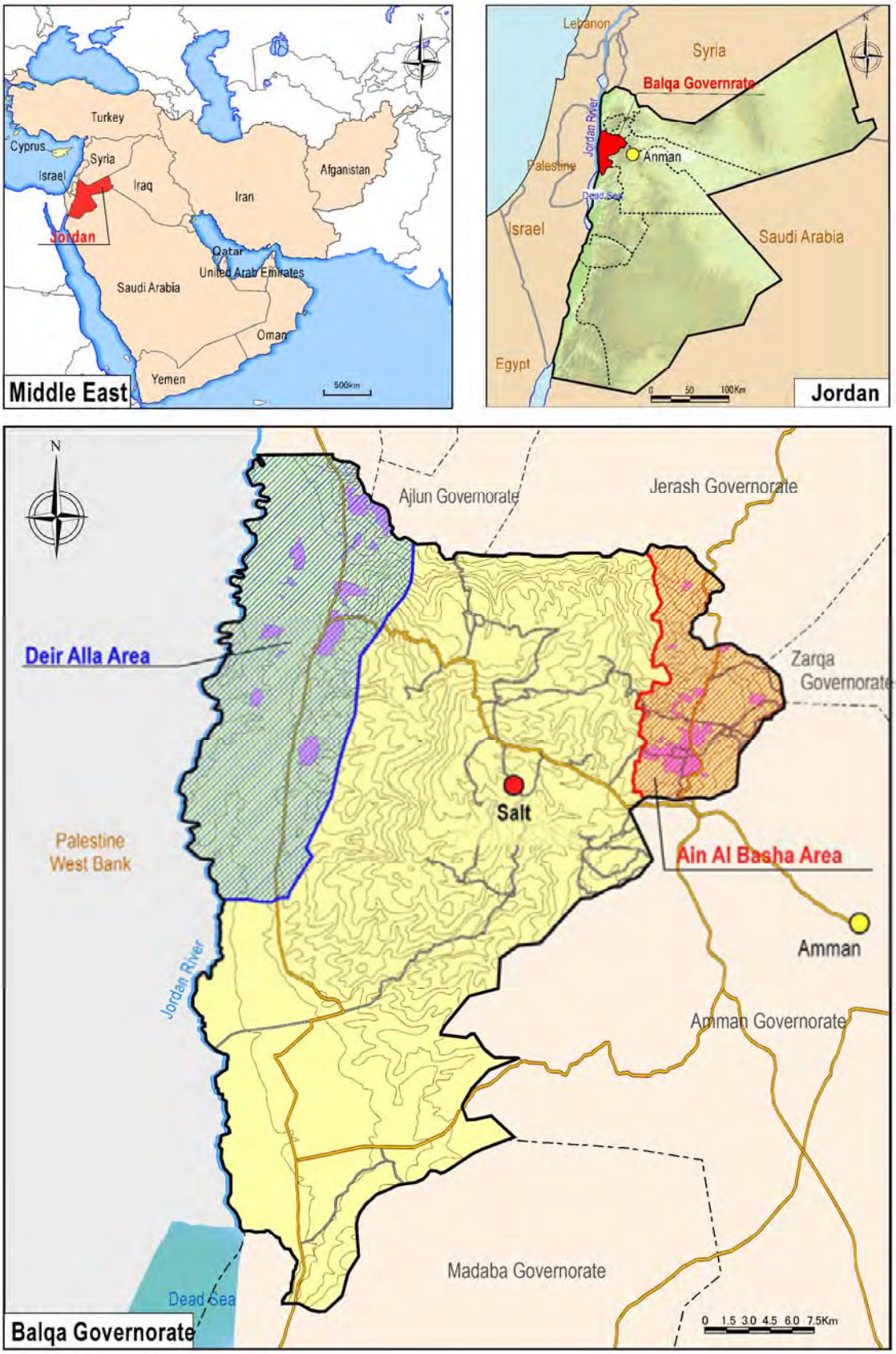
Expected quantitative outcomes of the project

Indicators	Unit	Current values in 2012		Target values in 2020	
		Deir Alla	Ain Al Basha	Deir Alla	Ain Al Basha
Supply pressure	MPa	0.01 - 3.0	0.01 - 2.0	0.1 – 0.7	0.1 - 0.7
Daily average water supply amount	m^3/day	8,900	20,000	9,100	27,200
Electricity consumption per m^3	kWh/m^3	0.688	0.458	0.611	0.239

2) Qualitative Outcomes

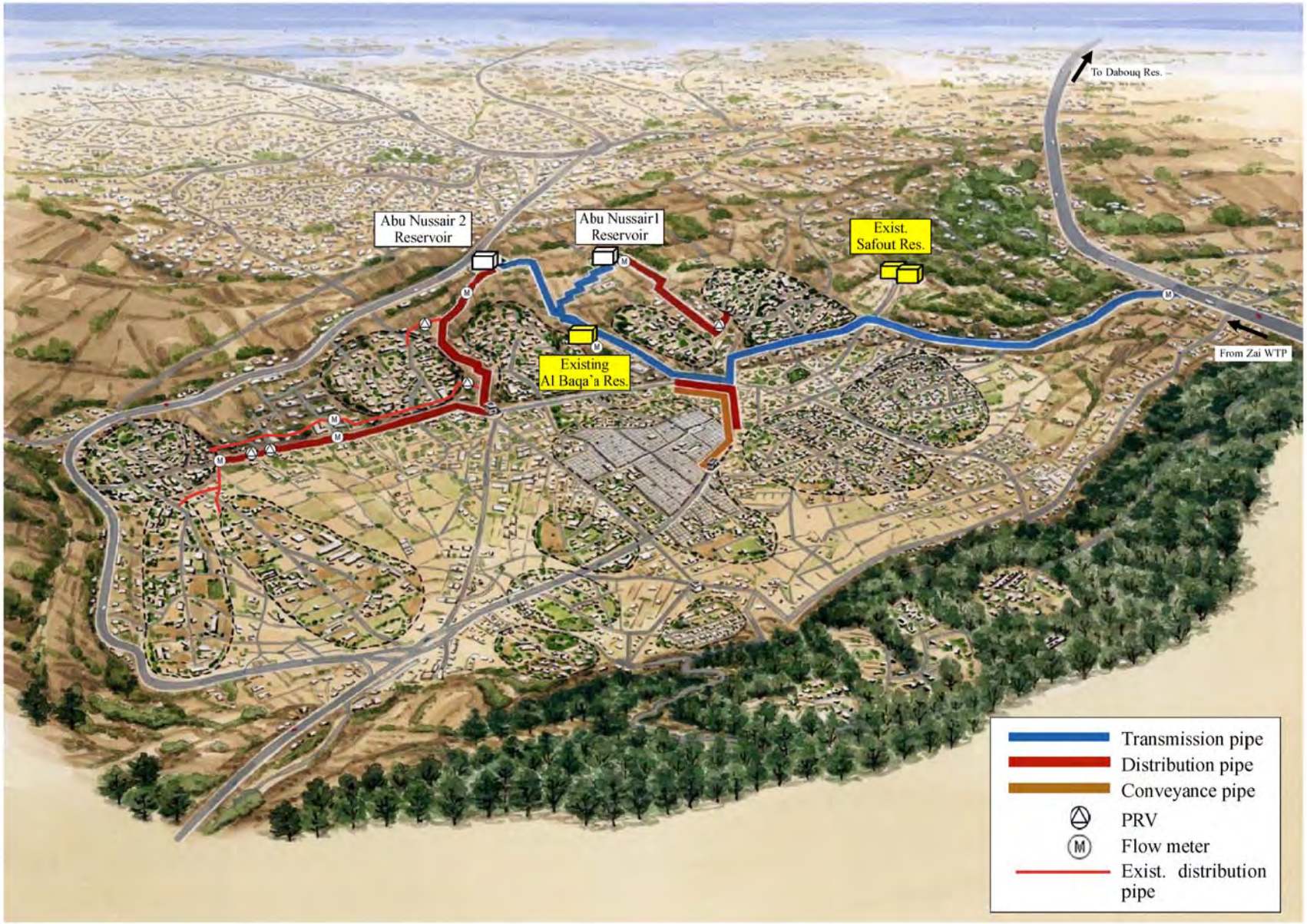
a. The living environment of the residents is improved because of improvement in water supply conditions through reduction of non-revenue water (NRW), improvement in water quality, and reduction of insufficient water pressure areas.
b. The project enables WAJ to carry out efficient water distribution management.

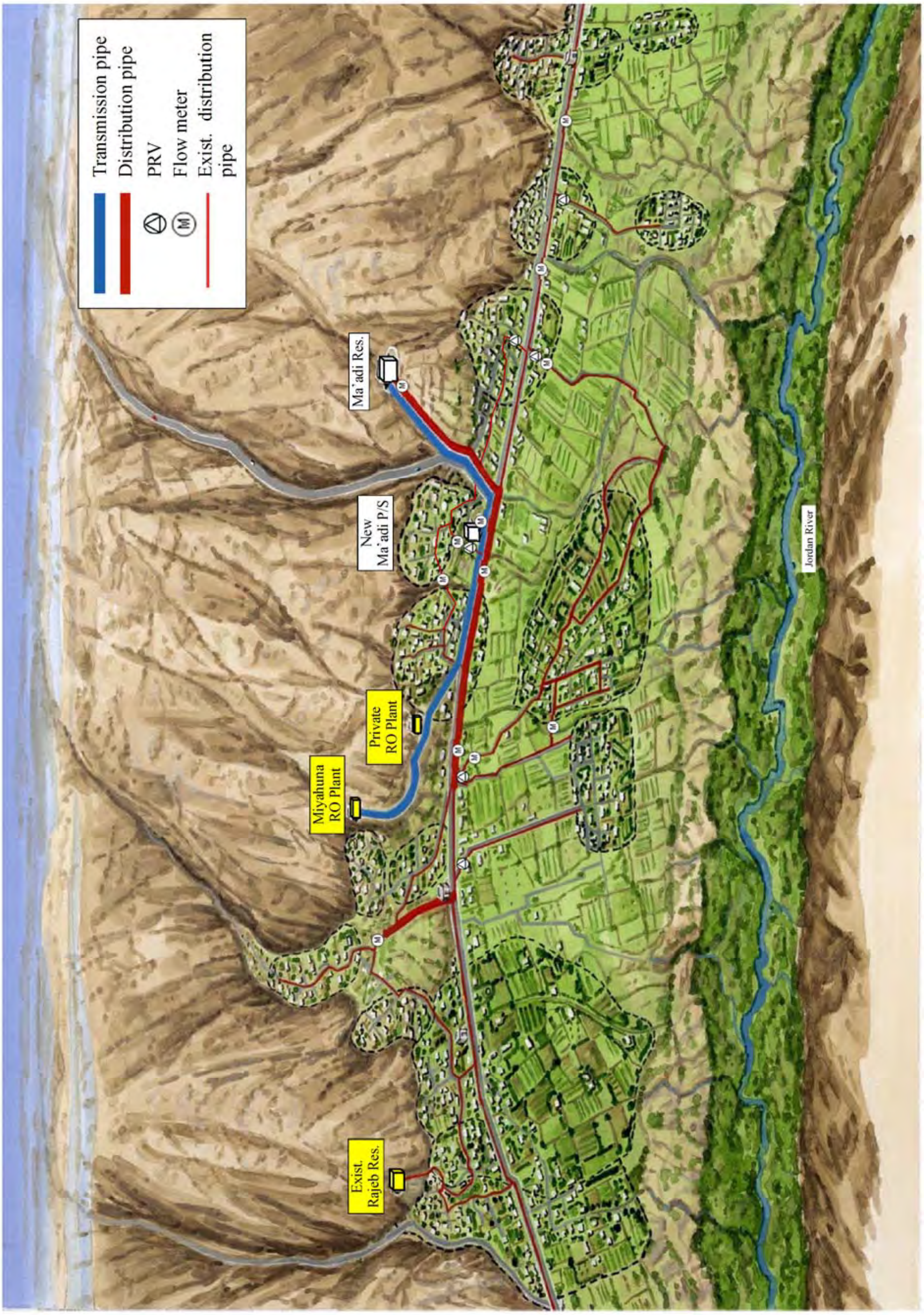
The project eventually contributes to satisfy the BHN of residential people and stabilize people's livelihood in Jordan. Also this project matches the assistance policy for Syrian refugee and the aid policy of Japan, thereby it can be said that the relevance is high. Increase of water supply time and amount by optimization of water supply pressure are expected to be the effects of the project implementation. Therefore, considering the above, it can be expected that the relevance and the effectiveness of the project is high.



LOCATION MAP

PERSPECTIVE-1





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Abbreviations

AWC	Aquba Water Company
DI	Ductile Iron Pipe
DMA	District Metered Area
DOS	Department of Statistics
DZ	Distribution Zone
E/N	Exchange of Notes
EIA	Environmental Impact Assessment
EIB	Europe Investment Bank
EPA	Environment Protection Agency (US)
EU	European Union
GIS	Geographic Information System
GPRS	General Packet Radio Service
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HDPE	High Density Polyethylene Pipe
JD / JOD	Jordan Dinar
KfW	Kreditanstalt für Wiederaufbau
M/D	Minutes of Discussions
MPa	1 bar = 0.1 MPa
MWI	Ministry of Water and Irrigation
PDM	Project Design Matrix
PRV	Pressure Reducing Valve
RC	Reinforced Concrete
USAID	United State Agency for International Development
WAJ	Water Authority of Jordan
Lpcd	Liter per capita per day
MOPH	Ministry of Public Works and Housing
MCM	Million cubic meter
MWI	Ministry of Water and Irrigation
OMS	Operation Management Support, WAJ, GIZ
RO	Reverse Osmosis Membrane
UNRWA	United Nations Relief and Works Agency for Palestine Refugees in the Near East
WTP	Water Treatment Plant

Exchange rate: 1US$ = JPY98.92, 1JD = JPY140.17

Chapter 1 BASIC CONCEPT OF THE PROJECT

1-1 Background of the Project

Jordan belongs to the desert area, 75 % of the land has the precipitation less than 200 mm and the average water resource per capita is extremely low, 145 m^3 comparing with the world average 8,000 m^3. The scarce of water resource is the serious problem in Jordan. The water supply hour is 50 hours per week in Amman, 24-30 hours in Jordan Valley and less than 10 hours in some small villages.

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Table 1-1 Components of the Project requested by the Jordan side

Component	Deir Alla district	Ain Al Basha district
1. Construction of new reservoirs	2 nos. [New Ma'adi High reservoir] Q=2,500 m^3, 1 No. [New Rajeb Upper Tank] Q=6,000 m^3, 1 No	5 nos. [Baqa'a] Q=8,000 m^3, 1 No. [Safout] Q=2,000 m^3, 1 No [New Eskandanavian] Q=2,000 m^3, 1 No. [New Abu Nussair 1] Q=1,000 m^3, 1 No [New Abu Nussair 2] Q=1,000 m^3, 1 No.
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4. Soft Component	The request includes technical assistance on strengthening of WAJ's staff in distribution management including non-revenue water countermeasure.	

1-2 Natural Conditions

The Hashemite Kingdom of Jordan (hereinafter referred to as "Jordan") has a population of 6.32 million people (as of 2012) and land area of 89,316 km^2. It is surrounded by West Bank, Palestinian Interim Self-Government Authority and Israel in the west, Syria in the north, Iraq in the east, and Saudi Arabia in the southeast. Western area of the Kingdom has a narrow valley, known as Jordan Valley, which spreads from Jordan River through the Dead Sea (which is 400m below sea level) and to the Gulf of Aqaba in the Red Sea. The east side of Jordan Valley is a plateau area of 600 ~ 1,500 m above sea level, and on the east of the plateau area is a desert area which covers around 75 % of the national land. Most of the rainfall occurs during winter. The amount rainfall varies, reaching an average of up to around 660 mm in the northeast plateau and only around 120 mm in the desert area.

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August, minimum around 5°C in January, and the precipitation is around 500 mm per annum. The average temperature of Deir Alla is 23.5°C, the maximum is 38.6°C in July, minimum is 10.6°C in January, and the precipitation is 280 mm per annum.

The type of soil at the project sites consists of gravel-mixed limestone or limestone bedrock.

1-3 Social and Environmental Considerations

This project has been categorized into “C” according to the JICA Guidelines for Social and Environmental Considerations as the impact of the project is judged as minimum.

Administration for the evaluation of environmental impact in Jordan is undertaken by the Environmental Impact Assessment Directorate in the Ministry of Environment. Evaluation of environmental impact is prescribed in EIA Bylaw No. 37/2005.

It was confirmed by WAJ with the Ministry of the Environment, a regulatory agency, whether or not it is necessary to environmental impact study. In response to it, as a result of the consultation in the committee, an exception letter shown in Appendix-6.1 was issued to WAJ addressed from the Ministry of the Environment that the environmental impact is minimal, and there is no need for environmental and social impact assessment in the context of the present project. However, it is added that consideration should be given enough to noise and traffic disturbance during construction and the like.

Environmental affects related to the major project component are as follows. In view of the environmental and social conditions of the project site, in the selection of the distribution reservoir site, it was decided that the open space or public domain environmental and social impact in and around the construction site is small and the acquisition is easy.

Table 1-2 Foreseen Impacts of the major Project Component

District	Component	Foreseen Social Environmental Impacts
Ain Al Basha	Construction of Abu Nussair 1 reservoir	There is no house and agricultural use in and around the land for the proposed reservoir. The land is owned privately and the land acquisition is required but the social impact will be minor since there is no house and relocation of resident is not required.
	Construction of Abu Nussair 2 reservoir	There is no house and no land use in the land for the proposed reservoir. The land is owned privately and the land acquisition is required but the social impact will be minor since there is no house and relocation of resident is not required.
	Installation of transmission and distribution pipelines	Planned pipes are buried in public roads and, therefore, no impact is foreseen except traffic disturbance during the construction stage. Trenchless technology will be adopted for installing pipeline under the main roads and thus traffic will not be affected. However, the adequate traffic control is required for branch roads.
Deir Alla	Construction of Ma'adi pumping station	The land for proposed pumping station is located in the premises of Deir All District office and thus land acquisition is not required. There are houses but enough distance is kept from the pumping station and there has been no complaint from the residents about the existing pumping station in the same premises. Pumps will be installed in a house so that noise and vibration in operation is minimum
	Construction of Ma'adi reservoir	The land for the reservoir and their surrounding areas are barren land and there is no house and land use. The land for the reservoir is owned by the government and transfer from the government is required. The social impact will be minor since resident relocation is not required. During the construction, access road to proposed reservoir is required.
	Installation of transmission and distribution pipelines	Planned pipes are buried in public roads and, therefore, no impact is foreseen except traffic disturbance during the construction stage. Trenchless technology will be adopted for installing pipeline under the main roads and thus traffic will not be affected. However, the adequate traffic control is required for branch roads.

Chapter 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

2-1-1 Overall Goal and Purpose of Project

Jordan established the “National Agenda 2006-2015” as a comprehensive national strategy, which presents the issues and measures that Jordan must address. Here, issues in the water-related field are pointed out, such as insufficient renewable water resource, depletion of groundwater, inefficient water distribution, inappropriate water charge, and insufficient sewage treatment capacity. “Streamlining of operation, maintenance, and management, and reduction of non-revenue water” was put forward as one of the measures. In addition, the Government of Jordan set up the following main objectives in the “Water for Life: Jordan‘s Water Strategy, 2008-2022”.

1) Provision of adequate, safe and secure drinking water supply;
2) Promoting greater understanding and more effective management of groundwater and surface water;
3) Healthy aquatic ecosystems;
4) Sustainable use of water resources;
5) Fair, affordable and cost-reflective water charges; and
6) Timely adaptation to increased population growth and economic development across the water sector and water users.

Under the overall goal, this project aims at upgrading water supply service by appropriateness of water pressure, extension of water service time, water quality improvement, reduction of non-revenue water and optimization of electricity consumption through improvement of transmission and distribution network. Furthermore, through this improvement, the project aims at improving the shortage of water due to Syrian refugees flowing into northern Jordan.

2-1-2 Outline of the Project

The project targets above will be achieved through reconstruction of water transmission and distribution system in the target area. For this purpose, the following activities including soft component will be implemented in the project.

(1) Activities on the Japanese Side
    1) Strengthening of transmission mains and distribution mains
    2) Installation of pressure reducing valves
    3) Construction of reservoirs

4) Construction of transmission pump station
5) Establishment of distribution zones and district metered areas (DMA)
6) Establishment of distribution flow monitoring system
7) Soft component for strengthening of water distribution management capacity

(2) Activities on the Jordanian Side

1) Land acquisition for distribution reservoirs and its access roads
2) Construction of access roads to the proposed reservoirs
3) Construction work such as road paving, lighting, vegetation, fencing, gates, etc., within the site
4) Adequate budget arrangement for the construction listed above, and management, operation and maintenance of the constructed facilities

(3) Comparison of the components of the requested project and proposed project in this study

The comparison of the components of the project between the request of the M/D (Minutes of Discussions) at the inception of the outline design survey and the results of the survey is shown in Table 2-1.

Table 2-1 Comparison of components of the request and results of the outline design survey

Area	Items		Unit	Quantities		Remarks
				Request	This Plan	
Ain Al Basha	Pipeline	100mm DI	m	15,000	350	
		150mm DI	m	2,700	5,740	
		200mm DI	m	7,000	4,700	
		250mm DI	m		540	
		300mm DI	m		8,750	
		400mm DI	m	2,500	0	
		total	m	27,200	20,080	
	Distribution reservoir	Al Baqa'a	m^3	8,000	-	Utilize existing 2000 m^3
		Safout	m^3	2,000	-	Utilize existing 800 m^3
		New Eskandanavian	m^3	2,000	-	
		New Abu Nussair 1	m^3	1,000	900	Vacant land (private)
		New Abu Nussair 2	m^3	1,000	1,100	Vacant land (private)
		total	m^3	14,000	2,000	
	Pump station		location	0	0	Disposal of existing 2 pump stations
	Pressure reducing valve (PRV)		location	0	5	
	Flow meter		location	0	7	3 DMAs, 1 transmission at branch point, 3 distribution reservoirs
Deir Alla	Pipeline	150mm DI	m	7,000	1,090	
		200mm DI	m	13,000	0	
		250mm DI	m	2,800	4,450	
		300mm DI	m	1,300	9,620	
		400mm DI	m	500	0	
		total	m	24,600	15,160	
	Distribution reservoir	Rajeb	m^3	6,000	-	Utilize existing 1,000m^3
		Ma'adi	m^3	2,500	3,300	Vacant land (public)
		total	m^3	8,500	3,300	
	Pump station		No.	3	1	Ma'adi pump station 141m^3/h x 170m x 110kW Suction pit: 280m^3 Disposal of 4 existing pump stations
	Pressure reducing valve (PRV)		location	0	6	
	Flow meter		location	0	11	9 DMAs, 1 pump station, 1 distribution reservoir
Total	Pipeline	100mm DI	m	15,000	350	
		150mm DI	m	9,700	6,830	
		200mm DI	m	20,000	4,700	
		250mm DI	m	2,800	4,990	
		300mm DI	m	1,300	18,370	
		400mm DI	m	3,000	0	
		total	m	51,800	35,240	
	Distribution reservoir		location	7	3	5,300m^3 in total
	Pump station		location	2	1	
	Pressure reducing valve (PRV)		location	0	11	
	Flow meter		location	0	18	12 DMAs, 1 transmission at branch point, 4 distribution reservoirs and 1 pump station

Note: DI (Ductile iron Pipe), DMA (District Metered Area)

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

(1) Basic policy

1) Scope of cooperation

The scope of cooperation to be studied is as given below.

- Installation of distribution reservoirs with distribution zoning
- Enhancement of transmission capacity and reconstruction of transmission and distribution main system including water distribution zones
- Reinforcement of distribution mains and installation of pressure-reducing valves
- Disposal of existing distribution pumping stations through reconstruction of water supply system, and installation of new transmission pumping stations
- Construction of district metered areas (DMA) and installation of bulk flow meters
- Soft component related to improvement of water distribution management capacity

2) Target area

The target areas of the project are Ain Al Basha and Deir Alla in the Balqa governorate.

3) Target year

The target year of the project is set as 2020. If the project is implemented as a grant aid project, the target year is considered as approximately three years after completion of the facilities. Since the capacity of the pipeline system cannot be increased in stages, a slightly longer period is set for the pipeline system. Therefore, the target year of the pipeline system is set as 2025 to meet the target year of the existing WAJ water supply project “Upgrading and Expansion of Water Facilities in the Central Governorates of Zarqa, Madaba and Balqa.”

4) Problems to be resolved and countermeasures

a. Problems

Existing water supply facilities fail to meet the demand in capacity and are found inappropriate in the layouts. Therefore, water is not being supplied and distributed appropriately in the demand areas. The causes of the problems are described in detail below.

- Zoning of distribution areas does not take into consideration the rugged undulating terrain of the demand area.

- Very high pressure for distribution is not being regulated by pressure reducing valves.
- Head of water transmission and distribution pump and booster pump is excessively high. This is because: (1) Specifications of pumps supplied by the WAJ Head Office are inappropriate; (2) Pipe diameter is not being increased with the increase in water demand, and water is forcibly distributed only by increasing the pump head.
- Pressure has become excessively high near distribution pump and booster pump since these are high head pumps. This has led to bursts of pipelines near the pumping station and thereby to high leakage ratio.
- Distribution reservoir does not exist in the distribution system. Even if it does exist, the capacity of the existing distribution reservoir is inadequate. The distribution network capacity is inadequate. For this reason, water can be supplied only 1 to 3 days per week regionally. Intermittent pumping of water using high head pumps is unavoidable, even if the altitude is lower than that of the distribution reservoir.
- In most cases, the same pipeline has the function of a transmission pipeline and a distribution pipeline. The transmission and distribution rates cannot be controlled; therefore, the water supply cannot be managed and controlled.
- Distribution zones and district metered areas do not exist; therefore, flow rate and water pressure cannot be controlled appropriately. Water is supplied intermittently, especially in areas distant from the pumping station.

Such defects of facilities lead to considerable leakage and non-revenue water, regionally unequal water supply and low energy-efficient water supply system. Therefore, the problems to be solved in this project are reduction of leakage and non-revenue water, fair water supply and the upgrading of high-energy-efficient water supply system through restructuring of transmission and distribution main system.

b. Countermeasures

To solve the problems mentioned above, the following countermeasures will be considered:

Countermeasure	Objectives
➢ Appropriate arrangement of transmission mains and pumps ➢ Abolishment of high-head distribution pump ➢ Separation of transmission and distribution line	➢ High-energy-efficiency is achieved because of abolishment of unnecessary high-head distribution pumps. ➢ High water pressure nearby the distribution pump stations decreases, leading to reduction in leakage. ➢ It is difficult for the distribution pump to send water at appropriate pressure with demand due to fluctuation of pressure. In contrast, gravity flow from the distribution reservoir can send water with demand because of lower fluctuation

Countermeasure	Objectives
	in pressure.
➢ Separation of transmission and distribution line and definition of facility: Transmission facility up to the reservoir, distribution facility from the reservoir ➢ Arrangement of a reservoir for each distribution zone, and utilization of gravity flow from the reservoir ➢ Enhancement of distribution mains	➢ Continuous water supply at constant pressure allows to minimize fluctuation in service water pressure and contributes to fair water supply. ➢ Easy management and control of transmission and distribution water contributes to fair water supply. ➢ The non-utilization of distribution pumps makes the water supply system highly energy effective. ➢ Adequate service water pressure is ensured up to the ends of the pipe network.
➢ Setting appropriate water distribution zones • Ain Al Basha area: 5 zones (3 zones for the project) • Deir Alla area: 2 zones (1 zone for the project)	➢ Management and control of flow and pressure for each distribution zone contributes to fair water supply.
➢ Setting DMA • Ain Al Basha area: 10 DMAs (5 DMAs for the project) • Deir Alla area 12 DMAs (7 DMAs for the project)	➢ Management of pressure and flow by DMA facilitates non-revenue water countermeasure. Control of pressure and flow contributes to fair water supply.
➢ Installation of PRV at high pressure locations	➢ Reducing pressure to appropriate value decreases leakage.

5) Policy for renewal of aged distribution pipeline network

Renewal of aged branch and service pipes is necessary for reducing leakage ratio. However, renewal of aged pipelines in this project is difficult considering the budget scale of the project. The project for renewal of distribution pipelines in the Ain Al Basha area has been implemented or is being implemented by a different donor; therefore, renewal of pipelines in this area is not considered in the scope of the project.

Renewal of distribution pipeline network in the Deir Alla area has been deferred. About 81 %, or about 190 km of the total pipeline length of 234 km are old pipelines laid before 1990. The aging of asbestos pipelines is especially noticeable among the aged pipelines. Plans are underway presently for renewal of distribution pipelines utilizing the Gulf funds. Therefore, only asbestos main pipelines with deficient pipe diameter will be renewed together with the reconstruction of the transmission and distribution main system in the project.

6) Contribution to climatic and global warming measures

Energy use will be reduced by disposing off pumping equipment with inappropriate head and discharge rate, and renewing them with suitable pumping equipment. A new transmission pipeline will be branched off from the pipeline from the Zai Water Treatment Plant (WTP) to the Dabouq reservoir in Amman and water will be transmitted to the distribution reservoirs of Ain Al Basha area through

this transmission pipeline using the residual pressure of Zai-Dabouq line pumped from the Zai WTP. Through this measure, the existing distribution pump stations, which are no longer necessary in new transmission and distribution system, will be disposed of.

7) Selection of sites for distribution reservoirs considering socio-environmental aspects

For proposed distribution reservoir sites, locations with hydraulically appropriate elevation will be selected so that water distribution to the target water distribution zones is effective. Furthermore, public land or open space which can be easily acquired and can minimize environmental and social impacts surrounding the proposed sites will be selected as reservoir site.

8) Effective utilization of existing facilities

As far as possible, existing facilities such as existing distribution reservoirs, well facilities and so on, will be effectively utilized.

9) Selection of components with higher benefits and higher contribution to project targets

The components of the project needs to be narrowed down based on the project budget, although it is ideal to maintain all required water transmission and distribution main facilities in both areas as the project components in order to improve the water supply system in total. The original components are construction of distribution reservoir, laying transmission pipelines up to distribution reservoirs, and laying distribution mains from distribution reservoirs. However, components with higher benefits, that is, with high contributory effects to project targets will be selected as criteria for selecting the components or facilities. Priority will be assigned by distribution zone in both areas. Distribution zones suitable for the project target will be selected and the facilities for improving water supply in these zones shall be selected. However, a water distribution plan for entire areas or even for distribution zones that are not targets will be prepared to satisfy the water supply amounts in the target year. The facility plan for all distribution zones is given in Appendix-6.2.

a. Policy for selection of components

The following form the policy for selection of components.

- The number of beneficiaries will be maximized as much as possible.
- Benefit to cost will be maximized.
- The priority area of Jordan side is Deir Alla but the components of Ain Al Basha will be included since the population of Deir Alla is 70,000 and it has a small number of beneficiaries.
- High potential zones of electricity reduction are given higher priority by disposing of existing pumping stations and shifting to gravity flow system (Abu Nussair 1 and Abu Nussair 2 zones).
- Project components will be selected by distribution zone.

b. Selection of components of Ain Al Basha area

Ain Al Basha area is divided into five distribution zones. The Al Baqa'a distribution zone is situated in a refugee camp and has the highest population, high population density and the beneficiaries are the largest. Although the capacity of the distribution reservoir in this zone is insufficient, the existing Al Baqa'a distribution reservoir can still be used. Similarly, the existing Safout distribution reservoir with the next largest population to be served in the Safout distribution zone after the Al Baqa'a distribution zone, can also be utilized. Target distribution zones are selected based on the following conditions.

- The components of Eskandanavian distribution zone, which show the least benefit-cost effect, will be deleted first.
- The existing distribution reservoir will be utilized without increasing the capacity of reservoir even if its capacity is insufficient.

Based on these conditions, the following 3 distribution zones have been selected for the project. Safout distribution zone has been excluded from cooperation components because KfW's rehabilitation project of water networks is now underway and is expected to provide benefits to this zone.

- Abu Nussair 1
- Abu Nussair 2
- Al Baqa'a

The features of their distribution zones are as given in the table below. The shaded distribution zones indicate the zones selected for the project.

Table 2-2 Features of the distribution zones and selected zone for the project (Ain Al Basha)

Symbol	Distribution zone	Beneficiaries in 2020	Existing distribution method	Gravity flow from the existing reservoir	Supply method in this plan	Reduction effect of electricity consumption
DZ01	Abu Nussair 1	11,178	Distribution pump	None	Gravity flow from the new reservoir	Disposal of pump stations (large)
DZ02	Abu Nussair 2	13,853	Distribution pump	None	Gravity flow from the new reservoir	Disposal of pump stations (large)
DZ03	Al Baqa'a	97,707 refugee camp located	Reservoir and distribution pump	Yes, but partly direct pumping supply	Gravity flow from the existing reservoir	(moderate)
DZ04	Eskandanavian	12,610	Distribution pump	None	Not changed	Disposal of pump stations (large)
DZ05	Safout	56,157	Reservoir	Yes	Not changed	(none)
Total		191,505				

The selected components are shown in Figure 2-1. Distribution reservoirs will be constructed in the Abu Nussair 1 and Abu Nussair 2 distribution zones and water will be supplied to these reservoirs through the proposed transmission pipelines. Water is transmitted to the existing Al Baqa'a distribution reservoir from the same new transmission pipeline which will extend to the proposed reservoirs. Furthermore, new distribution mains will be installed from these reservoirs to connect to the existing distribution network or in distribution zone to strengthen the capacity of distribution main, in order to supply water with adequate pressure. Implementation of the project will satisfy the water transmission amounts to the five distribution zones in the target year.

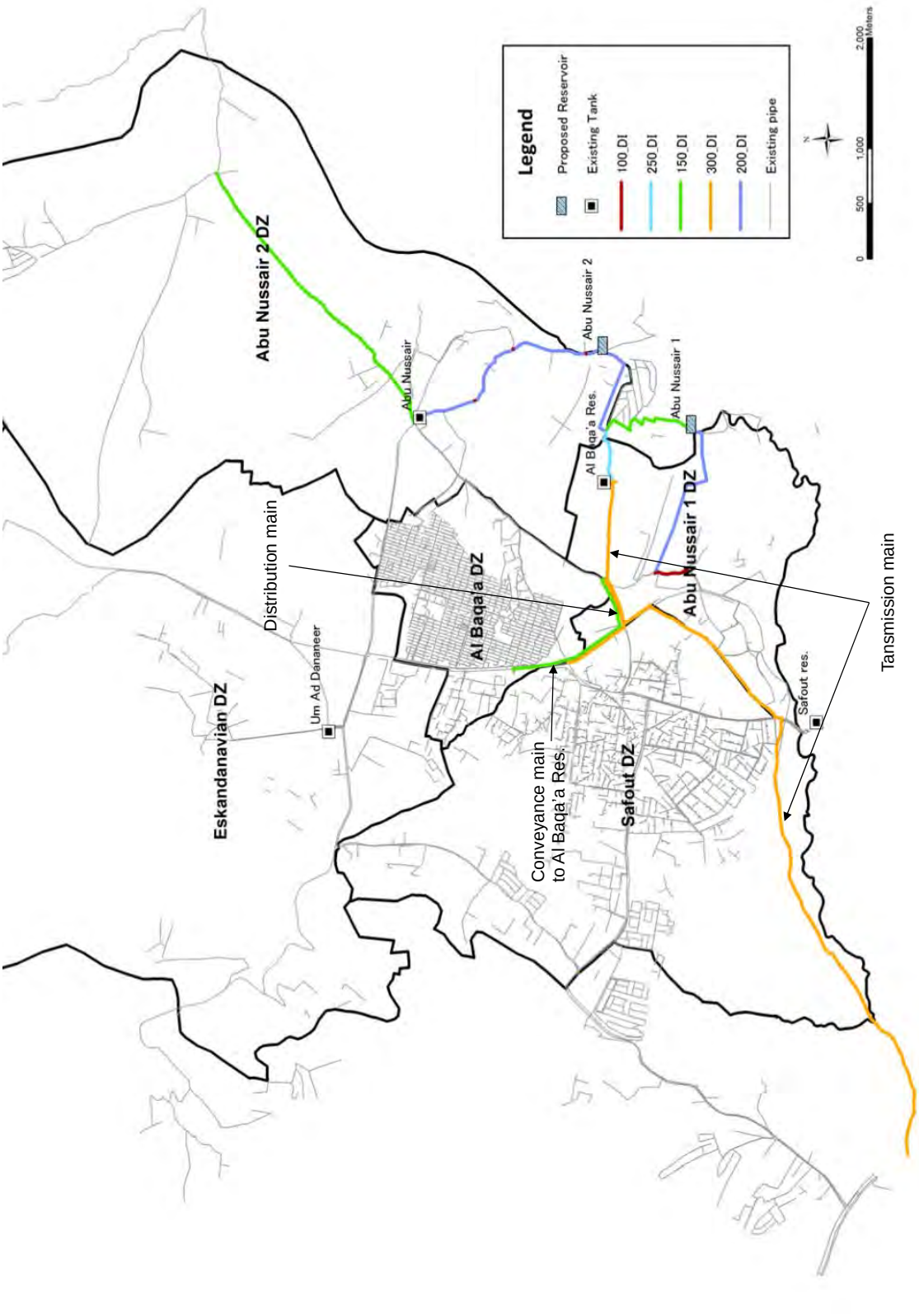


Figure 2-1 Selected components of the project in Ain Al Basha

c. Selection of components of Deir Alla area

Deir Alla area is divided into two distribution zones. Target distribution zones are selected based on following conditions.

- The components of Rajeb distribution zone, which show the less cost-benefit effect, will be deleted first.
- Only asbestos pipelines with deficient pipe diameter will be renewed together with the reconstruction of transmission and distribution system.

Based on these conditions, only Ma'adi distribution zone which has large beneficial population is selected for the project. The features of the distribution zones and selected zone for the project are as given in the table below. The shaded distribution zones indicate the selected zones for the project.

Table 2-3 Features of the distribution zones and selected zones for the project (Deir Alla)

Symbol	Distribution zone	Beneficiaries in 2020	Existing distribution method	Gravity flow from the existing reservoir	Supply method in this plan	Reduction effect of electricity consumption
DZ01	Rajeb	25,753	Distribution pump and well pump	None	Gravity flow from the new reservoir	Small
DZ02	Ma'adi	44,371	Distribution pump	None	Gravity flow from the new reservoir	Small
合計		70,125				

The selected components are shown in Figure 2-2. A distribution reservoir will be constructed in the Ma'adi distribution zone and water will be supplied to this reservoir through proposed new transmission pipeline. The water sources are two existing reverse osmosis (RO) membrane plants located in this zone; one is owned by Miyahuna Water Company and the other is owned by private person. The new transmission pipeline will be constructed from Miyahuna RO to the new Ma'adi distribution reservoir. On the way, water will be conveyed to the proposed new Ma'adi pump station in the WAJ Deir Alla office by gravity and then pumped up to the Ma'adi reservoir from this pumping station. Furthermore, distribution main will be constructed from this reservoir to the distribution zone to supply water in the zone.

Existing booster and distribution pumps in this zone will be disposed of as they will no longer be required after construction of the new water supply system. To dispose of one existing pumping station in Ma'adi distribution zone, an additional distribution pipeline, through which water is supplied to the high elevated land in Rajeb zone, is necessary in the Rajeb distribution zone. Therefore, this pipeline for Rajeb zone will be included in the project.

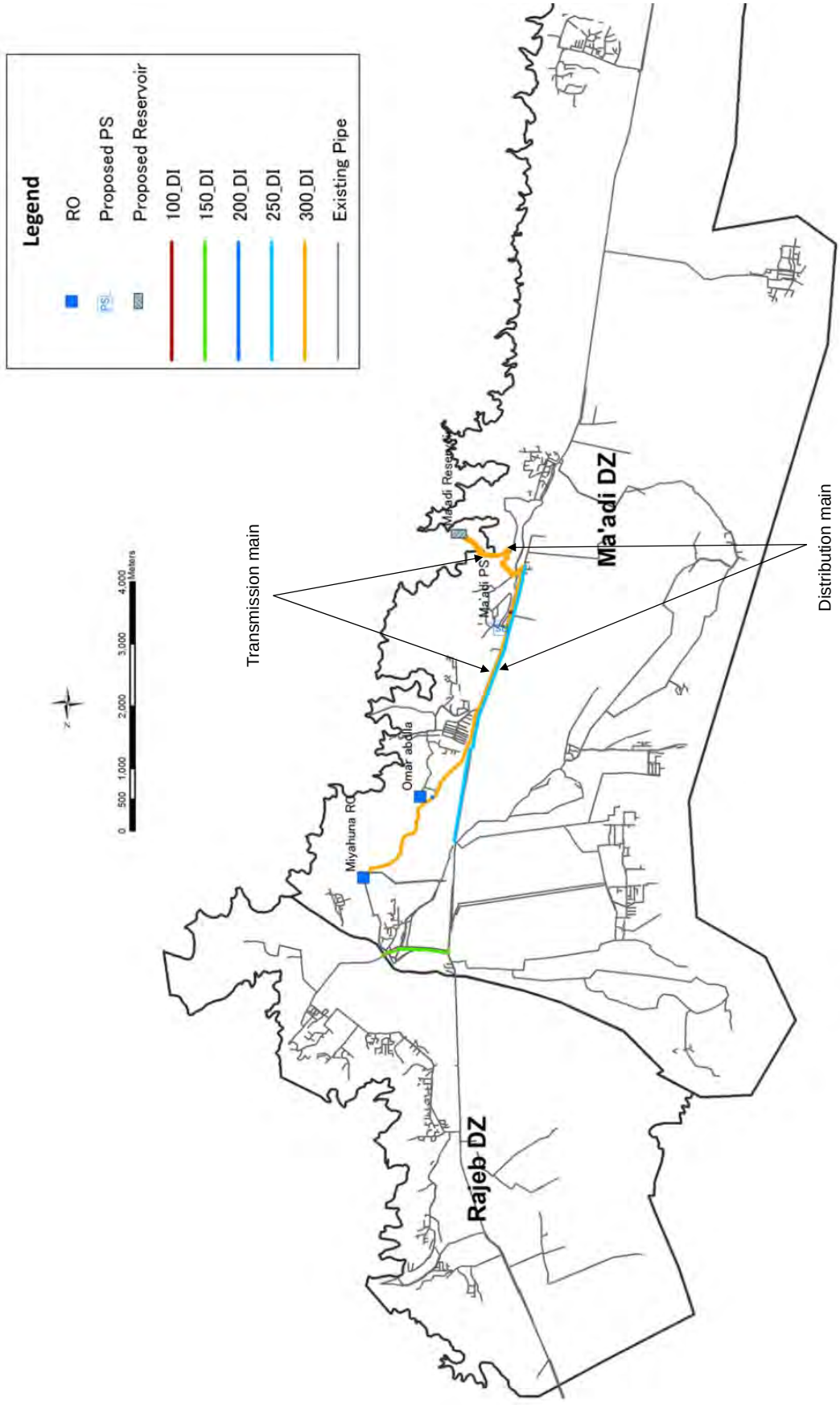


Figure 2-2 Selected components of the project in Deir Alla

(2) Policy on natural conditions

During the summer season in the target area, the day temperatures sometimes exceed 40˚C. Therefore, special care needs to be taken when placing concrete especially, and quality controls need to be properly enforced.

The geological features of the target area are gravel mixed with limestone (earth and sand) and limestone ground (soft rock). Since the ground has adequate bearing capacity considering geological conditions, it is suitable as direct foundation for distribution reservoir. On the other hand, rock (soft rock) excavation is necessary in all sections of the pipe laying routes, but sheet piling is not required. The geotechnical survey results are given in Appendix-6.12.

The project area has rugged undulating terrain with an elevation ranging from 700 to 900 m above MSL (Ain Al Basha) and -300 to -70 m MSL (Deir Alla). The location of distribution reservoir is to be selected, the boundaries of water distribution zones set and pressure-reducing valves planned considering such terrain so that water supply pressure is appropriate.

(3) Policy on socio-economic conditions

Water supply rationing is being implemented on a daily basis in the target area because of the rugged undulating terrain and lack of capacity of water transmission and distribution facilities. The water supply hours vary with the area. The present water supply is one day to three days per week in the target areas. The supply hours have a major impact on the daily life of the residents. Plans will be made to remove such inconsistencies in water supply and ensure fair distribution of the limited water supply, so that the number of days water is supplied increases.

Since the work is to be carried out in commercial areas and densely populated residential areas, the construction method used should be such that hindrance to daily life and business activities is minimized as far as possible. Similarly, construction methods for major main roads with heavy traffic should be selected such that the effects of the work on the through traffic and safety are properly considered.

The target area of Deir Alla is located in a low-income area within Jordan, and benefits such as employment for construction work for local people, and so on, will be considered.

The results of socio-economic condition survey and water pressure survey are given in Appendix 6.8 and Appendix 6.9.

(4) Policy related to procurement

All materials and equipment that can be procured in Jordan will be procured in Jordan, in principle. Materials and equipment that cannot be procured in Jordan or the quality of which cannot be adequately ensured, will be procured from a third country or from Japan. As far as possible, materials and equipment will be procured locally and laborers employed locally because this will contribute to the local economy of the target area.

(5) Policies related to construction methods and construction periods

The critical path of this work is the pipeline work. Appropriate number of work teams will be set, and an appropriate overall work period will be decided.

Since pipe laying work involves road excavation work, plans for the excavation work will be formulated considering minimal hindrance to traffic. The necessary safety measures related to the work will be formulated.

Open-cut method is not permitted when laying pipes on and across trunk roads under the jurisdiction of the Ministry of Public Works and Housing (MOPH). Accordingly, trenchless construction method will be adopted for road-crossing sections.

Transmission of water from the Zai water treatment plant to Amman cannot stop. Method of non-suspension of water will be adopted to branch off the new transmission pipeline from the Zai - Dabouq transmission pipeline for connection.

(6) Utilization of prominent Japanese technology and products

For the project, prominent Japanese products of ductile cast iron pipe (DCIP), pressure reducing valve (PRV), and pumps, etc. and prominent Japanese technology for pipe connection method of under-pressure connection / branching works and trenchless construction method are applicable.

(7) Policy on operations and maintenance capability of the implementing organization

WAJ is the implementing agency for this project, and will be responsible for the operation and maintenance after this project is completed. The Technical Affairs Directorate, WAJ, will be the department responsible for design and supervision. The routine maintenance and operation of the transmission and distribution facilities after completion of the work will be the responsibility of the WAJ Balqa Office.

The facility plan is formulated such that the facilities and the systems are simple and easy to maintain

and operate. The maintenance plan will be formulated such that the materials and equipment for maintenance owned by WAJ are utilized as far as possible.

The overall water distribution management of the waterworks system and non-revenue water management capability of the WAJ office is inadequate. The WAJ Office will be supported by soft components so that distribution management capacity improves and the effects of construction of facilities under this project are demonstrated to the maximum extent possible.

(8) Cooperation and sharing information with other donors

The secondary and lower class distribution pipes are expected to be improved by KfW/GIZ in Ain Al Basha, while existing distribution networks in Deir Alla are proposed to be improved by the Gulf Funds. It is required to cooperate and share in information on the project with the other donors because such projects and plans are closely related to this project.

2-2-2 Basic Plan

2.2.2.1 Planning Conditions

(1) Total population of the target area

Total population of target area will be set using the population data of the Department of Statistics. Population census was made in the past in 1994 and 2004. For the population in the future, the estimated values of DOS were used. The past and future estimates of population in both areas are shown in the figure below and in the table below.

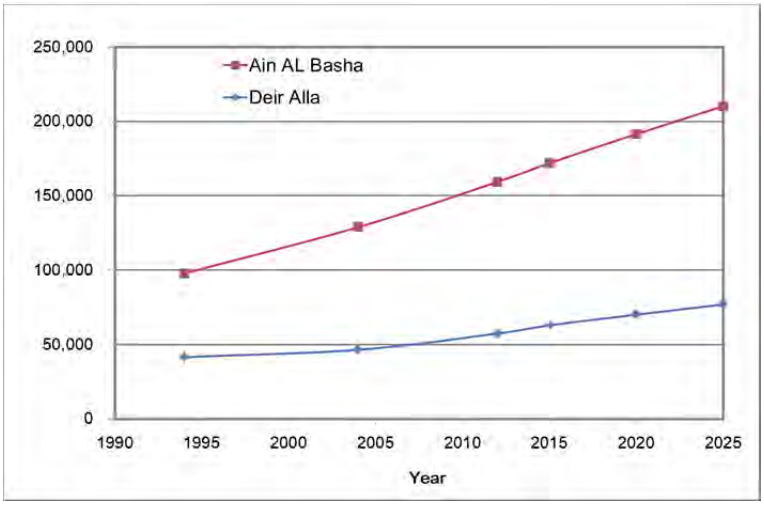


Figure 2-3 Population trend and future estimated population

Table 2-4 Estimated population of target area

Item	2012	2015	2020	2025
Ain Al Basha area	159,350	174,678	194,545	213,599
Deir Alla area	57,440	62,966	70,125	76,944

Remarks: The served population ratio has reached 98 %; served population is taken as administrative population.

(2) Planned non-revenue water ratio and planned leakage ratio

The past values of non-revenue water ratios, and the planned non-revenue water ratio and leakage ratios used in this project are as given below. The actual values up to 2011 are data given by the Ministry of Water and Irrigation (MWI), while the latest non-revenue water ratio values in 2012 have been acquired from the WAJ Balqa Office. The values of 2012 of WAJ Balqa Office were used as the baseline values although inconsistencies were observed in the values of 2011 and 2012. The Study Team set the planned non-revenue water ratio for 2015 and 2020 based on the non-revenue water ratio of 2012. For the planned non-revenue water ratio of 2025, the value in Jordan's Water Strategy 2008-2022 (2008) was used. Excluding 2025, the planned leakage ratio was taken as half the planned non-revenue water ratio based on the actual results in Jordan. The planned leakage ratio for 2025 was taken as 15 % of the planned value given by the Water Reallocation Committee, the Ministry of Water and Irrigation.

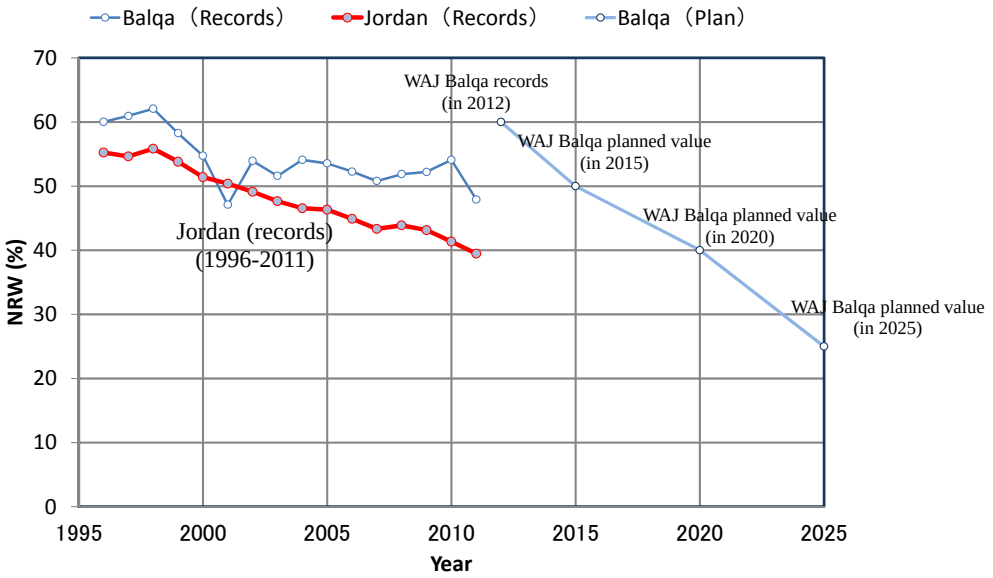


Figure 2-4 Change in the non-revenue water ratio of Balqa Governorate and Jordan with time

Table 2-5 Planned non-revenue water ratio and leakage ratio

Index		2012	2015	2020	2025	Remarks
Non-revenue water ratio (%)		60	50	40	25	The non-revenue water ratio for 2012 is 59.2% (Ain Al Basha) and 54.6% (Deir Alla).
	Leakage ratio (%)	30	25	20	15	

(3) Planned water demand

1) Planned average daily water consumption per capita and water supply amount

The planned average daily water consumption per capita is determined using the value estimated by the Water Reallocation Committee, MWI, as given below.

Table 2-6 Planned consumption per capita per day

No.	Item	Amman City	Urban area	Rural Area
1	Basic amount of water demand (LPCD)	120	100	80
2	For commercial use	3% of basic amount	3% of basic amount	3% of basic amount
3	For industrial use	8%	5%	2%
4	For tourism industry	5%	3%	-
5	Emergency use	5%	5%	5%
	Daily average consumption amount (LPCD)	147.6	116	93
6	Seasonal variation	17% of basic amount	17% of basic amount	17% of basic amount
	Daily maximum consumption amount (LPCD)	165.6	133	102

2) Planned load factor

1.17 of the basic amount of water demand, which is the planned value of the Water Reallocation Committee, MWI, will be used.

3) Time coefficient

The time coefficient is the ratio of hourly average water supply amount to the hourly peak water supply amount. The value used in WAJ design is 1.5 to 2.0. The value of 1.5 will be used as the minimum required limit.

4) Summary of planned water demand conditions

The planned water demand conditions calculated with the conditions above are summarized in the table below.

Table 2-7 Water demand in the target areas and planned water supply conditions

Item	Units	Area	2012 (Actual value)		Common to both areas		
			AAB	DA	2015	2020	2025
Planned average consumption per capita per day	Lpcd	Urban	57.7	84.8	116	116	116
		Rural			93	93	93
Planned average supply amount per capita per day	Lpcd	Urban	-	-	155	145	136
		Rural	-	-	124	116	109
Planned daily maximum water supply amount per capita per day	Lpcd	Urban	-	-	177	166	156
		Rural	-	-	136	128	120
Planned leakage ratio	%		-	-	0.30	0.20	0.15
Load factor (percentage corresponding to basic amount)	-		-	-	1.17	1.17	1.17
Time coefficient	-		-	-	1.5	1.5	1.5

Note: AAB: Ain Al Basha; DA: Deir Alla, Lpcd: Liter per capita per day (L/cap/d)

(4) Water demand balance

1) Actual water supply values in Balqa governorate

The table below shows the actual water amount supplied in 2012 by water source and by office in the Balqa governorate. The maximum amount is from internal water sources (groundwater) within the governorate, followed by water transmitted from the Zai water treatment plant owned by the Miyahuna Water Company.

Table 2-8 Actual water supply from within the Balqa governorate (2012)

(unit: MCM/year)

Directorate (Office)	Supply amount (system input)						Percentage
	Internal Source	Import from Miyahuna Zai	Import from Miyahuna RO	Private wells (RO)	Other Gov Wells	Total	%
Salt	5.88	5.05	0	0	0	10.93	37%
Ain Al Basha	2.28	4.84	0	0	0.19	7.31	25%
Fuhies	1.44	1.43	0	0	0	2.87	10%
South Shounah	2.77	0	0	2.39	0	5.16	17%
Deir Alla	1.32	0	0.66	1.09	0.38	3.45	12%
Total	13.69	11.32	0.66	3.48	0.57	29.72	100%
%	46%	38%	2%	12%	2%	100%	

2) Future supply-demand balance

The future estimated water demand of Balqa governorate is shown in Table 2-9, while the balance of the water supply amount and the estimated demand for 2012 is shown in Table 2-10. The maximum daily demand in 2025 is deficient by 2.02 MCM for the entire Balqa governorate; however, the daily average demand is covered by the existing supply amount. This suggests that water supply amount greater than the existing water source amount will be required in summer, when the water demand is high; so excess water from Disi Project and the like (water transferred from the Zai water treatment plant) needs to be utilized.

The daily average water demand in Salt, Fuhies and South Shounah is met by the existing water sources, but the demand in Ain Al Basha and Deir Alla is not met and additional water is required for these latter two districts.

Table 2-9 Estimated water demand in Balqa governorate

(unit: MCM/year)

District	Daily average demand				Daily maximum demand			
	2012	2015	2020	2025	2012	2015	2020	2025
Salt	7.73	7.91	8.26	8.59	8.87	9.07	9.48	9.86
Ain Al Basha	9.35	9.63	10.06	10.40	10.73	11.05	11.54	11.92
Fuhies	1.67	1.70	1.78	1.84	1.91	1.95	2.04	2.11
South Shounah	2.67	2.87	3.06	3.16	3.06	3.29	3.51	3.63
Deir Alla	3.05	3.19	3.33	3.50	3.51	3.67	3.83	4.03
Total	24.5	25.3	26.49	27.49	28.08	29.03	30.40	31.55

Note: Values of 2012 are estimated and calculated from planning conditions.

Table 2-10 Balance of future water demand and water supply amount in Balqa governorate

(unit: MCM/year)

Office	Daily average balance				Daily maximum balance			
	2012	2015	2020	2025	2012	2015	2020	2025
Salt	3.20	3.02	2.67	2.34	2.06	1.86	1.45	1.07
Ain Al Basha	-2.04	-2.32	-2.75	-3.09	-3.42	-3.74	-4.23	-4.61
Fuhies	1.20	1.17	1.09	1.03	0.96	0.92	0.83	0.76
South Shounah	2.49	2.29	2.1	2	2.10	1.87	1.65	1.53
Deir Alla	0.40	0.26	0.12	-0.05	-0.06	-0.22	-0.38	-0.58
Total	5.25	4.42	3.23	2.23	1.64	0.69	-0.68	-1.83

Note: “- “ indicates deficiency.

3) Water supply-demand balance in target area and future water sources

The existing daily average and daily maximum water supply quantities are both insufficient for Ain Al Basha considering the water demand in 2020, the target year of the project. On the other hand, the existing water supply amount for Deir Alla is sufficient for daily average, but the water supply amount for daily maximum is insufficient. That is, the water supply is deficient during the peak demand period or summer. To maintain the balance of water demand and supply in the target year, the water supply amount will be supplemented by the water sources mentioned below under this project.

- The present (2012) amount pumped up from source wells will be maintained in the present project as well.
- After implementation of the Disi project, additionally required water amount will be supplemented by the water sources as mentioned below.
  - Ain Al Basha: Addition of allocated water from the Zai treatment plant to Dabouq transmission main pipleline.
  - Deir Alla: the required amount is being supplied to Deir Alla from the RO plant owned by Miyahuna Water Company to reduce water transmission to the Zai water treatment plant from RO plant.

Additional distributed water at 4 MCM/year has been committed for supply to the Balqa governorate according to the MWI plan after implementation of the Disi Project.

(5) Distribution reservoir capacity

The standard waterworks facilities plan of WAJ has set the distribution reservoir capacity as greater than the 12-hour equivalent of daily maximum water supply amount. A 12-hour equivalent of daily maximum water supply amount is also set as the distribution reservoir capacity for the target area of this project. The distribution reservoir capacity in the Japanese standard "Guidelines on the Design of Water Supply Facilities" is also greater than the 12-hour equivalent; therefore, the distribution reservoir capacity for this project will be taken as 12-hour equivalent of the daily maximum water supply amount in the target year 2020.

(6) Designed service water pressure

According to the WAJ Guidelines, the service water pressure in the water distribution zone is between 0.25 MPa to 0.7 Mpa (2.5 bar to 7.0 bar). However most buildings in the target area are two-storey buildings, and water can be supplied if the supply pressure is 0.15 Mpa.

The target for the present project is planned minimum pressure of 0.25 Mpa in the customer water taps. However, when water is to be transmitted to a supply zone that is hydraulically disadvantageous based on the relationship between positions of distribution reservoir and supply zone, and the terrain, the standards below used in the existing plan of WAJ will be adhered to so as to avoid a situation wherein excessive investment cost may be incurred for satisfying the target value. However, the target lowest water pressure is set as 0.1 Mpa to supply water to 1st floor of house.

Table 2-11 Design standards for service water pressure

For daily maximum water supply amount	For hourly maximum water supply amount	Maximum service water pressure
P > 0.25 Mpa(2.5 bar)	P> 0.05 Mpa(0.5 bar)	P < 0.7 Mpa (7.0 bar)

2.2.2.2 Overall Plan of Transmission and Distribution System

(1) Ain Al Basha

1) Existing transmission and distribution scheme

Existing water sources include water from wells in the governorate and water from the Zai water treatment plant. The Zai water treatment plant distributes water to various supply areas after transmitting water to the existing Safout distribution reservoir and the Al Baqa'a distribution reservoir.

During transmission to these areas, water is distributed directly by transmission pipeline to the Eskadanavian zone also. Well water from within the area is supplied directly from wells; however, water from multiple wells is collected in distribution pumping station and then distributed by distribution pumps or through distribution reservoirs.

2) Planned water source

This plan consists of maintaining the discharge rate of existing well pumps and increasing the supply flow from the Zai water treatment plant when the supply in the target year is deficient.

3) Distribution zone and DMA plan

There are no defined distribution zones in the existing distribution system. To utilize the existing distribution pipeline network under this plan, the existing distribution scheme will be taken as the basis, and the existing distribution zones will be divided into five distribution zones (DZ01 to DZ05). One distribution reservoir will be installed at one location in each distribution zone, transmission and distribution pipelines will be separated, and the distribution method will be changed over to the gravity flow method, in principle. Furthermore, DMA will be set in the distribution zone to carry out distribution management in DMA units.

Development of three distribution zones (Abu Nussair 1, Abu Nussair 2 and Al Baqa'a) will be carried out based on the outcome of selection of components in the Design Policy. However, distribution reservoir will not be added in Al Baqa'a since a distribution reservoir already exists. Distribution reservoirs will be newly constructed at two locations: Abu Nussair 1 and Abu Nussair 2 distribution zones. The installation height of the new distribution reservoir will be the height that enables gravity flow to the distribution zone. Pressure-reducing valves will be used in distribution pipelines with excessive pressure within the distribution zone so as to reduce pressure to an appropriate level. DMA is planned for DZ04 and DZ05; however, since these zones do not fall under this plan, construction of DMA will not be made. However, a water allocation plan to all zones in the target year including the zones that do not include in this plan will be prepared and the proposed transmission pipeline is planned based on the allocation plan.

Table 2-12 shows the outline of each distribution zone, Table 2-13 shows the planned water demand of each distribution zone, and Figure 2-5 shows DMA of the distribution zones.

Table 2-12 Outline of distribution zone

(unit: m^3/day)

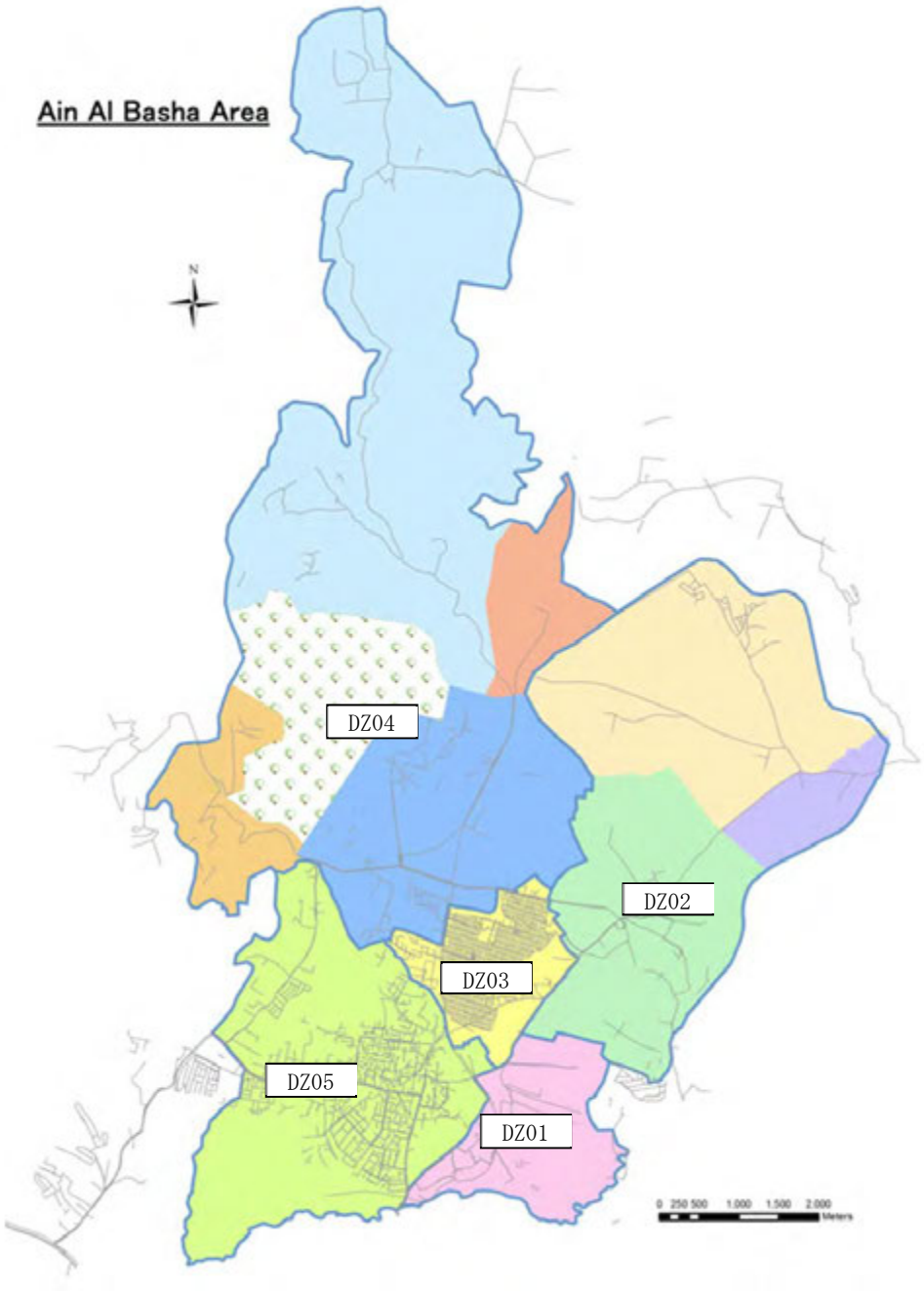
No.	Water distribution zone	Population (2020)	Elevation in distribution zone (m)	Distribution reservoir			No. of DMA *
				Existing capacity	New	Site elevation (m)	
DZ01	Abu Nussair 1	11,178	840-680	-	New	867	1
DZ02	Abu Nussair 2	13,853	900-620	-	New	925	3
DZ03	Al Baqa'a	97,707	700-630	2,000	-	740	1
DZ04	Eskandanavian	12,610	790-480	-	-	-	(4)
DZ05	Safout	56,157	730-590	800	-	757	(1)
Total		191,505	900-480	2,800	-	—	10

Note: * The items indicated by figures in ( ) will not be considered in this plan.

Table 2-13 Planned water demand in each distribution zone

(unit: m^3/day)

No.	Water distribution zone	Current (2012)		2020		2025	
		Daily average	Daily maximum	Daily average	Daily maximum	Daily average	Daily maximum
DZ01	Abu Nussair 1	1,517	1,740	1,621	1,859	1,675	1,920
DZ02	Abu Nussair 2	1,707	1,961	1,824	2,096	1,884	2,164
DZ03	Al Baqa'a	13,151	15,083	14,050	16,113	14,519	16,649
DZ04	Eskandanavian	1,305	1,505	1,587	1,824	1,639	1,883
DZ05	Safout	7,623	8,739	8,143	9,336	8,414	9,647
	Total	25,303	29,028	27,225	31,228	28,131	32,263



Note: Colored areas indicate DMA.

Figure 2-5 Distribution zones and DMA (Ain Al Basha)

4) Conveyance and transmission plan

a. Transmission from the Zai water treatment plant

Newly installed distribution reservoirs are at Abu Nussair 1 and Abu Nussair 2. To transmit the treated water from the Zai water treatment plant to these newly installed distribution reservoirs by the water head of the transmission pump in the Zai WTP, a new transmission pipeline will be branched from the transmission pipeline between the Zai water treatment plant and the Dabouq distribution reservoir and laid up to these two distribution reservoirs. Water will be transmitted to the existing Al Baqa'a

distribution reservoir by branching off a pipe from the proposed transmission pipeline, which will be installed between the branch of the Zai-Dabouq pipeline and the proposed Abu Nussair 2 distribution reservoir.

b. Conveyance from existing wells

In the existing water supply system, the water is distributed from wells in the zone directly to the supply area, and distributed after collection at the pumping station and after conveying the water to the Safout and Al Baqa'a distribution reservoirs. On the premise that the specifications (pumped quantity and head) of the existing well pumps will not be changed, in this project, the transmission destinations of the existing wells that distribute water directly will be changed to the existing distribution reservoirs at two locations (Al Baqa'a and Safout distribution reservoirs). The figure below shows the outline of water conveyance from existing wells. The existing water sources and water sources plan for the project are given in Appendix 6.3.

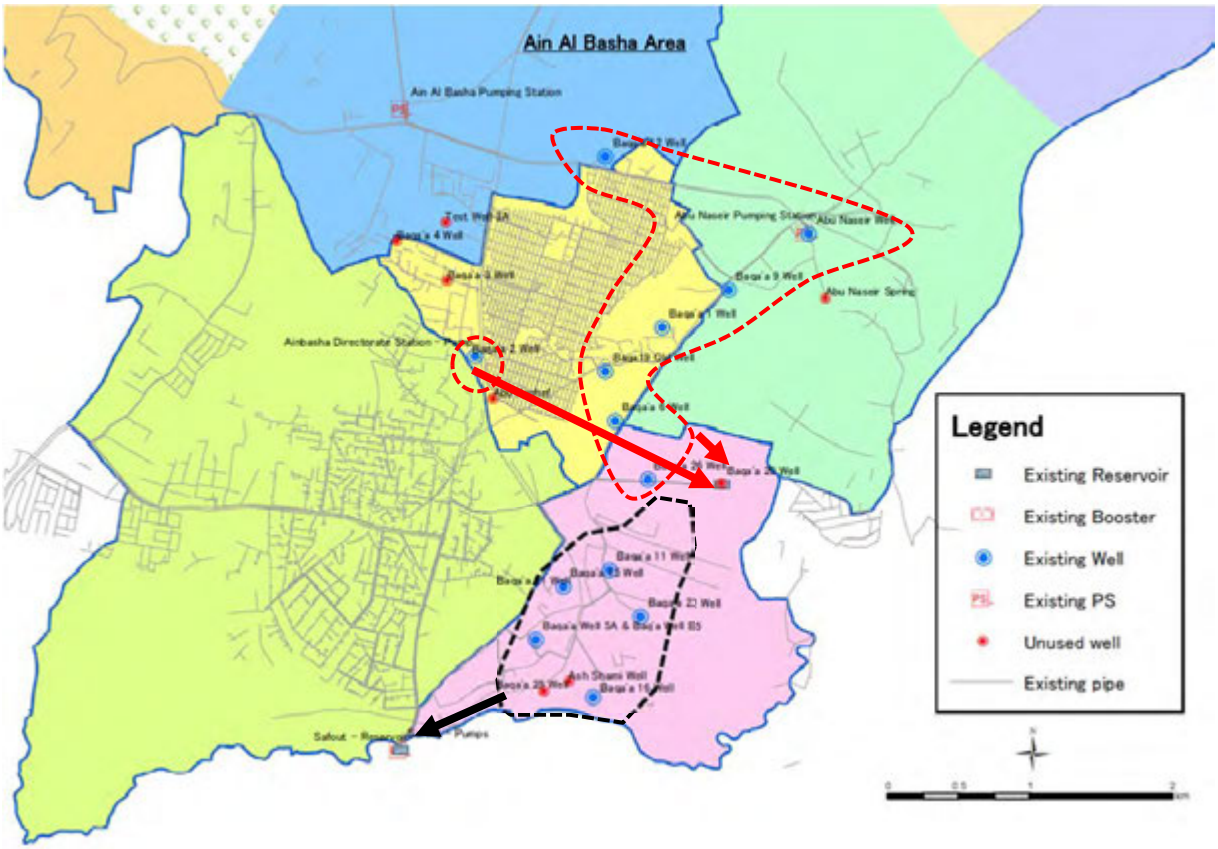


Figure 2-6 Use of existing wells (Ain Al Basha)

5) Disposal of usage of existing pumping station

Utilizing the water head of the transmission pumping station at the Zai water treatment plant, water can be transmitted to the existing Al Baqa'a distribution reservoir and the proposed Abu Nussair 1 and Abu Nussair 2 distribution reservoirs. Therefore, the two existing distribution pumping stations listed below can be disposed of.

- Abu Nussair pumping station
- Safout pumping station

6) Type of pipelines

Ain Al Basha has the following kinds of pipelines:

- Transmission main is the pipeline that will be branched off from the Zai - Dabouq pipeline and extended to the reservoirs in the target area.
- Conveyance main is the pipeline from the well to the distribution reservoir; so this is the pipeline from existing wells to the Al Baqa'a distribution reservoir.
- Distribution main is the main pipeline from distribution reservoir to distribution zone.

7) Overall plan of transmission and distribution system

Figure 2-7 shows the arrangement of pipeline routes and facilities in the overall plan of the transmission and distribution system under this plan. Figure 2-8 shows the concept diagram of the proposed water supply system including existing facilities to be utilized. Moreover, the comparison of existing and proposed systems is shown below. The outline of network analysis is given in Appendix-6.4.

Figure 2-9 Schematic of existing and proposed transmission system with daily maximum flow rates

Figure 2.10 Comparison of elevation profile of the existing and proposed water supply systems

In addition, the elevation profile of DMA and hydraulic characteristic of PRV is shown in Appendix-6.11.

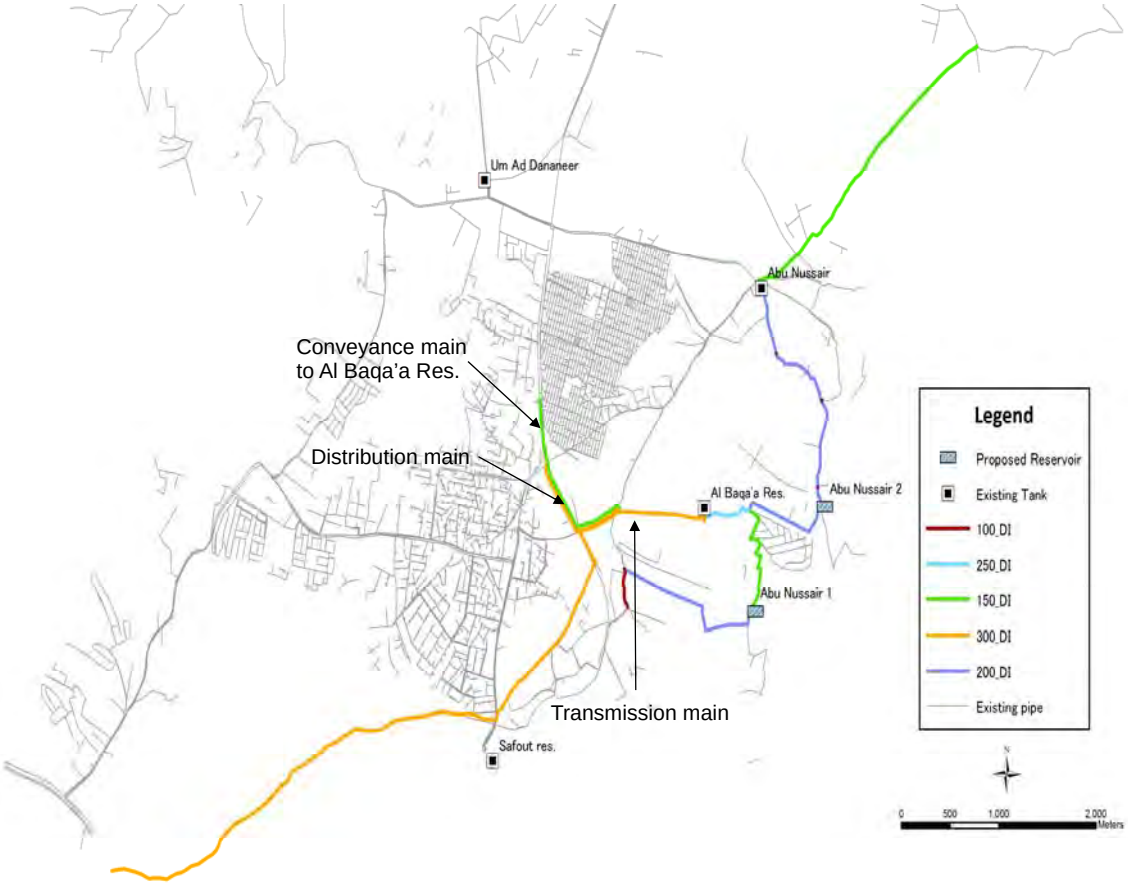


Figure 2-7 Arrangement of proposed pipeline routes and proposed facilities (Ain Al Basha)

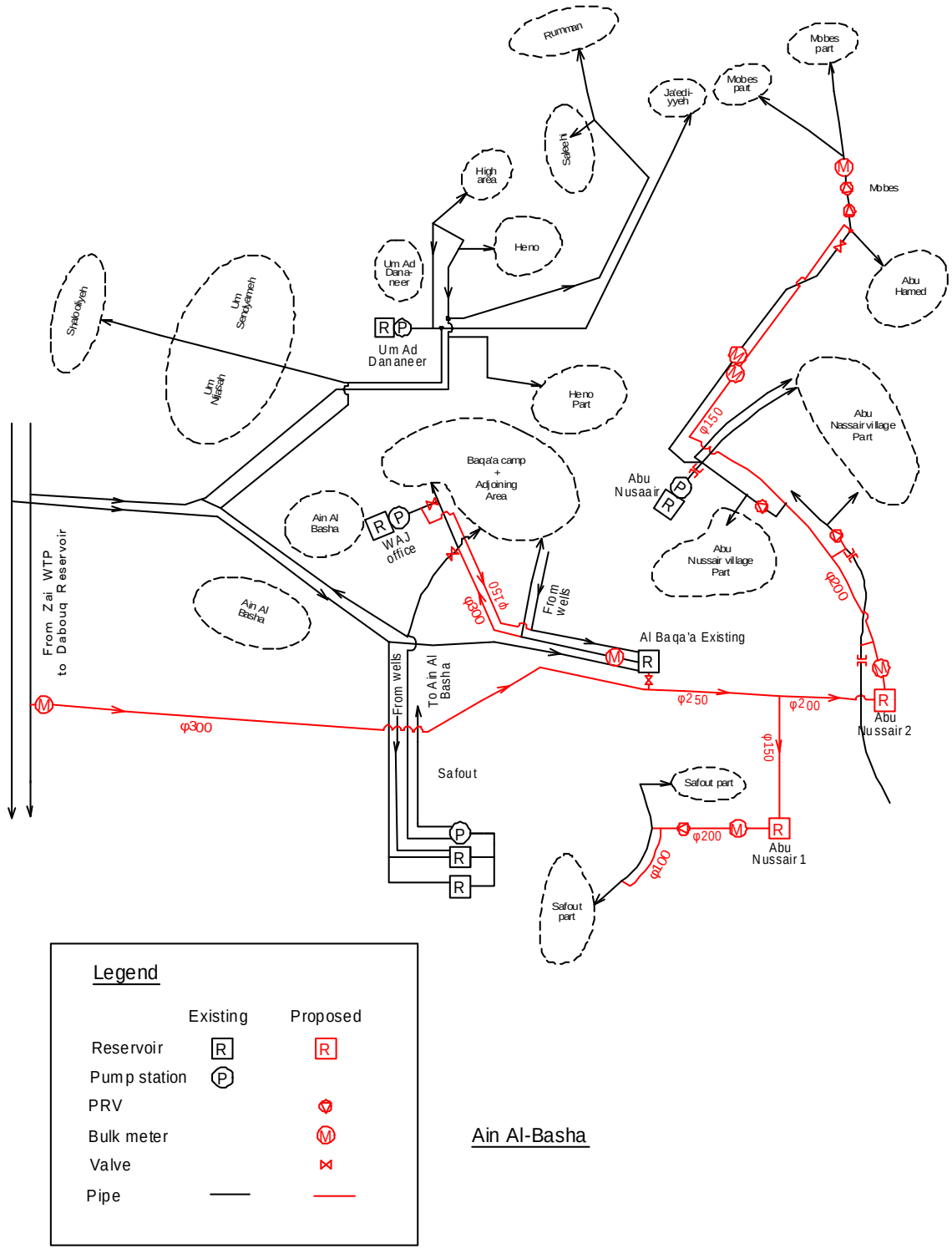
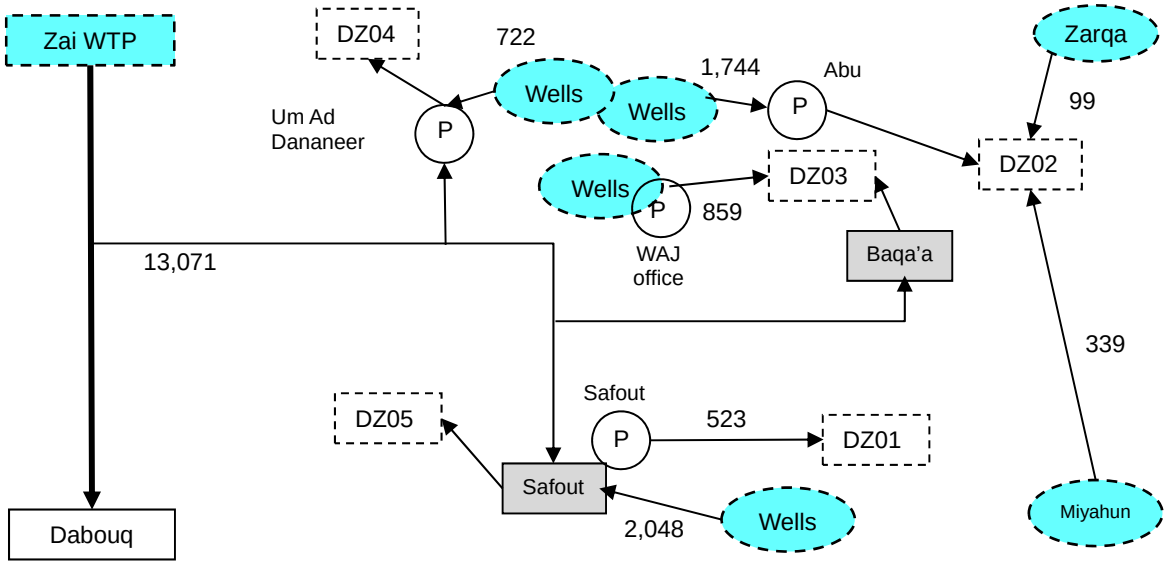
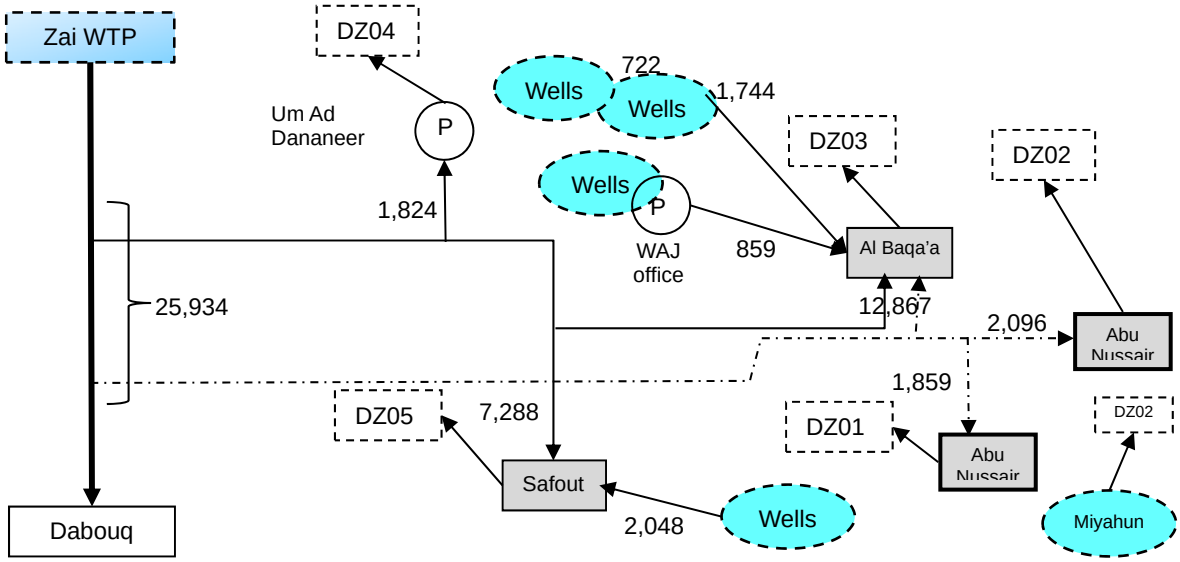


Figure 2-8 Schematic of arrangement of facilities for the proposed water supply system (Ain Al Basha)



(Daily Average Flow in 2012)



(Daily Maximum Flow Plan in 2020)

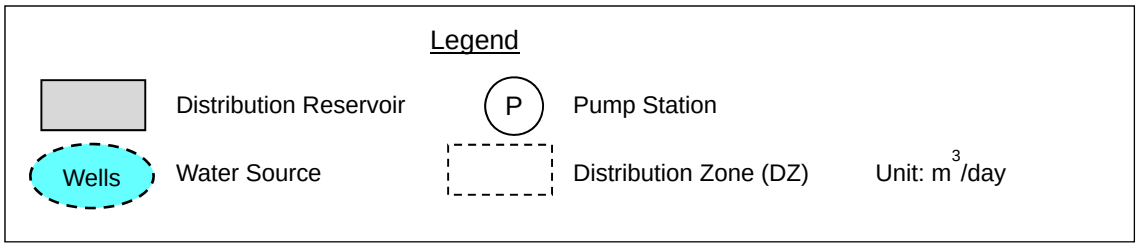
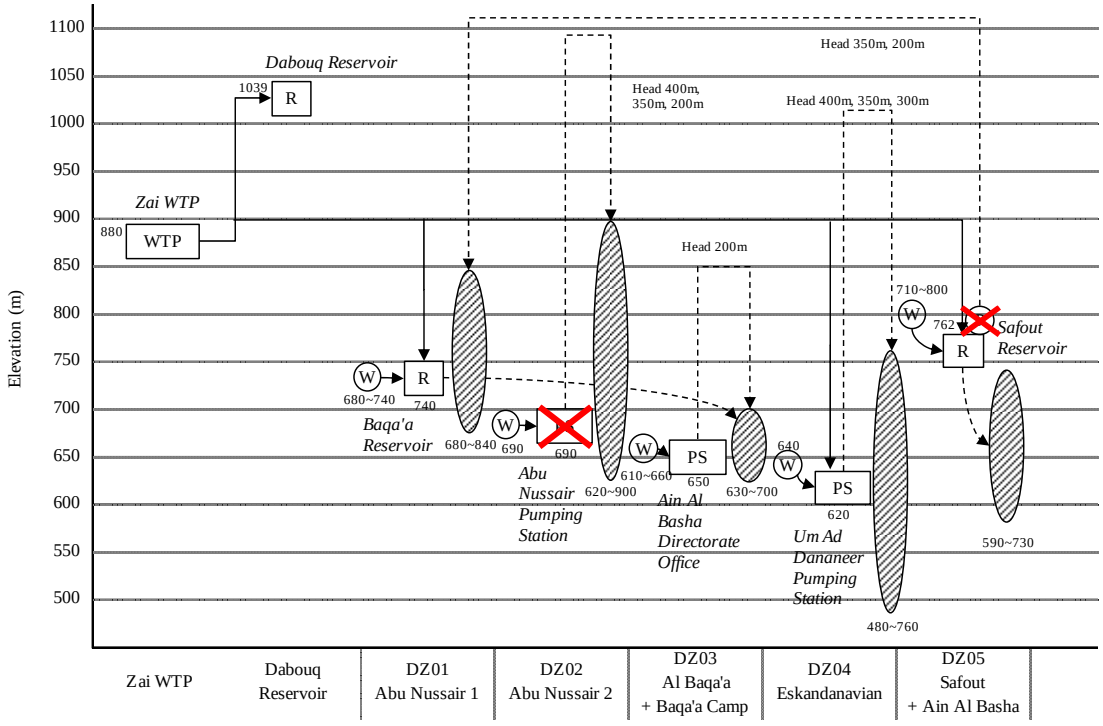
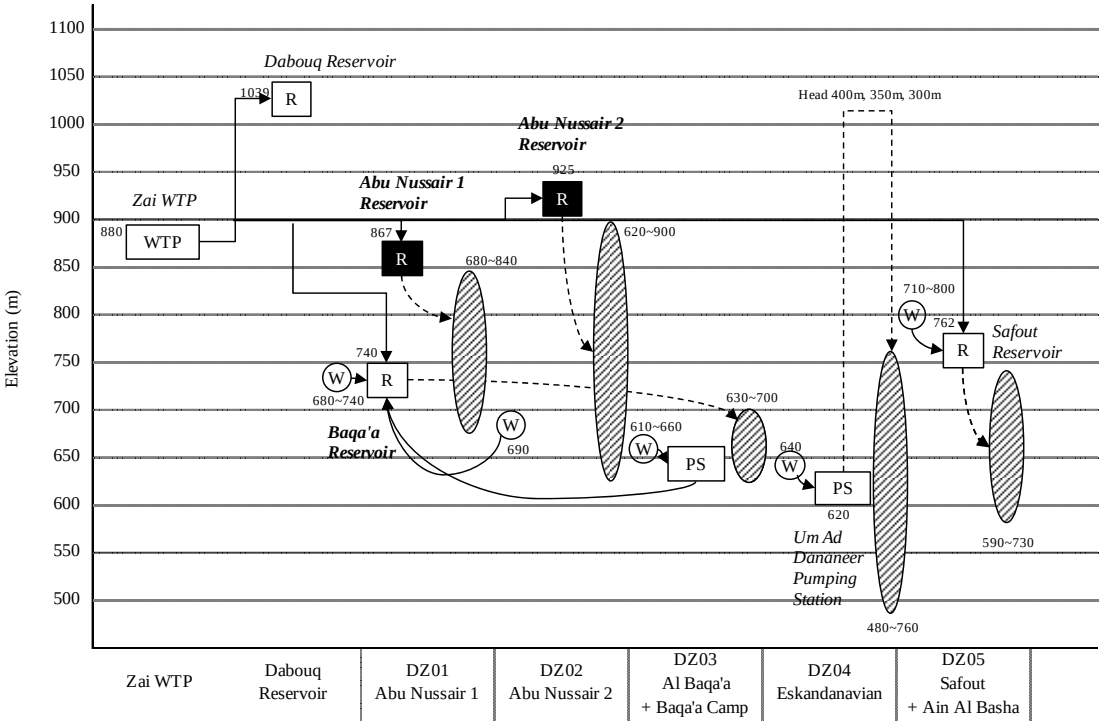


Figure 2-9 Schematic of existing and proposed transmission systems and daily flow rates (Ain Al Basha)



(Existing water supply system)



(Proposed water suply system)

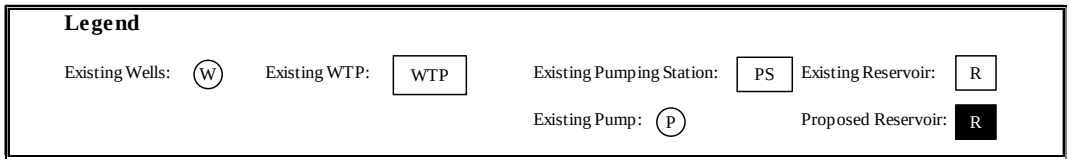


Figure 2-10 Comparison of elevation profile of existing and proposed water supply systems (Ain Al Basha)

(2) Deir Alla

1) Existing transmission and distribution scheme

The existing distribution system of Deir Alla may be broadly divided into three parts: northern part, central part and southern part. Water sources in the northern part depend on well water in the Deir Alla area and on the inflow of well water from the adjacent Irbid governorate. Water source of the central part and southern part is well water in the area through two RO plants; one owned by Miyahuna and the other a privately-owned plant.

Water is being distributed in the northern part by pumps from the existing Rajeb distribution reservoir. The central and southern parts receive water supply from RO plants and the water is distributed by gravity or through pumping stations where the low supply pressure is boosted.

2) Proposed water source

This plan consists of maintaining the existing well pump discharge and increasing the supply flow from the RO plans of the Miyahuna Water Company when the supply becomes deficient in the target year.

3) Distribution zone and DMA plan

There are no defined distribution zones in the existing distribution zone. To utilize the existing distribution pipeline network under the present plan, the existing distribution scheme will be taken as the basis, and the existing distribution zones will be divided into two distribution zones (DZ01: Rajeb, DZ02: Ma'adi). Water supply to the Rajeb distribution zone will be covered by supply from the existing wells. Water supply to the Ma'adi distribution zone in the central and southern parts will be covered by the two reverse osmosis plants.

One distribution reservoir will be installed at one location in each distribution zone, transmission and distribution pipelines will be separated, and the distribution method will be changed over to the gravity flow method, in principle. Furthermore, District Metering Area (DMA) will be set in the distribution zone to carry out distribution management in DMA units.

Based on the results of selection of components in the Design Policy, the Ma'adi distribution zone is selected for this plan. A new distribution reservoir will be provided in the Ma'adi distribution zone and water distributed from the reservoir by gravity flow. To transmit water from the two RO plants to the new distribution reservoir, the Ma'adi pumping station will be constructed on the way in the premise of WAJ Deir Alla office, and the water head will be increased before transmitting the water to the reservoir.

The installed height of the new water distribution reservoir will be such that water will flow by

gravity to the water distribution zone. Pressure-reducing valves will be used in pipelines of the distribution zone where excessive pressure occurs, and the pressure will be reduced to an appropriate level.

DMA is planned for the Rajeb water distribution zone; however, since it does not fall within the scope of this plan, DMA will not be constructed. An outline of each water distribution zone is shown in Table 2-14; the planned water demand of each distribution zone is shown in Table 2-15; while the division of distribution zones and DMA are shown in Fig. 2-11.

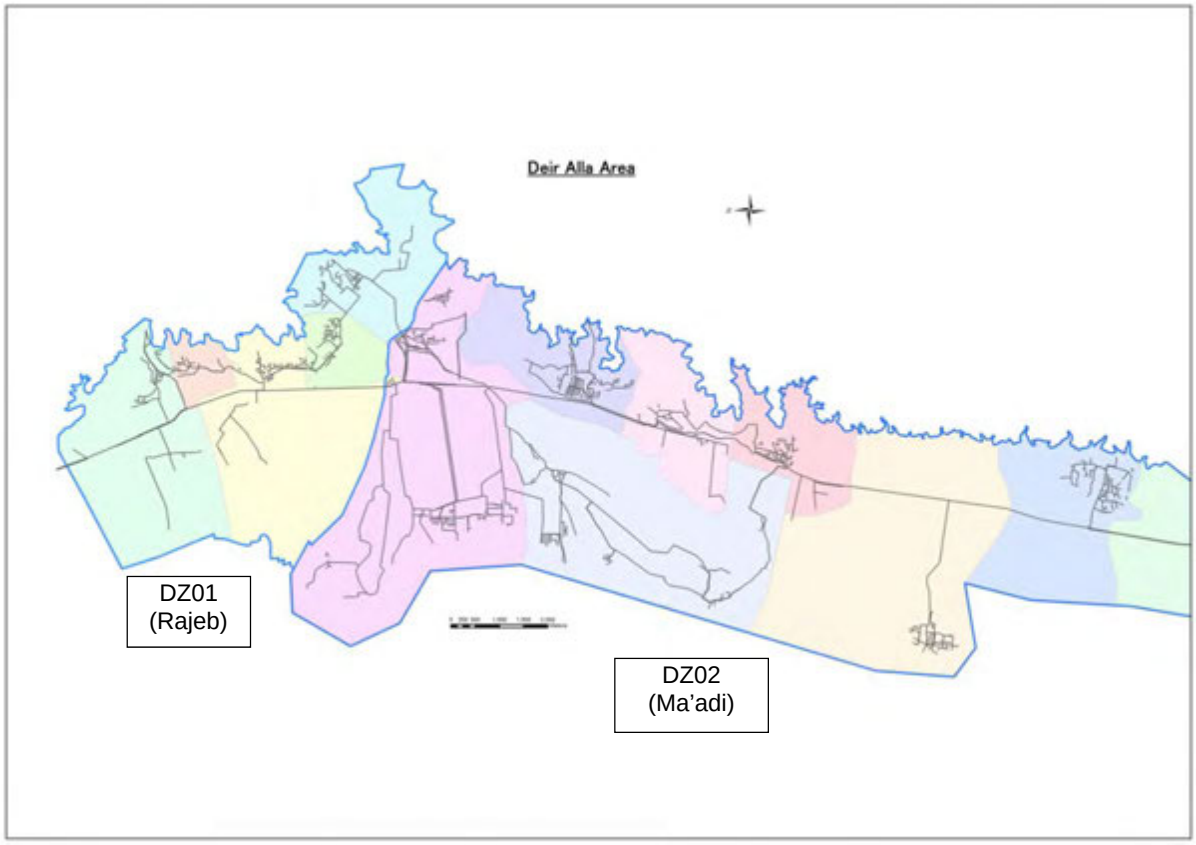
Table 2-14 Outline of distribution zones

No.	Zone	Population (2020)	Population percentage	Zone elevation (m)	Dist. Reservoir elevation (m)	No. of DMA
DZ01	Rajeb	25,753	30%	-70 to -260	Existing dist. reservoir used	(5)
DZ02	Ma'adi	44,371	70%	-140 to -330	-90	7
Total		70,125	100%	-70 to -330	—	12

Table 2-15 Water demand in distribution zones

(unit: m^3/day)

No.	Water distribution zone	2012		2020		2025	
		Daily average	Daily maximum	Daily average	Daily maximum	Daily average	Daily maximum
DZ01	Rajeb	3,214	3,691	3,435	3,945	3,714	4,261
DZ02	Ma'adi	5,148	5,921	5,697	6,552	5,888	6,768
	Total	8,362	9,612	9,132	10,497	9,602	11,029



Note: Colored areas indicate DMA.

Figure 2-11 Division of distribution zones and DMA (Deir Alla)

4) Transmission plan

The new distribution reservoir is the Ma'adi distribution reservoir. Water will be transmitted to this distribution reservoir from the two RO plants, which are water sources. Therefore, transmission pipelines will be laid from RO plants owned by the Miyahuna Water Company to the proposed Ma'adi reservoir. On the way, the transmission pipeline will be connected to the privately-owned RO plant, and another new pumping station will be installed within the premises of the WAJ Deir Alla office. Water will be transmitted by gravity flow from the water source to the proposed Ma'adi pumping station, water will be boosted at this pumping station and then transmitted to the Ma'adi distribution reservoir. The transmission conceptual sketch is shown in the figure below. The existing water sources and water sources for the project are given in Appendi-6.3.

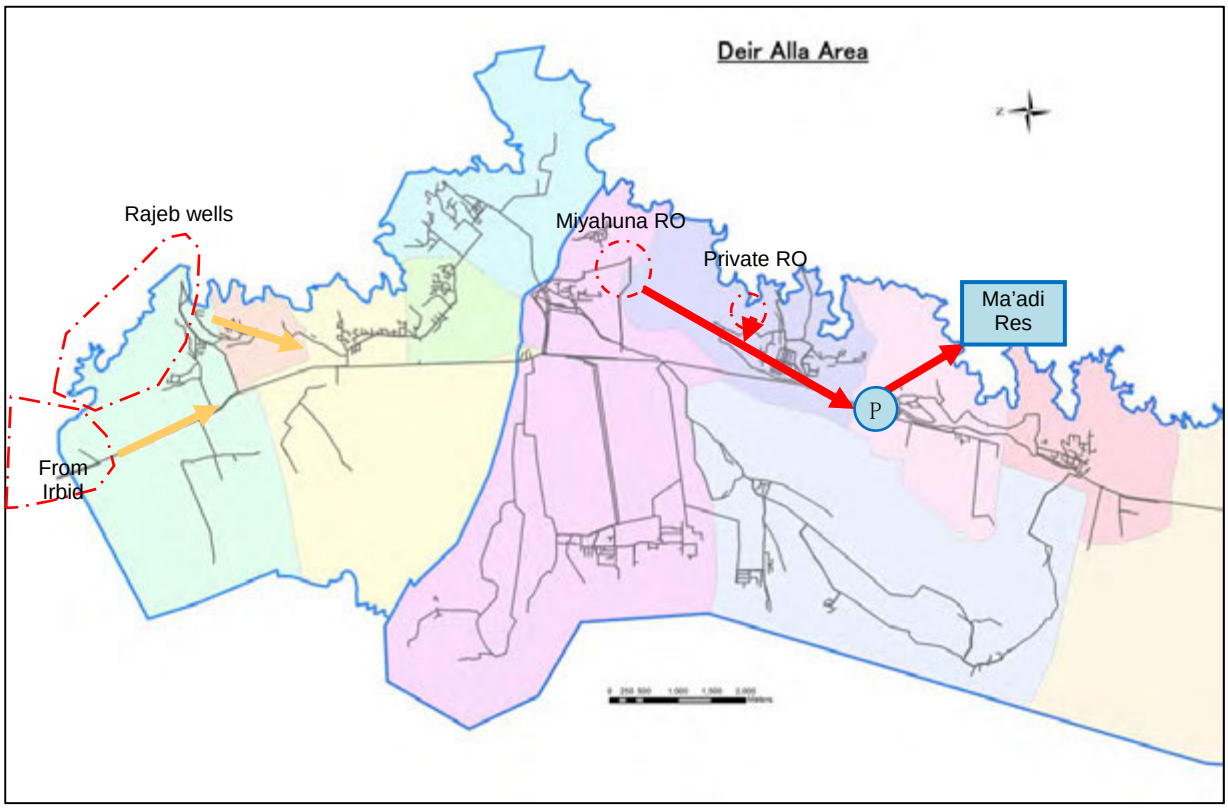


Figure 2-12 Transmission from existing water sources to distribution reservoir

5) Disposal of existing pumping station

The existing four booster pumping stations listed below will no longer be required since water will be supplied to all supply zones in the Ma'adi distribution zone by gravity flow.

- Abu Ziegan
- Rawaih
- Ma'adi
- Thahret Al Ramel

6) Type of pipelines

Ain Al Basha has the following kinds of pipelines:

- Transmission pipeline is the pipeline extending from the two existing reverse osmosis plants to the proposed Ma'adi distribution reservoir through the Ma'adi pumping station
- The distribution main is the main pipeline from the proposed Ma'adi distribution reservoir to the distribution zone.

7) Overall plan of transmission and distribution system

Figure 2-13 shows the arrangement of pipeline routes and facilities in the proposed transmission and distribution system, while Figure 2-14 shows the conceptual sketch of the proposed water supply system including existing facilities to be used. Moreover, the comparison of existing and proposed

systems is shown below. The outline of network analysis is given in Appendix-6.4.

Figure 2-15 Schematic of existing and proposed transmission system with daily maximum flow rates

Figure 2-16 Comparison of elevation profile of the existing and proposed water supply systems

In addition, the elevation profile of DMA and hydraulic characteristic of PRV is shown in Appendix-6.11.

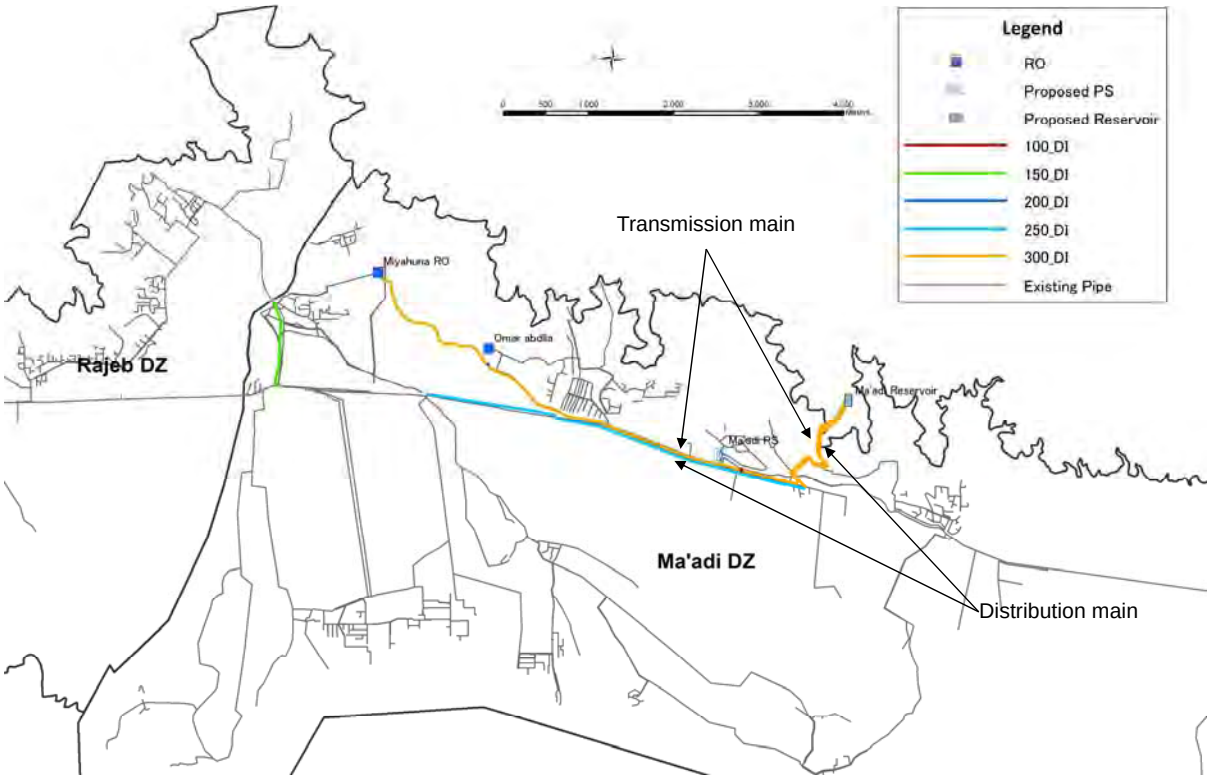


Figure 2-13 Arrangement of proposed pipeline routes and proposed facilities (Deir Alla)

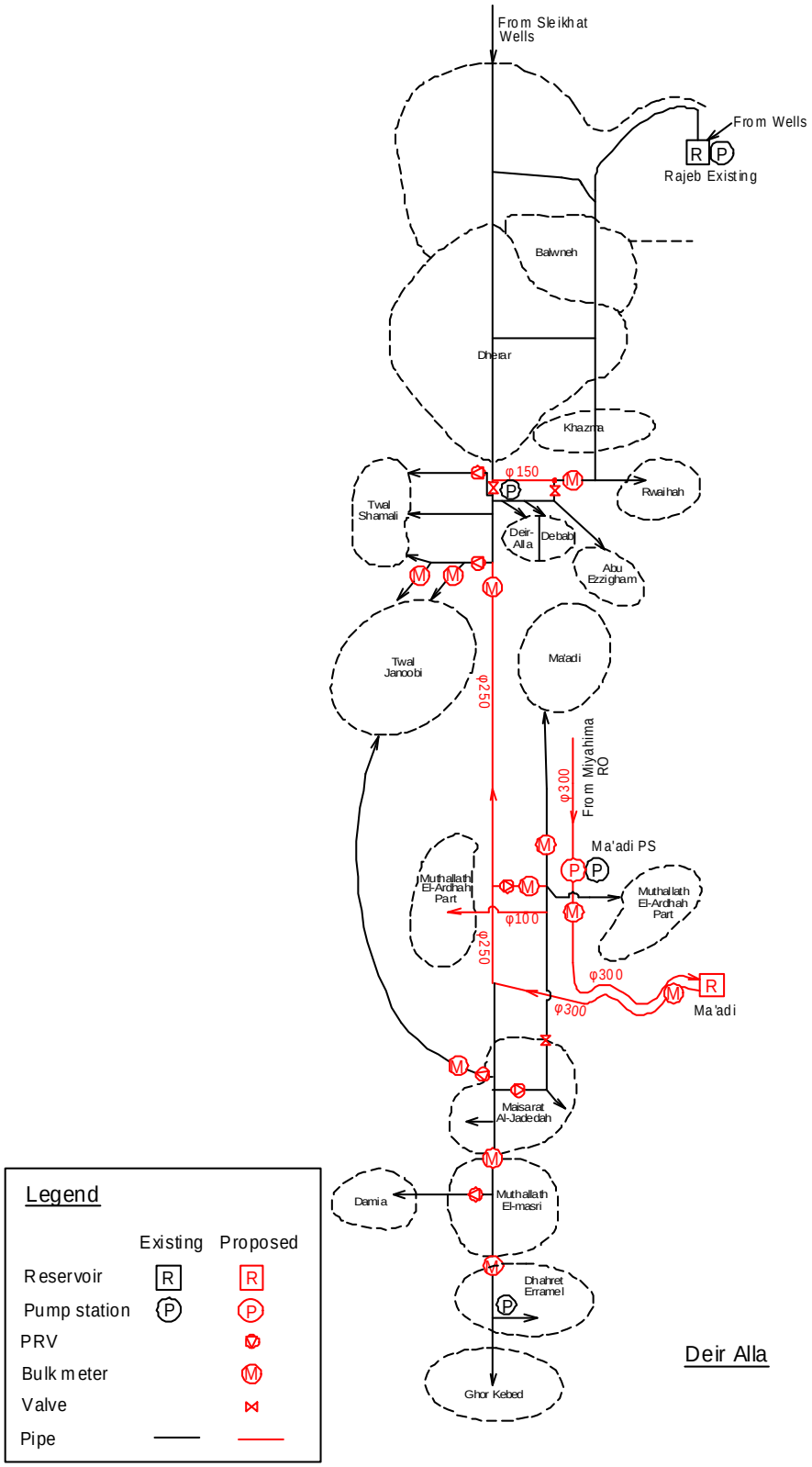
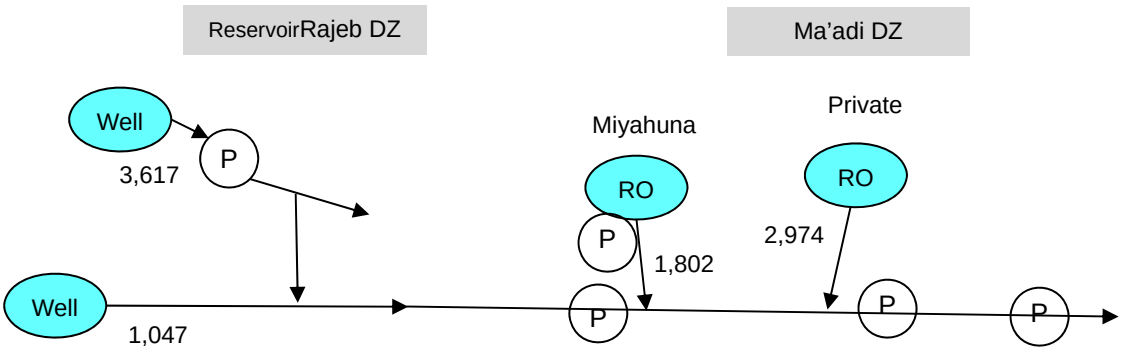
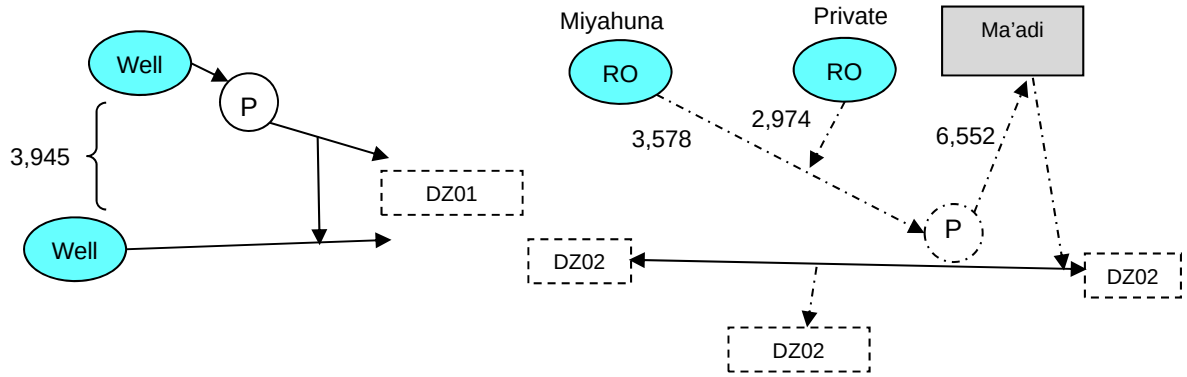


Figure 2-14 Schematic of arrangement of facilities for the proposed water supply system (Deir Alla)



(Daily Average Flow in 2012)



(Daily Maximum Flow Plan in 2020)

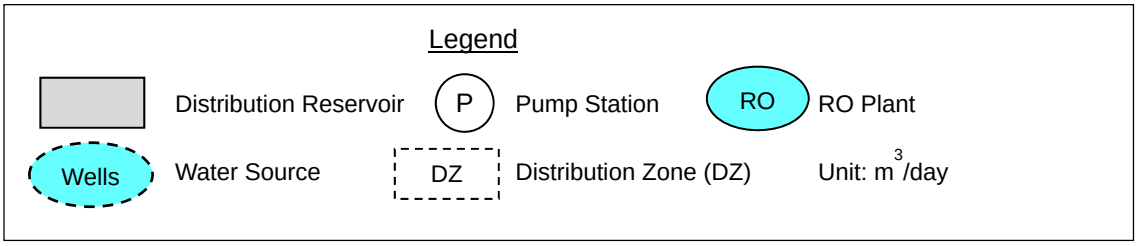
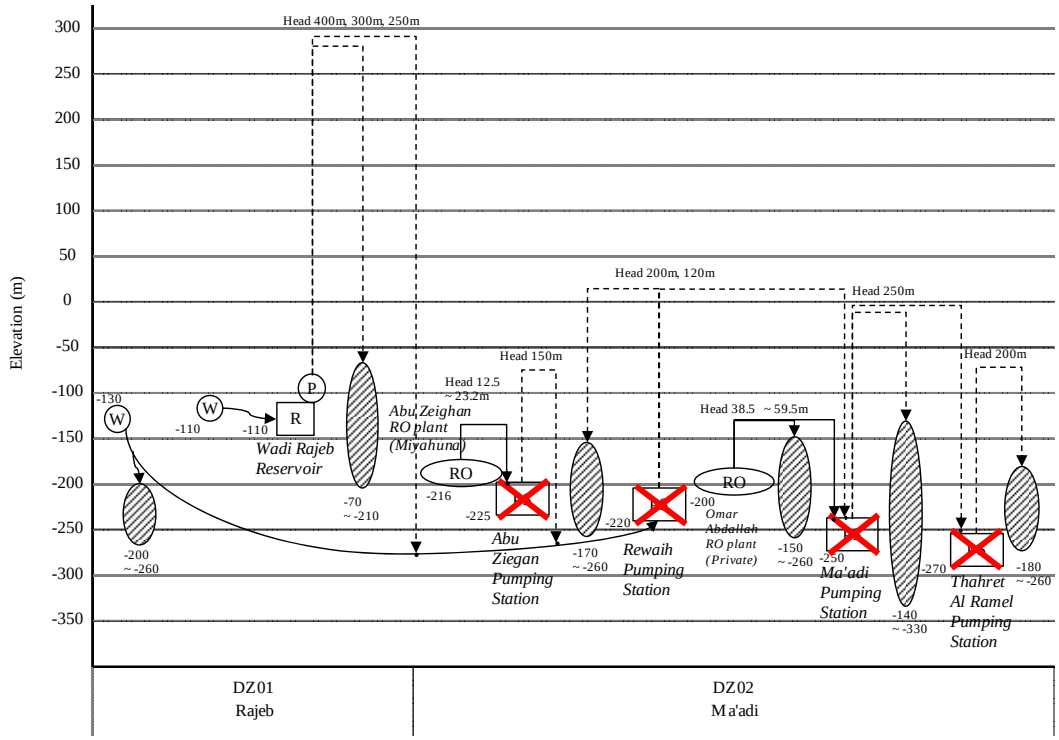
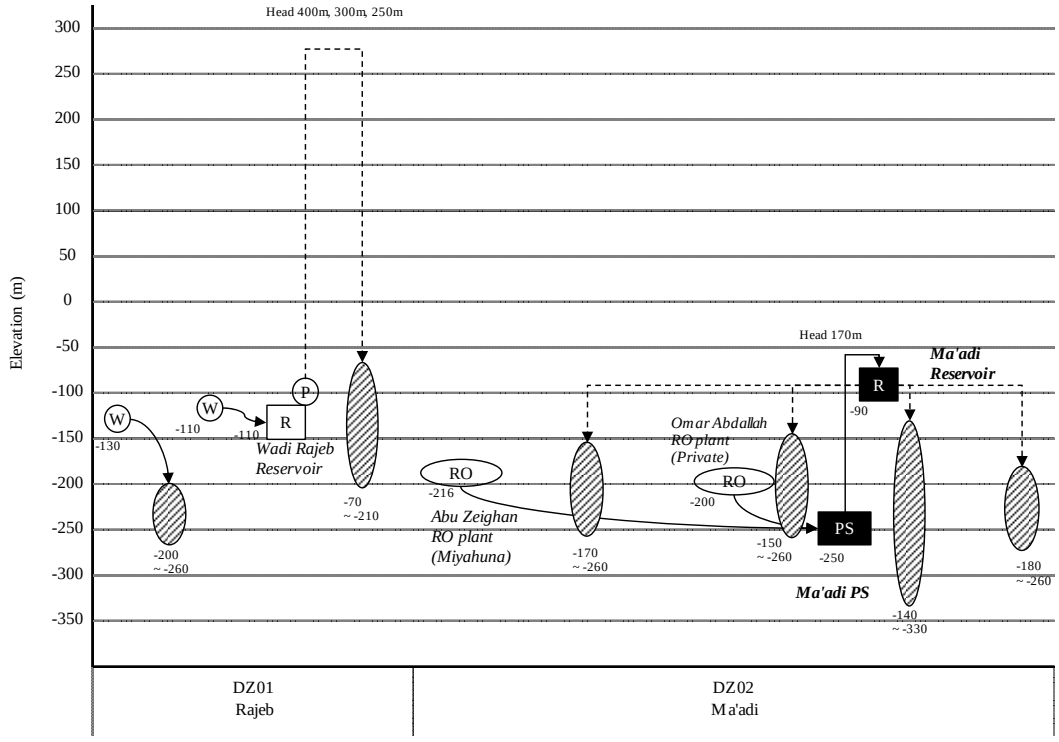


Figure 2-15 Schematic of existing and proposed transmission systems and daily flow rates (Deir Alla)



(Existing water supply system)



(Proposed water suply system)

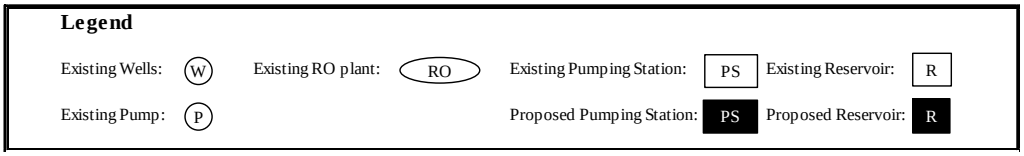


Figure 2-16 Comparison of elevation profile of existing and proposed water supply systems (Deir Alla)

2.2.2.3 Distribution Reservoir Design

(1) Distribution reservoir land

The sites of Abu Nussair 1 and Abu Nussair 2 distribution reservoirs are owned by private, but the distribution reservoir sites and the land around them are open space; so there will likely not be a major problem in acquiring the land.

(2) Structure and foundation of distribution reservoir

The economic effective water depth of a reinforced concrete (RC) distribution reservoir is 3 to 6 m. The proposed site is adequate in size, and the effective water depth of the proposed distribution reservoir of RC construction (rectangular) is about the same as mentioned above.

Since the soil at the proposed site has adequate bearing capacity for the foundation ground, a direct foundation will be used for the distribution reservoir. Arrangement of reservoir structure in the site will be proposed such that structure at the planned ground level of the distribution reservoir will be directly placed on natural ground so that the bearing capacity of the foundation ground is effectively utilized.

(3) Distribution reservoir capacity

The table below shows the facility plan of the existing and proposed distribution reservoirs of Ain Al Basha and Deir Alla.

Table 2-16 Distribution reservoir plan for Ain Al Basha

Zone No.	Name of distribution reservoir	Effective capacity			Ground height	Effective depth (m)	Site type	Access road
		Existing	New	Total				
DZ01	Abu Nussair 1	—	900	900	866.8	4.1	Private	Not required
DZ02	Abu Nussair 2	—	1,100	1,100	926	3.9	Private	Not required
DZ03	Al Baqa'a	2,000	—	2,000	—		—	—
DZ04	Eskandanavian	—	—	—	—		—	—
DZ05	Safout	300 + 500	—	800	—		—	—
Total		2,800	2,100	4,900	—		—	

Table 2-17 Distribution reservoir plan for Deir Alla

Zone No.	Name of distribution reservoir	Distribution reservoir capacity			Ground height (m)	Effective depth (m)	Site type	Access road
		Existing	New	Total				
DZ01	Rajeb	1,000	－	1,000	－		－	－
DZ02	Ma'adi	－	3,300	3,300	-91.2	4.2	Public	Required
Total		－	3,300	4,300	－		－	－

(4) Accessories

The following accessory equipment and materials will be provided in each distribution reservoir:

1) Waterproof coating (epoxy coating) applied in the distribution reservoir
2) Overflow and discharge pipes will be installed in addition to influent and effluent pipes
3) Bulk meter (electromagnetic flow meter) will be installed in the effluent pipe
4) Mechanical water level indicator will be installed
5) Level regulating valve will be installed to prevent overflow

2.2.2.4 Pumping Station Design

(1) Overall plan of Ma'adi pumping station

The pumping station (P/S) is proposed to be a transmission P/S for conveying water up to the distribution reservoir at constant flow rate, accompanying a stand-by pump. To ensure smooth pumping operation, a pump suction pit will be installed in the pumping station with a one-hour pump operation capacity. The installation level of the suction pit is higher than that of the pump center for allowing initial pump operation without any priming system. The proposed site of the pumping station is inside the WAJ Deir Alla office. The table below shows the plan of the pumping station.

Table 2-18 Pumping station plan

Name of P/S	Purpose	Suction pump pit	Site type	Access road
Ma'adi	For transmission of water from Miyahuna Water Company and private (Omar Abudulla) RO plants to Ma'adi distribution reservoir	280 m^3	Public	Not required

(2) Plan of pumping equipment

Since the pump head in the proposed pumping station is large, horizontal axis multistage centrifugal pump will be used. Flywheel will be used for measures against water hammer effect. Connecting power supply to the pumping equipment is the responsibility of the counterpart; however, power distribution network is provided near the pumping station, so power distribution work may not be

required to perform afresh. Electric equipment included in this plan are incoming panel and pump control panel. The incoming panels will suit the counterpart's 400-V, 50-Hz and 3P4W power supply specifications. Specifications of the pumping equipment are given below. The result of water hummer measure is given in Appendix-6.5.

Table 2-19 Specification of pump facilities

Name of P/S	Capacity		Head	Quantity (Stand-by)	Flywheel	Electric motor	
	m^3/min	m^3/h	m				
Ma'adi	2.35	141	170	3 no.(1 no.)	25 kg-m^2	110 kW	400 V, 50 Hz, 1,480 min^{-1}

Note: Pump efficiency varies depending on the motor output of each manufacturer; therefore the values given are for reference only.

(3) Accessories

The following will be installed as accessories in the pumping station:

- Check valve
- Motor-driven discharge valve
- Chain block for operation and maintenance

2.2.2.5 Pipeline Design

(1) Total pipeline length

The total pipeline length by diameter and by area under this plan is shown as below.

Table 2-20 Total pipeline length by diameter and by area

Bore	Length (m)
Ain Al Basha	
100mm	350
150mm	5,740
200mm	4,700
250mm	540
300mm	8,750
Sub total	20,080
Deir Alla	
150mm	1,090
200mm	0
250mm	4,450
300mm	9,620
Sub total	15,160
Total	
100mm	350
150mm	6,830
200mm	4,700
250mm	4,990
300mm	18,370
Total	35,240

(2) Type of pipe and joint

WAJ's policy for selection of type of pipe are to use ductile cast iron pipe (DCIP) when the pipe diameter is 100 mm and greater, and to use high density polyethylene (HDPE) pipe when the pipe diameter is below 100 mm. The pipe diameter for this project is less than 100 mm; therefore, DCIP pipes will be used. The design pressures of the pipe in gravity flow system and pumping flow system are taken as maximum hydrostatic pressure plus water hummer and maximum dynamic water pressure plus water hummer, respectively.

Joints of DCIP pipes should have excellent workability and should be economical. To ensure water tightness, T-type ductile pipe (push-on type) will be used.

The calculated dynamic water pressure levels are shown in the outline design drawings for transmission mains and Appendix 6.11 for distribution and conveyance mains.

(3) Accessories

- Air valve (single-mouth air valve) and drain valve will be installed at the required locations along the pipeline, and sluice valve installed for operation and maintenance of the pipeline. In principle, sluice valves should be installed at every 2 km approximately along straight pipeline sections.
- To control supply pressure to the appropriate level, pressure-reducing valves (PRV) will be installed at the necessary locations. This is described in the following section.
- Bulk meter (electromagnetic flow meter) will be installed at the connection point of the

proposed transmission line branched off from the Zai - Dabouq transmission pipeline.

- Bulk meter (mechanical flow meter) will be installed with the aim of measuring the distribution amount of DMA.
- Since urban roads and trunk lines are many for the proposed pipeline routes, restraint joints will be used for protecting all pipe fittings in order to increase the work efficiency.

(4) Construction

- Jordan national standards will be adhered to when laying distribution pipelines. Standards of MOPH will be used for laying pipelines along national roads and WAJ standards used for laying pipelines along governorate roads.
- The branch of the new transmission pipeline from the Zai - Dabouq transmission pipeline will be connected by the method of non-suspension of water so as to not stop the transmission of water from the Zai water treatment plant to Amman.
- Siphon culverts will be used at all crossings of wadis.
- Aqueduct bridges will be used for the crossing of the King Abdullah canal at Deir Alla (see figure below for Deir Alla).
- Trenchless construction method will be used since excavation of trunk roads was not approved during discussions with MOPH. Casing pipe system will be used under this plan; its location and description are given below in Figures 2-17 and 2-18.

Item	Pipe Diameter				
	Single pipe in a casing			Two pipes in a casing	
Pipe (DCIP)	100mm	250mm	300mm	150mm+200mm	150mm+300mm
Casing (steel pipe)	400mm			900mm	
Adopted jacking method	Small calibre jacking method (Mechanical horizontal boring method)			Blade jacking method (Conventional method)	

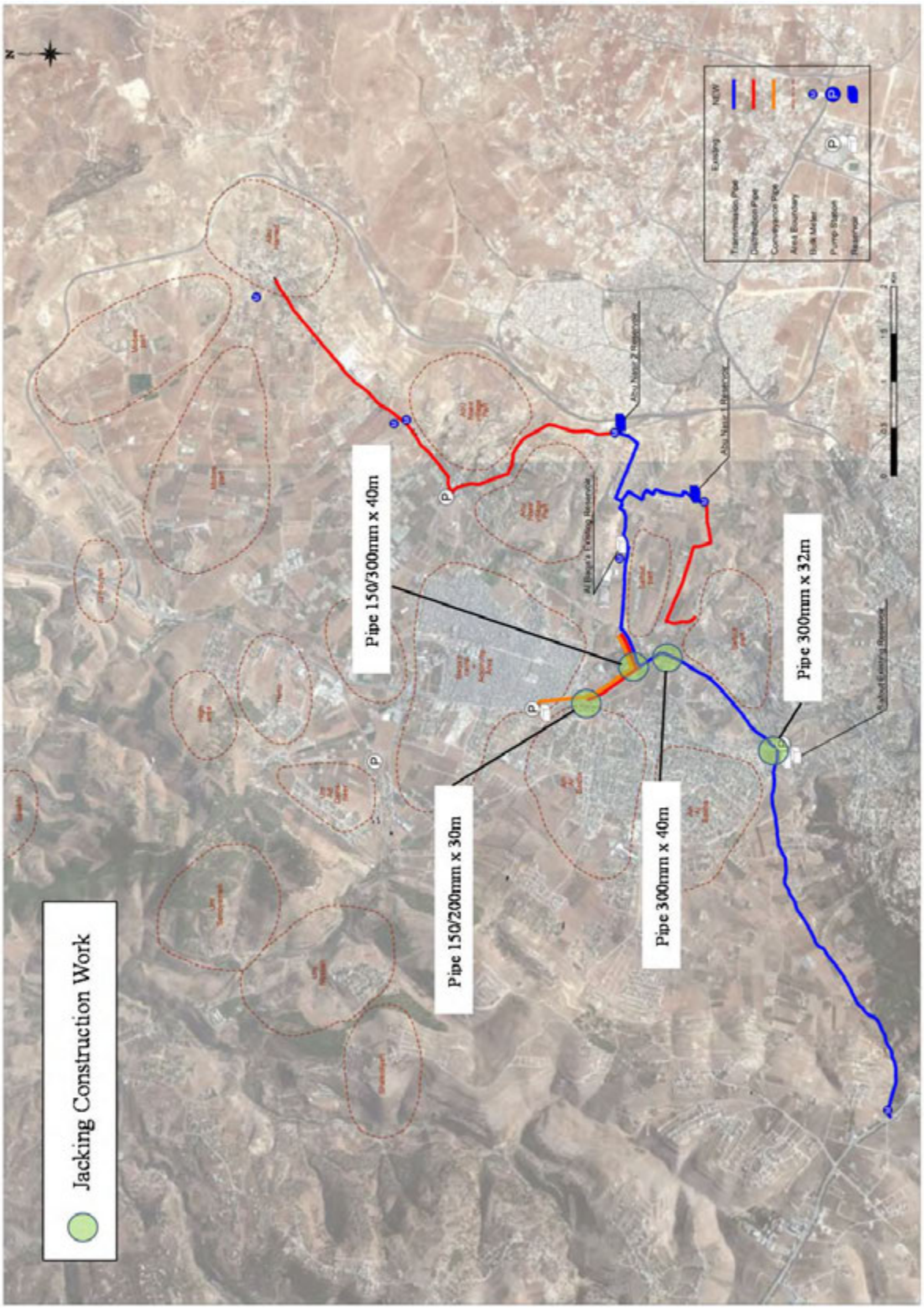


Figure 2-17 Construction locations of distribution pipeline work by trenchless construction method (Ain Al Basha)

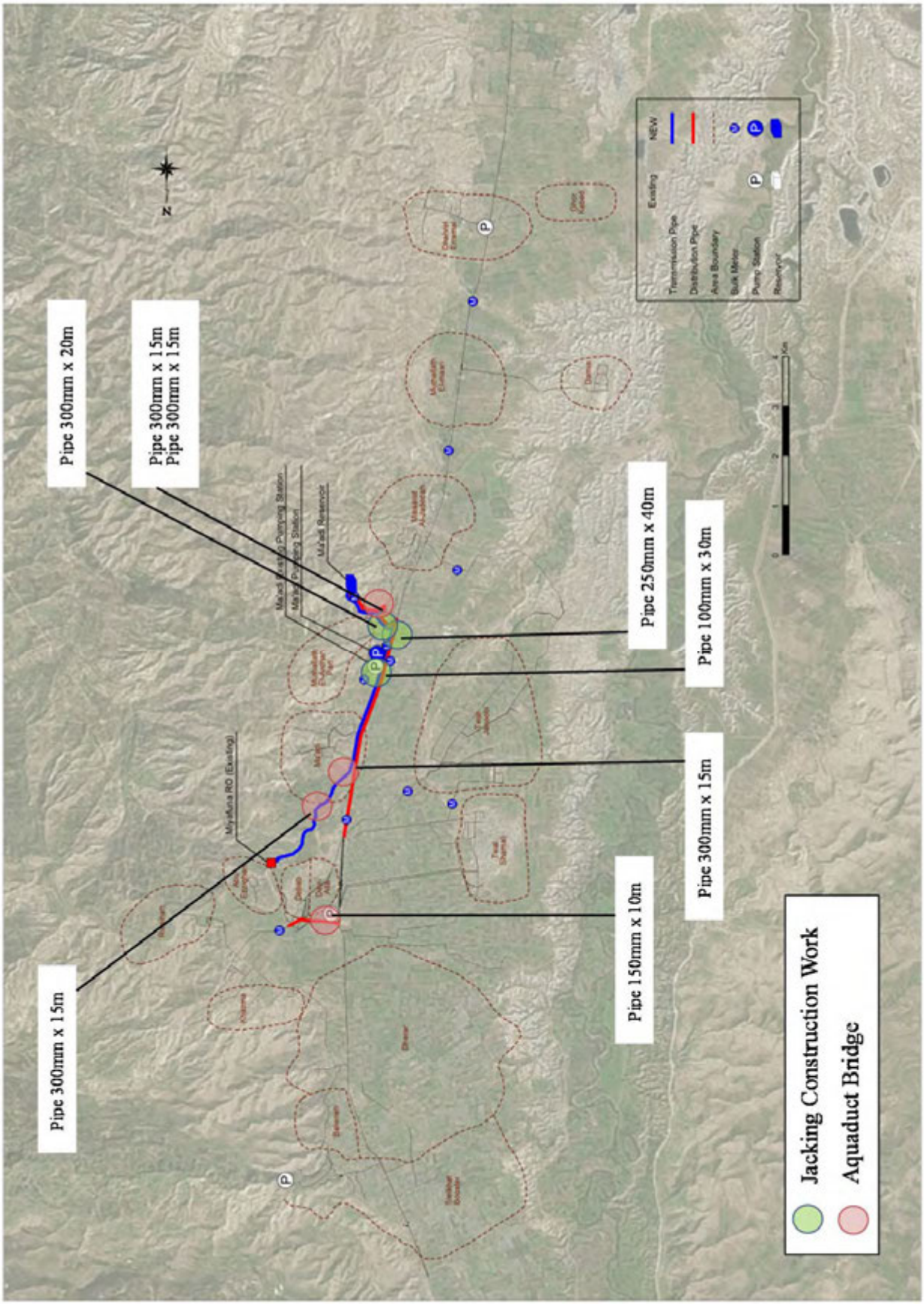


Figure 2-18 Construction locations of distribution pipeline work by trenchless construction method and by aqueduct bridges (Deir Alla)

(5) Pressure-reducing valve design

The elevation profile of the distribution zone is undulating in the target zone, and it is difficult to satisfy the proposed water supply pressure (2.5 bars to 7 bars). The proposed water supply pressure will be maintained in this project by installing pressure-reducing valves (PRV) in the distribution pipelines. Water is distributed by gravity flow from the distribution reservoir; therefore, the required dynamic water pressure will be maintained so as to maintain appropriate supply pressure and at the same time, the static pressure will also be controlled. The pressure-reducing valve plan determines the appropriate location of the valve based on the results of hydraulic calculations. The pressure reduction range will be decided for the pressure reducing valve such that cavitation does not occur. The mechanism of PRV is given in Appendix-6.6.

PRVs will be installed at one location in the distribution pipeline from the Abu Nussair 1 distribution reservoir and at four locations in the distribution pipeline from the Abu Nussair 2 distribution reservoir in Ain Al Basha (See Figure 2-20). PRVs will be installed at six locations at the inlet of DMA in Deir Alla (Figure 2-21). The specifications of the pressure-reducing valves are shown in Table 2-21 and Table 2-22 for each area. In addition, the hydraulics of PRV is shown in Figure 2-19.

Table 2-21 Specification of PRV (Ain Al Basha)

Distribution zone	Distribution reservoir	NO	Pipe size mm	PRV size mm	Primary hydrostatic pressure level m	PRV level m	Primary hydrostatic head m	Primary dynamic head m	Secondary hydrostatic head m	Pressure-reduction range m
DZ01	Abu Nussair1	PRV1	200	100	872	696	176	165	120	45 - 56
DZ02	Abu Nussair2	PRV2	150	80	930	843	87	78	20	58 - 67
		PRV3	100	80	930	756	174	162	40	122 - 134
		PRV4-1	100	80	930	714	216	192	80	112 - 136
		PRV4-2	100	80	794	709	85	80	30	50 - 55

Table 2-22 Specification of PRV (Deir Alla)

Distribution zone	Distribution reservoir	NO	Pipe size mm	PRV size mm	Primary hydrostatic pressure level m	PRV level m	Primary hydrostatic head m	Primary dynamic head m	Secondary hydrostatic head m	Pressure-reduction range m
DZ02	Ma'adi	PRV2	150	100	-85	-226	141	81	40	41 - 101
		PRV3	150	80	-85	-250	165	135	110	25 - 55
		PRV4	100	50	-85	-239	154	125	80	45 - 74
		PRV5	180	50	-85	-240	155	125	30	95 - 125
		PRV6	100	50	-85	-261	176	128	40	88 - 136
		PRV8	150	50	-85	-216	128	61	25	36 - 103

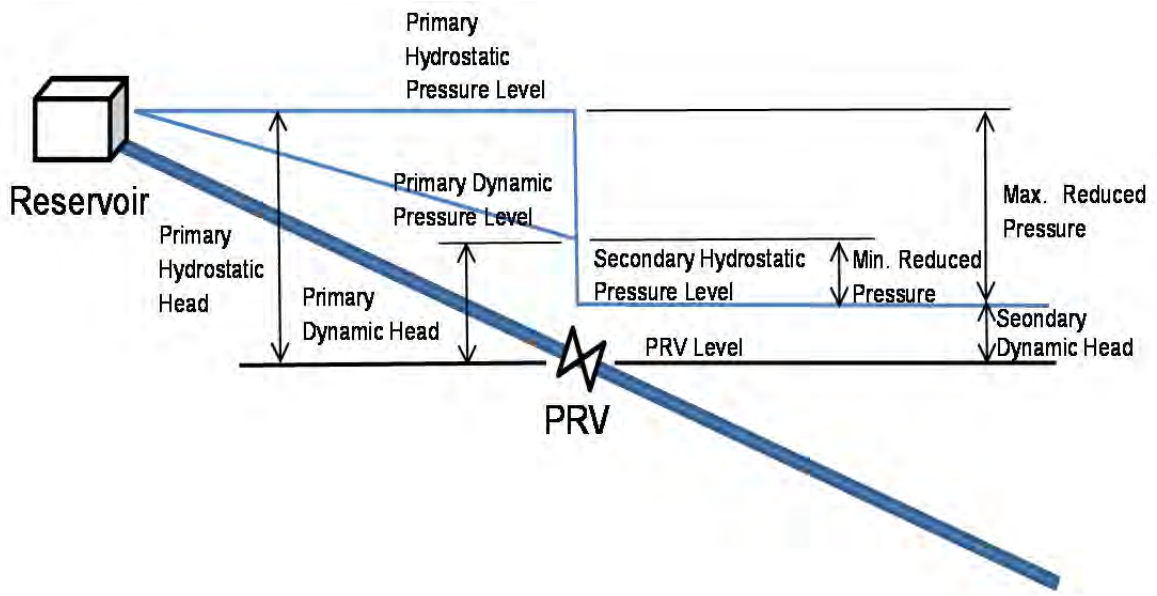


Figure 2-19 Hydraulics of PRV

1) Pressure-reducing valve and its installation method

To avoid the frequency PRV problems as much as possible, a safety valve will be installed when the abnormal pressure increases on the secondary side and exceeds the planned pressure. Furthermore, a strainer will be installed on the primary side to avoid flow of debris into the main body of PRV. A bypass pipeline will be installed for operation and maintenance of the pressure-reducing valve. The diameter of all bypass pipelines will be 80 mm, and the accessories listed below will be provided for each PRV.

Table 2-23 Accessories of pressure-reducing valve

Accessories	No. of parts	Installation location
Strainer	1	Upstream of PRV
Sluice valve (for O&M of PRV)	2	Upstream/downstream of PRV
Sluice valve (for bypass pipe)	1	Bypass pipe (80 mm)
Safety valve	1	Downstream of PRV
Air valve	2	Upstream/downstream of PRV
Pressure gauge	2	Upstream/downstream of PRV
Bypass pipe (80mm)	1	

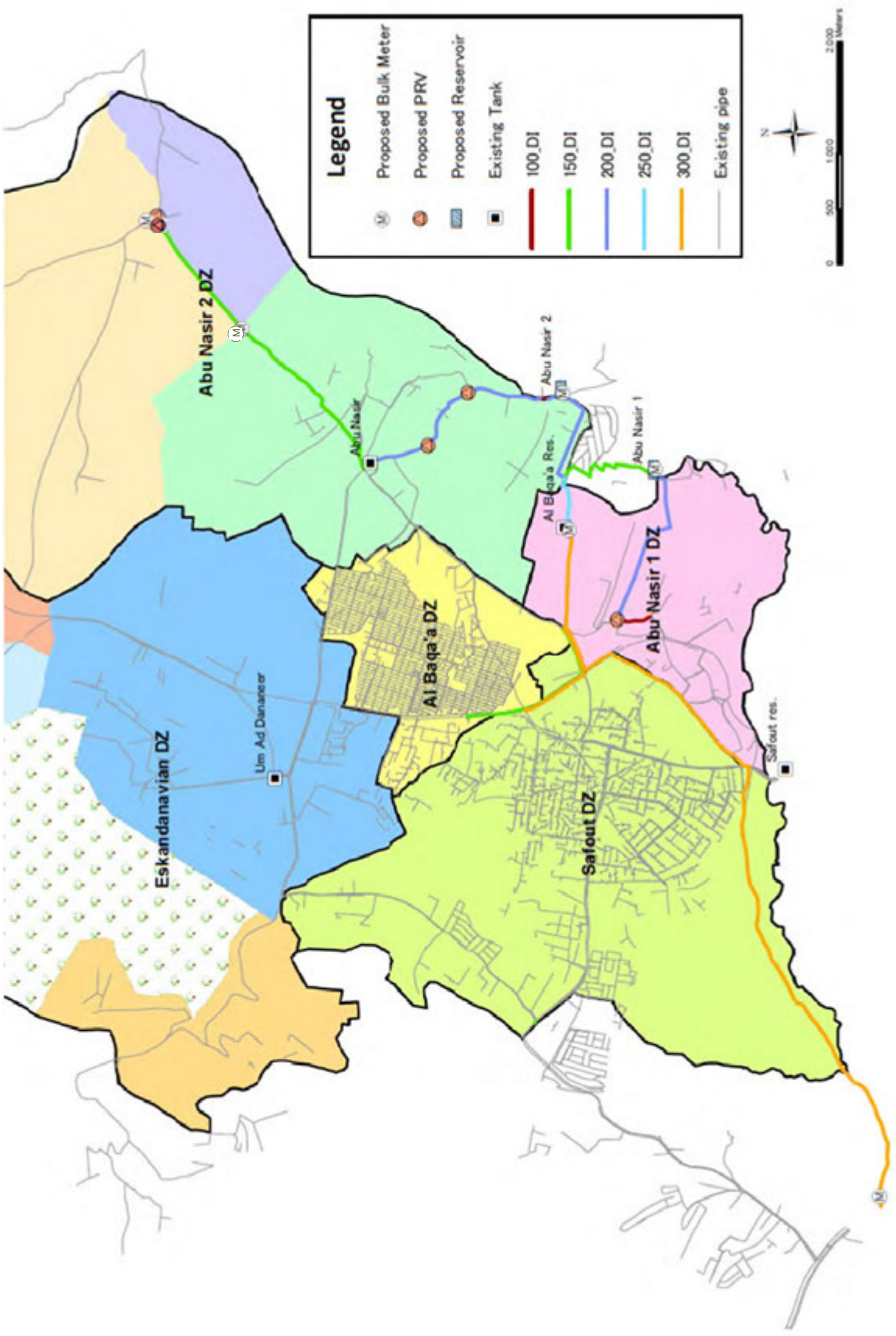


Figure 2-20 Location of pressure-reducing valve and flow meter (Ain Al Basha)

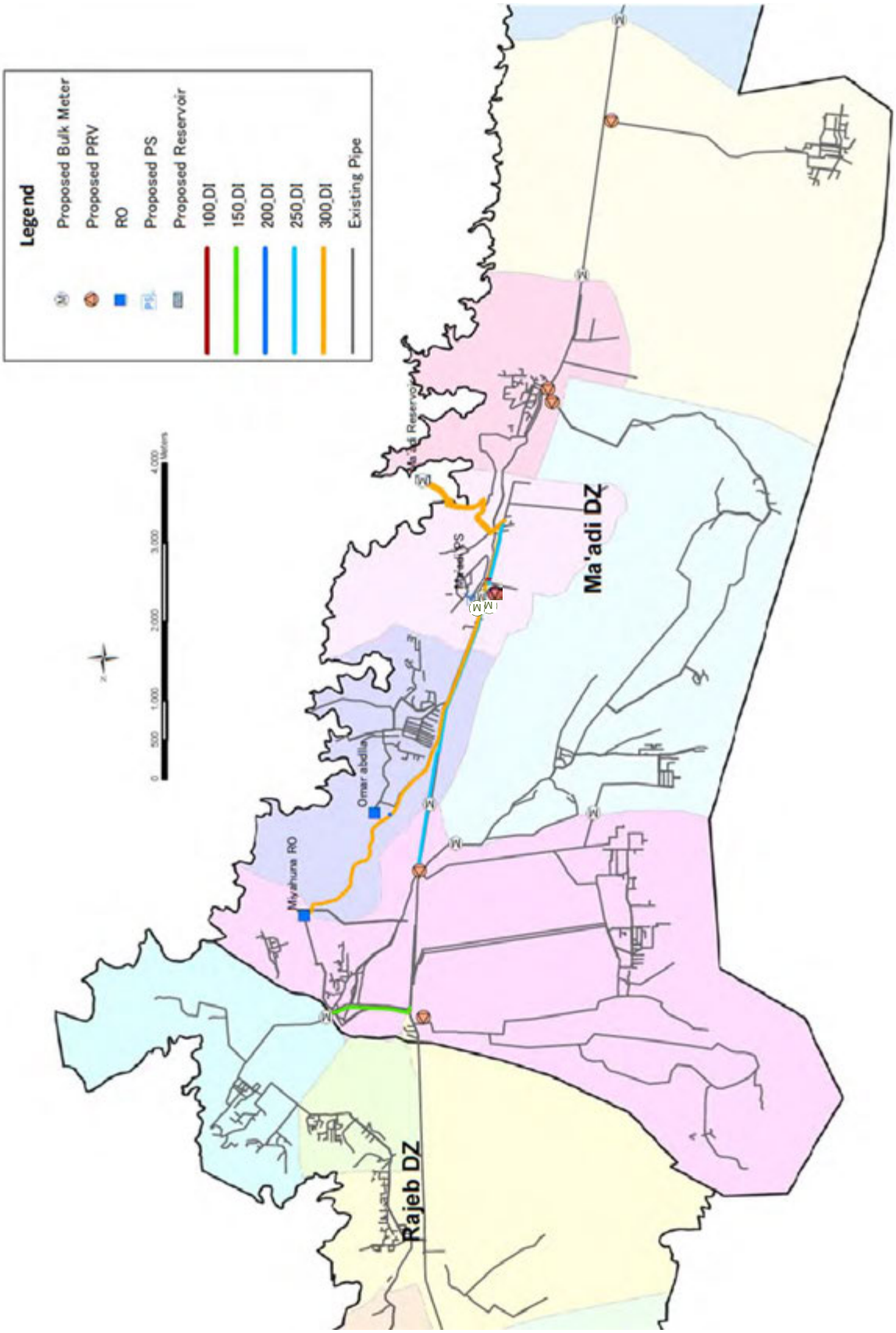


Figure 2-21 Location of pressure-reducing valve and flow meter (Deir Alla)

(6) Conceptual design of monitoring system

Monitoring system will be proposed with the aim of distribution management in the distribution zones. The key items in distribution management are flow rate management and water pressure management. The installation of measuring equipment required for management of these items will be proposed. After completion of the construction, soft component related to distribution management will be implemented. Training will be given to WAJ employees related to methods of operation and maintenance of measuring equipment, data collection, tabulation and data analysis, and methods of adoption of the analyzed results in distribution management.

1) Flow meter

To measure the flow rate to each DMA and the flow rate from the distribution reservoir, electromagnetic flow meters and mechanical flow meters will be used for flow rate measurements of distribution reservoir and DMA, respectively. Flanged joints will be used in flow meters and valves for operation and maintenance will be installed on both sides of the flow meters. Tables 2-24 and 2-25 give specifications of the flow meter and Figures 2-20 and 2-21 show their locations.

Table 2-24 Specifications of flow meter (Ain Al Basha)

No.	Type	Pipe diameter mm	Bore mm	Flow meter side	Remarks
FM1	Electromagnetic flow meter	300	250	Transmitted amount from Zai WTP using new transmission pipeline	
FM2	Electromagnetic flow meter	300	250	Distribution amount of Al Baqa'a distribution zone	DMA of Al Baqa'a distribution zone at 1 location
FM3	Electromagnetic flow meter	200	150	Distribution amount of An Nussair 1 distribution zone	DMA of An Nussair 1 distribution zone at 1 location
FM4	Electromagnetic flow meter	200	150	Distribution amount of An Nussair 2 distribution zone	DMA of Abu Nussair 2 distribution zone at 3 locations and a outlet of a reservoir
FM5	Mechanical flow meter	150	100	DMA distribution amount in An Nussair 2 distribution zone	
FM6-1	Mechanical flow meter	100	80	DMA distribution amount in An Nussair 2 distribution zone	
FM6-2	Mechanical flow meter	150	100	DMA distribution amount in An Nussair 2 distribution zone	

Table 2-25 Specifications of flow meter (Deir Alla)

No.	Type	Pipe diameter mm	Bore mm	Flow meter side	Remarks
FM1	Electromagnetic flow meter	300	250	Amount transmitted to Ma'adi distribution reservoir	Installed in discharge pipe of Ma'adi pumping station
FM2	Electromagnetic flow meter	300	250	Amount distributed from Ma'adi distribution reservoir	Installed in discharge pipe of Ma'adi distribution reservoir
FM3	Mechanical flow meter	250	200	Distribution main (supply amount to Northern Part)	Installed in new pipeline
FM4	Mechanical flow meter	150	100	Distribution main (supply amount to Southern Part)	Installed in existing pipeline
FM5	Mechanical flow meter	150	100	Distribution main (supply amount to Southern Part)	Installed in existing pipeline
FM6	Mechanical flow meter	150	100	DMA distribution amount of Ma'adi distribution zone	Installed in new pipeline
FM7	Mechanical flow meter	150	100	DMA distribution amount of Ma'adi distribution zone	Installed in existing pipeline
FM8	Mechanical flow meter	150	100	DMA distribution amount of Ma'adi distribution zone	Installed in existing pipeline
FM9	Mechanical flow meter	100	100	DMA distribution amount of Ma'adi distribution zone	Installed in existing pipeline
FM10	Mechanical flow meter	100	80	DMA distribution amount of Ma'adi distribution zone	Installed in existing pipeline
FM11	Mechanical flow meter	100	80	DMA distribution amount of Ma'adi distribution zone	Installed in existing pipeline

2) Water pressure gauge

As mentioned in the pressure-reducing valve plan above, water pressure gauges will be installed upstream and downstream of the pressure-reducing valve.

2-2-3 Outline Design Drawings

Outline design drawings are listed below. The outline drawings are attached to Attachment-1 of this report.

Table 2-26 Outline design drawing list (Ain Al Basha)

Drawing No.	Drawing Title
AL-GN-01	General site plan (Ain Al Basha)
AL-TP-01	Plan and profile of transmission line from connection NO.1 to Al Baqa'a existing reservoir (1/5)
AL-TP-02	Plan and profile of transmission line from connection NO.1 to Al Baqa'a existing reservoir (2/5)
AL-TP-03	Plan and profile of transmission line from connection NO.1 to Al Baqa'a existing reservoir (3/5)
AL-TP-04	Plan and profile of transmission line from connection NO.1 to Al Baqa'a existing reservoir (4/5)
AL-TP-05	Plan and profile of transmission line from connection NO.1 to Al Baqa'a existing reservoir (5/5)
AL-TP-06	Plan and profile of transmission line from Al Baqa'a existing reservoir to Abu Nussair 2 Reservoir
AL-TP-07	Plan and profile of transmission line from connection NO.2 to Abu Nussair 1 Reservoir
AL-RV-01	Layout plan of Abu Nussair 1 Reservoir ($900m^3$)
AL-RV-02	Structural plan and section view of Abu Nussair 1 Reservoir ($900m^3$)
AL-RV-03	Layout plan of Abu Nussair 2 Reservoir ($1,100m^3$)
AL-RV-04	Structural plan and section view of Abu Nussair 2 Reservoir ($1,100m^3$)
Common	
TD-01	Typical trench cross section for pipeline in the road under municipality
TD-02	Typical trench cross section for pipeline in the road under MPWH
TD-03	Details of flow meter chamber (electromagnetic type)
TD-04	Details of flow meter chamber (mechanical type)
TD-05	Typical drawing of pressure reducing chamber and air valve chamber
TD-06	Typical drawing of pit for outlet and drain pipe

Table 2-27 Outline design drawing list (Deir Alla)

Drawing No.	Drawing Title
DA-GN-01	General site plan (Deir Alla)
DA-TP-01	Plan and profile of transmission line from existing RO plant to Ma'adi pumping station (1/3)
DA-TP-02	Plan and profile of transmission line from existing RO plant to Ma'adi pumping station (2/3)
DA-TP-03	Plan and profile of transmission line from existing RO plant to Ma'adi pumping station (3/3)
DA-TP-04	Plan and profile of transmission line from Ma'adi pumping station to Ma'adi reservoir (1/2)
DA-TP-05	Plan and profile of transmission line from Ma'adi pumping station to Ma'adi reservoir (2/2)
DA-RV-01	Layout plan of Ma'adi Reservoir ($3,300m^3$)
DA-RV-02	Structural plan and section view of Ma'adi Reservoir ($3,300m^3$)
DA-RV-03	Access road for Ma'adi Reservoir
DA-PS-01	Layout plan of Ma'adi pumping station
DA-PS-02	Structural plan and section view of Ma'adi pumping station
DA-PS-03	Structural plan and section view of Ma'adi pump suction tank
DA-PS-04	Single lone diagram of Ma'adi pumping station
DA-PS-05	Doors and windows schedule in Ma'adi pumping station

2-2-4 Implementation Plan

2.2.4.1 Implementation Policy

This project will be implemented in accordance with the framework of Japan's grant aid scheme. Following approval by the Governments of Jordan and Japan, the Exchange of Notes (E/N) regarding the detail design will be signed to initiate the actual implementation process of the project. Subsequently, the Water Authority of Jordan (WAJ), which is the implementation agency of the Government of Jordan, will conclude a contract with a Japanese consultant and construction company, and the detail design and construction work will be implemented.

Considering the framework of grant aid and the content of construction of facilities, the construction plan will be formulated for the project to which aid is applicable, in accordance with the basic guidelines below.

(1) Project Implementing Entity

The national organization in Jordan responsible for the supervision related to this project will be the Ministry of Water and Irrigation (MWI). The WAJ will take up the role of the organization implementing the project under this Ministry. The WAJ is responsible for the water supply and sewerage project of the whole country. It consists of eight Directorates (3 Water Affairs for operation and maintenance of Middle, South and Yarmouk governorates, Technical Affairs, Production & Conveyance, Administration, Laboratories and Quality and Finance). The responsible department related to design and construction work in this project is the Technical Affairs Directorate, and the operation and management after completion of the facilities will be implemented by the WAJ Balqa office, belonging to Middle District Water Administration.

(2) Consultant

The Japanese consultant company will conclude an agreement with the project-implementing agency of the Government of Jordan, and will perform the detail design and work supervision. The consultant will also prepare the tender documents, examine the tenderer's qualifications, and assist in the tendering work for selecting the contractor by open tender. After the start of construction of the facilities, the consultant will supervise the construction from an objective standpoint and also ensure that the grant aid is being appropriately utilized.

(3) Contractor

In accordance with the framework of Japan's grant aid scheme, the Japanese contractor selected

through open tendering will carry out the construction of facilities according to the construction plan. As the construction work is to be performed at a remote site quite different from the social environment and social background in Japan, the contractor is required to possess adequate capability to complete the work overseas. Furthermore, since this plan requires the use of locally-procured materials and equipment, and work in congested urban areas, the contractor should be adequately aware of the local market, local labor laws, the geography of the place, the local customs and acceptable practices.

The contractor will maintain a proper communication system even after handing over the facilities after completion of the project since after care services, such as response to breakdowns and procurement or replacement parts will be necessary during maintenance and management after completion of the project.

2.2.4.2 Implementation Conditions

The precautions to be taken related to the formulation of the construction plan are as given below.

(1) Construction of Transmission and Distribution Pipelines

The routes for laying the pipelines include main trunk roads and service roads where the traffic volume is high; thus, third-party safety measures, measures against effects of traffic, and measures against existing buried objects become important. Considerations are necessary for preventing any adverse effects on the activities of the local industries and businesses, as far as possible.

The work of laying pipelines in sections other than main trunk roads and urban areas should be performed during the daytime by the open-cut method. The work of laying pipelines in sections within the urban areas and main trunk roads will be performed by the open-cut method at night time considering the industrial and business activities at the site.

The work of laying pipelines will be the critical path in the project due to the long length of pipelines. Therefore, effective construction sequence of the work of laying pipelines in each area will be considered and the necessary and rational construction period will be calculated.

(2) Procurement of materials

Basic materials, such as cement, aggregate and reinforcement bars etc. can be procured in the local markets. However, ductile iron pipes for transmission and distribution pipelines cannot be procured in the local markets; thus, it should be imported from the third countries or Japan. The pump equipment also will be imported from third countries or from Japan.

Basic labor force and construction machines can be procured in the local markets, however, the local sub-contractors with the ability to meet with specifications and quantity of the project have an office in Amman. Therefore, the procurement of engineers and construction materials is assumed to take place in Amman.

(3) Treatment of the existing asbestos pipes

Existing pipes in the target area contain many asbestos pipes, especially in Deir Alla. Unnecessary existing asbestos pipes should be hydraulically detached and left in ground as it is after installation of the new pipes. Connection with existing asbestos pipes should be carried out not by cutting asbestos pipes, but by attaching joint as much as possible. Unnecessary existing asbestos pipe pieces after the connection work should be carried away to the appropriate place designated by Jordanian side. The work should basically comply with the Guidelines of Asbestos Work of Ministry of Health, Labor and Welfare in Japan.

2.2.4.3 Scope of Works

The scope of works by Japan and by Jordan is shown in Table 2-28.

Table 2-28 Demarcation of construction works of facilities between the two countries

Construction/Procurement & Installation	Japan	Jordan
1. Construction work of distribution reservoir		
(1) To acquire the land for reservoir construction sites		●
(2) To reclaim and level the land	●	
(3) To construct distribution reservoirs	●	
(4) To supply primary power of required capacity		●
(5) To construct the access road to Ma'adi reservoir	● (base course)	● (asphalt)
(6) To construct road paving, lighting, vegetation, fencing, gates, etc., within the site		●
(7) To lay drain pipe from the site to discharge place	●	
2. Construction of new Ma'adi pumping station		
(1) To acquire the land for the new pumping station		●
(2) To reclaim and level the land for the new pumping station		●
(3) To construct the new pumping station	●	
(4) To supply primary power of required capacity (to install a new electricity receiving facility or update the existing ones)		●
3. Installation work of conveyance, transmission and distribution pipeline		
(1) To install conveyance pipelines	●	
(2) To install transmission pipelines	●	
(3) To install distribution pipelines	●	
(4) To install flow meters	●	
(5) To install pressure reducing valve (PRV)	●	
(6) To coordinate for required approvals and permissions to implement construction works, and procedure for traffic control during construction period in the road		●
(7) To cooperate in piping work, such as coordination in water cut off,		●

Construction/Procurement & Installation	Japan	Jordan
communication for water cut, presence at site during piping works when required, etc.		
4. Soft-component		
(1) To provide required equipment and training room for soft component		●
(2) Implementation of soft-component	●	
5. Common items for construction works		
(1) To provide temporary stock yards for construction materials and machinery and lands for temporary works		●
(2) To take all necessary measures to secure disposal sites for excavated debris and drains for wastewater from construction works		●
(3) To provide necessary water and chemicals (chlorine) for trial operation of the constructed facilities		●

2.2.4.4 Consultant Supervision

(1) Work supervision system of consultant

The consultant will supervise and offer guidance to the contractor to achieve "completion of construction of facilities within the predetermined work period," "the work indicated in the contractual drawings," and "implementation of safe work." Furthermore, the consultant also has the role of supervising and confirming from a neutral standpoint that the construction of the facilities is being implemented appropriately under the framework of grant aid.

1) Main supervisory duties of consultant

The description of the main supervisory duties that the consultant is required to perform is given below.

a) Progress control

The consultant will confirm the validity of the progress chart submitted by the contractor, compare the actual progress of construction of facilities with the progress shown in the progress chart, and confirm the progress status of the work daily, monthly and weekly. If delay is a cause for concern, the consultant will issue a warning to the contractor. If a delay occurs, the consultant will study and investigate the causes and measures together with the contractor, and will guide the contractor in the adoption of the required measures. The work supervision will include the following:

- Checking the amount of work done
- Results of input and output of important materials and equipment
- Results of input and output of engineers, workers, etc.

b) Quality control

The quality of facilities and work specified in the agreement will be ensured. If there is concern about ensuring quality, the consultant will issue a warning to the contractor and also request that the required modifications and measures be adopted. Quality supervision will be implemented using the

measures below.

- Verification of catalogs, specifications, and manufacturing drawings of materials and equipment
- Verification of test results of materials and equipment
- Site inspection of test of materials and equipment
- Verification of construction drawings and method of installation of equipment prepared by contractor
- Site inspections, such as inspection of rolling, reinforcing bar arrangement, and concrete strength during work
- Site checks of work implementation status, work methods, etc., and guidance
- Witnessing the trial operation and inspecting the performance
- Binding supervisory records and submitting them to the Client

c) Safety control

The consultant will perform the validity check of the safety control plan of the contractor and check its implementation status. The consultant will supervise the work on site beforehand to prevent accidents at work and accidents to a third party. Safety control will be implemented using the measures below.

- Confirm the measures for safety control plan and the presence of a safety control manager appointed by contractor
- Confirm the validity of the safety control plan proposed and the safety manager appointed by contractor
- Confirm the status of progress of the safety control plan
- Check the scheduled operating route of work vehicles, confirm the validity of precautions during operation, and adherence to the plan
- Check the content of the benefit system for workers and confirm that holidays and recesses are being enforced.

The routes for bringing in construction materials and equipment, and the time of transporting the same will be appropriately arranged. Measures such as arranging adequate watchmen during day and night times will be adopted.

2) Work supervision system

The consultant will aim to implement the project smoothly and effectively by building the necessary work supervision system with the focus on construction schedule control, quality control and safety control of the processes mentioned above. In this case, work supervision considering the gist of the basic design is necessary, therefore, a system consistent with the series of tasks of basic design, detail design and work supervision will be built. The consultant will build the supervision systems mentioned below since work supervision needs to be implemented in both Japan as well as at the site.

a) On-site work supervision

Since it is important to confirm that the construction work is being performed appropriately under the framework of grant aid, the work supervision on site needs to be performed by Japanese engineers who thoroughly understand the grant aid scheme. The Japanese work supervision system on site considered necessary for this project is shown in the table below. During the work period, the quality of work will be confirmed by engineers in charge of design and the chief consultant, who is in charge of the entire project including work within Japan, and who will give instructions to the work supervisors at the appropriate time. The consultant will also employ local engineers, and implement work supervision using the local engineers together with the Japanese engineers.

Table 2-29 Japanese supervision organization on site

Job title	Field	No. of field trips	Responsible for
Supervision engineer (Chief consultant)	1.5	3	Overall work supervision, checking kick-off meetings, site conditions, delivery on site, construction overview every year, client communication and defect liability inspection
Resident representative supervision engineer	19.5	3	Resident supervision during construction, site inspection on soil bearing capacity, procurement materials, piping materials and so on at the beginning, and supervision of structures, final inspection on reservoirs
Piping work supervision	10.0	1	Supervision of piping works
Mechanical work supervision (Pumping facility)	2.0	2	Final inspection of mechanical facility of pumping station, PRVs and flow meters
Electrical work supervision (Pumping facility)	2.0	2	Final inspection of electrical facility of pumping station, PRVs and flow meters
Completion inspection	0.23	1	Inspection for completion
Total	35.23	11	

b) Work supervision in Japan

Systems necessary for overall supervision of the project mentioned below will be maintained in Japan, and the overall work supervision including work at site and work in the country will be supervised.

- Checking the contents of the agreement, schedule, progress and quality
- Studies to resolve issues that have occurred on site and instructions to contractors
- Technical and financial assistance for consultant's local offices

(2) Contractor's work control system

Some parts of reservoir construction work and piping installation work can be carried out by local subcontractors. However, piping works such as jacking method and non-suspension water method should be performed by Japanese experts and skilled technicians. Laying of transmission and distribution pipelines will be performed in trunk roads near important facilities and buildings,

therefore, strict safety controls are necessary.

For this reason, contractors with extensive overseas experience in similar work with overall quality, process and safety controls must be selected. Resident and short term engineers of contractors required according to the scale and type of the facilities of the project may be as assumed below.

Table 2-30 Contractor's work control system

Job title	Responsible for
Resident representative engineer	As the person responsible for the large scale project in Balqa Governorate, resident representative is in charge of discussions with related government organizations of Jordan and with relevant construction companies, checks and adjustments of various work ranges and processes, formalities such as work permits, overall work control including construction work, labor, and safety.
Office Manager	On-site labor control, financial control, procurement of materials and equipment, transportation control, and general administrative aspects related to fulfilling the contract.
Chief Engineer (Pipelines) For Ain Al Basha	Responsible for test pit survey and all the piping work. In charge of quality control, progress control and safety control of the piping work. In addition, in charge of pipeline laying work in Ain Al Basha. The engineer who has thorough experience in urban civil engineering and pipeline laying work should be dispatched since laying distribution pipelines is implemented in urban area, and should manage construction work in plural sites.
Civil engineer (Pipelines) For Deir Alla	Responsible for pipeline laying work in Deir Alla. The engineer who has a thorough experience in urban civil engineering and pipeline laying work should be dispatched since laying of distribution pipelines is implemented in urban areas, and the engineer should manage construction work in multiple sites
Civil engineer (Reservoir) For Ain Al Basha	Responsible for construction work of two reservoirs in Ain Al Basha. As construction sites are located at two sites, this engineer is responsible for supervising the work and helping the representative engineer.
Civil engineer (Reservoir, Pumping Station) For Deir Alla	Responsible for construction work of a reservoir and a pumping station in Deir Alla. As construction sites are located at two sites, this engineer is responsible for supervising the work and helping the representative engineer.

The contractor can also employ local engineers, and implement work control using local engineers together with the Japanese engineers mentioned above.

2.2.4.5 Quality Control Plan

The project requires quality control of various works such as pipe laying work in congested urban areas, and in distribution reservoir work that requires high water-tightness and durability. The control items to be implemented for quality control of important works are shown in Table 2-31.

Table 2-31 Quality control plan

Type of work	Control item	Method	Standard
Pipe materials	Strength and size Lining and painting	Factory inspection Visual inspection	Japanese standards
Pipe laying work	Joint accuracy Leakage	Clearance gauge measurement Hydraulic pressure test	Japanese standards
Paving work	Base course	CBR test	Japanese standards
Foundation work	Soil bearing capacity	Plate bearing test	Japanese standards
Concreting work	Concrete quality	Mixing test Compressive strength test Air test Aggregate test	Japanese standards
Reinforcement	Strength Reinforcing bar arrangement	Tensile test, bending test Reinforcing bar arrangement test	Japanese standards
Waterproofing work	Paint quality Paint film thickness Leakage	Confirmation of quality control certificate Film thickness test Water filling test	Japanese standards
Machinery installation work	Installation accuracy Functions	Measurement of installed position Actual load operation test	Japanese standards
Electrical equipment installation work	Installation accuracy Functions	Measurement of insulation resistance Sequence interlocking test	Japanese standards

2.2.4.6 Materials and Equipment Procurement Plan

(1) Locations for procurement of materials and equipment

1) Labor

Ordinary laborers and general skilled laborers (carpenters, plumbers, etc.) will be hired locally by the contractor.

2) Materials and equipment

General construction materials and equipment such as cement and reinforcing bars can be procured locally. Ready-mixed concrete can be supplied from the ready-mixed concrete plant in Amman city. Since ductile cast iron pipes and valves are not being manufactured in Jordan, these items will be procured from Japan or a third country. Pumps and monitoring equipment for distribution water are also not manufactured in Jordan and three will be procured from Japan or a third country.

3) Construction machinery

Companies that lease construction machinery do not exist in Jordan, but general construction machinery such as large breakers, backhoes, bulldozers, dump trucks and truck cranes can be leased from local construction companies. Procurement companies that offer construction machinery at economic prices will be scheduled considering the lease rate, transportation cost, and number of days for which the machinery is offered.

Considering the local conditions mentioned above, the procurement items of main materials and

equipment to be used in the project are shown in Table 2-32.

Table 2-32 Procurement plan for main materials and equipment

Item	Local	Japan	Third Country	Remark
Materials and equipment				
Cement	O			
Aggregate	O			
Reinforcing bars	O			
Concrete form materials		O		
Scaffolding and support materials		O		
Timbering work materials		O		
Ladder and lid (FRP) for reservoir		O		
Inner anticorrosive materials		O		
Outer painting materials	O			
Ductile cast iron pipe		O	O	
Valves		O	O	
Base course material	O			
Asphalt	O			
Mechanical equipment (Pump)		O		
Electrical equipment (Power receiving and control equipment)	O	O	O	
Instrument apparatus (flow meter, water level gauge)		O	O	
Construction machinery				
Backhoes (0.28m^3, 0.45m^3, 0.8m^3, 1.4m^3)	O			
Breaker (1,300kg)	O			
Truck cranes (16t)	O			
Trucks with crane (4t load/ 2.9t lift)	O			
Dump truck (10t)	O			
Grader (3.1m)	O			
Macadam roller (10-12t)	O			
Tire roller (8-20t)	O			
Asphalt finisher (1.4-3.0m)	O			
Concrete pump vehicles (90-110m^3/h)	O			
Vibrating roller (0.8-1.1t, 3-4t)	O			
Tamper (60-80kg)	O			
Concrete cutter (0.5m)	O			
Jacking machine (trenchless work)		O	O	
Drilling machine (under-pressure connection)		O	O	

(2) Transportation plan

Considering long-term transportation of the materials and equipment procured from Japan and third countries by sea, loading and unloading at ports, and transport on land to the project area, machinery and electrical parts the quality of which may deteriorate during transportation will be adequately packed in cases, and straight pipes and large-sized materials and equipment will be packed in bundles or as bare packages. Aqaba port is the only unloading port in Jordan. Accordingly, the imported materials and equipment will be unloaded at Aqaba port and transported over land to the project area.

2.2.4.7 Operational Guidance Plan

The contractor should prepare the operation and maintenance manuals for the facilities and equipment, and implement the operational guidance for following facilities and equipment.

- Pumping station (2 weeks)
- PRV (pressure reducing valve), flow meter
- Flow measurement to reservoir

In addition to basic operational guidance for equipment of distribution monitoring system, training for distribution management for the entire water supply system will be implemented by the consultants through soft-component. The details of soft-component are mentioned below.

2.2.4.8 Soft Component Plan (Technical Assistance Plan)

(1) Outline

The transmission and distribution system will be improved by construction of transmission and distribution facilities and delineation of water distribution zones of Ain Al Basha and Deir Alla as the outcome of this project. However, if distribution management by utilization of acquired transmission and distribution data and operation and maintenance of distribution network are not implemented appropriately and continuously, the effects of the project will not be produced to the maximum extent.

On the other hand, the present knowledge and technical level of staff members of Ain Al Basha and Deir Alla zonal offices which operate and maintain water transmission and distribution systems are not adequate. Moreover, the skills and abilities of the staff members of the WAJ Balqa Office to provide guidance to these two offices are also not adequate. In the light of this situation, technical support to strengthen the capacity of transmission and distribution management will be provided to the staff members of the two zonal offices in charge of actual water distribution management and also to the staff members of the WAJ Balqa Office through soft component.

The soft component will utilize the outcomes of the technical cooperation projects implemented by JICA: “Capacity Development Project for Non Revenue Water Reduction in Jordan” (2005 to 2008), and the “Capacity Development Project for Non Revenue Water Reduction in Jordan Phase 2” (2009 to 2011). These projects have enhanced the organizational system of WAJ and skills related to non-revenue water such as leakage detection, water meter installation, distribution network management.

By the soft component, the capacity of distribution management of the staff members of both zonal offices and WAJ Balqa Office (hereinafter called “the trainees”) will be enhanced through technology

transfer for implementation of appropriate monitoring of water distribution, acquisition, management and analysis method of distribution data, and method of distribution management and NRW calculation based on the collected and analyzed data.

(2) Goal of soft component

To enhance the capacity of staff members of Ain Al Basha and Deir Alla offices related to water distribution management in new transmission and distribution facilities constructed in the project.

(3) Outcomes of soft component

The outcomes and main activities of soft component are as given below.

Outcome 1: Management capacity for distribution management
The trainees will develop the capacity to collect flow data from bulk meters continuously, analyze the data, understand zone and DMA distribution amounts. They will be able to adopt the approach to equitable water distribution.

Outcome 2: Capacity of calculation of NRW
The trainees will be able to calculate non-revenue water from water distribution data collected and will be able to utilize this data for reducing non-revenue water.

Outcome 3: Capacity of distribution pressure control
The trainees will be able to control the water supply pressure within the appropriate range through control by PRV.

(4) Method of confirming the outcome achievement level

Table 2-33 Method of confirming the outcome of soft component

Field	Items for confirming achievement level
Management of water distribution data	➢ Do the trainees understand the importance of monitoring? ➢ Have the trainees acquired the ability to perform O&M of bulk meters? ➢ Can the trainees properly preform data collection from bulk meters, tabulation, analysis and plotting? ➢ Can the trainees show proper approach to water distribution control based on the problems extracted from analyzed results?
Calculation of non-revenue water	➢ Are the trainees aware of the concept of non-revenue water? ➢ Can the trainees calculate non-revenue water by comparing subscribers' consumption data and data from bulk water meter data? ➢ Can the trainees perform the evaluation of non-revenue water? ➢ Can the trainees specify the measures for reducing non-revenue water?
Distribution pressure control	➢ Are the trainees aware of the appropriate range of water distribution pressure? ➢ Do the trainees understand the principles of pressure-reducing valve? ➢ Can the trainees perform the O&M method of pressure-reducing valves and method of adjusting range of reduced pressures?

(5) Soft component activities (introduction plan)

Japanese side: Japanese water distribution engineer (1 person), 49 person-days
Jordanian side: WAJ staff (total 52 persons), 128 persons-days

Trainees of the soft component to be selected are one staff from WAJ Balqa office and two staff members each from the district office for a total five persons. The trainee of WAJ Balqa office is required to take lead over other trainees, and district trainees are to be in charge of water distribution work on site. In the general seminar after training, additional two staff members from respective office will be also participated there from respective district offices. The five trainees receiving the soft component training are expected to be responsible for operation & maintenance of the facilities after completion of the project.

(6) Soft component schedule

Table 2-34 Soft component schedule

Activity	In Japan	At Site First month	At Site Second month	At Site Third month
1. Preparations for training				
1) Domestic preparations	▬			
2) Implementation preparations and introductory technical briefing		▬		
2. Training				
1) Distribution data management		▬		▬
2) Calculation of non-revenue water				▬
3) Water distribution pressure control		▬		▬
3. General report				
1) General seminar				▬
2) Preparation of reports and provision of manuals				▬

(7) Soft component products

Table 2-35 Soft component products

Reports & Deliverables	Description	Time
Preparation of transfer of technology plans (English)	Description, achievement target, detailed schedule, implementation method, etc. of soft component	At start
Completion report (in English with Japanese summary)	General report including description of transfer of technology, results of upgrading skills, training evaluation, transfer of technology manual and photos	At completion
Flow data	Input flow data	At completion
Manuals	Distribution data input and management manual	At completion
Others	Teaching records, outputs, training texts	At completion

2.2.4.9 Implementation Schedule of Work

Expecting implementation schedule of work is shown below.

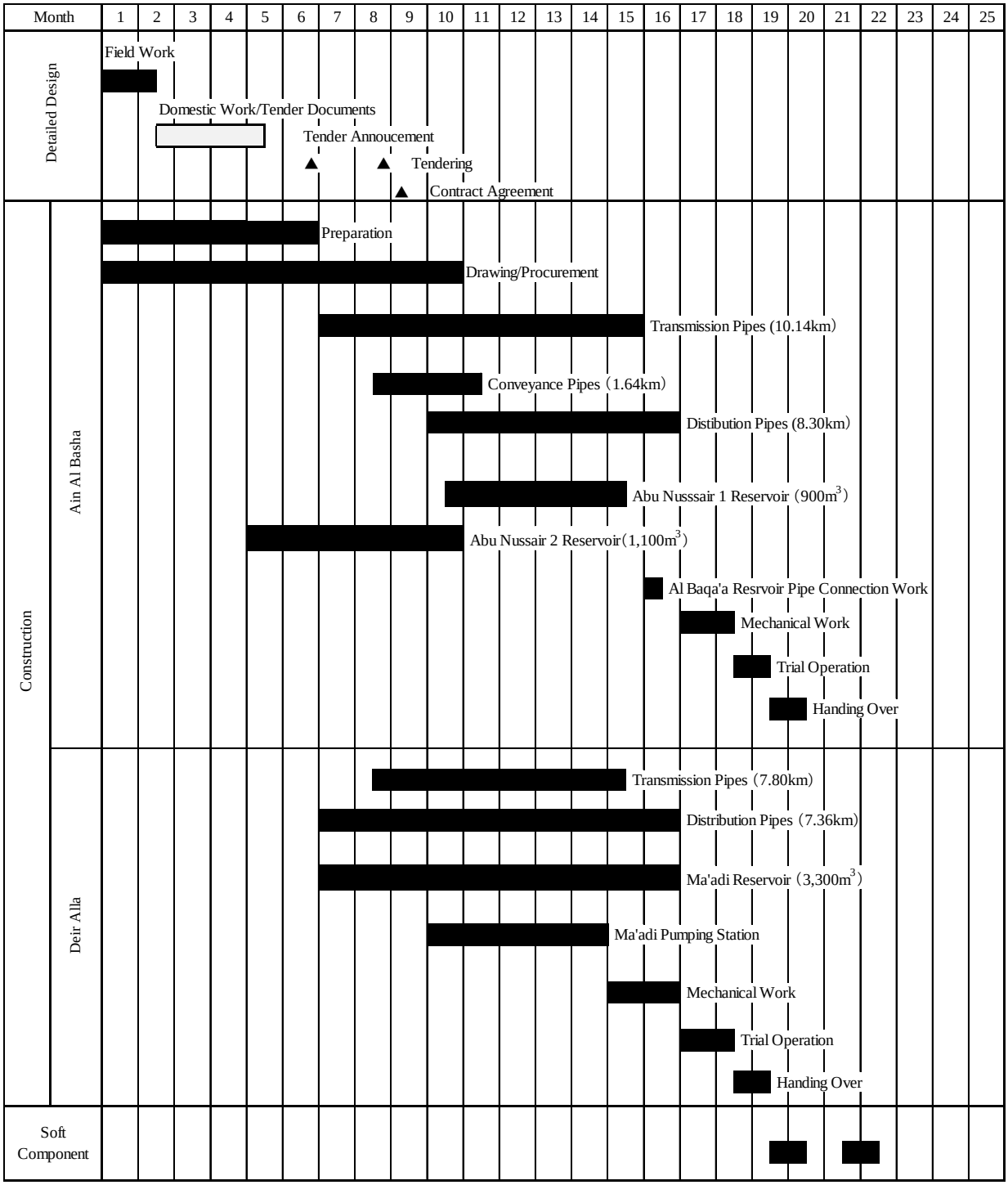


Figure 2-22 Implementation schedule

2-3 Obligations of Recipient Country

The project is composed of Japanese cooperation and with requisite work to be performed by the Jordanian side through self-effort. The necessary measures and obligations with scheduling of Jordanian side activities for the project are as listed below:

Table 2-36 Obligation of recipient country

Items
1. Construction of reservoirs
(1) To acquire the land for reservoir construction sites before the start of construction work by Japanese side
(2) To supply primary power of required capacity (necessary procedure and cabling)
(3) To acquire land for access road of Ma'adi Reservoir and asphalt paving
(4) To construct road paving, lighting, vegetation, fencing, gates, etc., within the site
(5) To provide water and chemicals for testing and cleaning
2. Construction of Ma'adi Pumping Station
(1) To provide the land for the pumping station
(2) To supply primary power of required capacity and to install a new transformer or upgrade the existing one to required capacity
3. Installation of transmission and distribution pipeline
(1) To provide water and chemicals for testing and cleaning
(2) To cooperate for construction work on the road including acquisition of approvals and permissions, and traffic control procedure
(3) To cooperate during pipe connection work such as attendance at water suspension work, notice to people, etc.
4. Soft Component
(1) To prepare equipment and training room for soft component activities
5. Common items for construction works
(1) To provide temporary stock yards for construction materials and machineries and land for temporary works
(2) To prepare disposal site for waste soil
6. Other Items
(1) To coordinate for required approvals and permissions from relevant authorities for implementing detailed design and construction works
(2) To cooperate in consultation with residents living near the construction sites and to coordinate procedures for traffic control in works with the relevant authorities
(3) To carry out necessary procedures for issue of A/P required for payments to Japanese consultants and contractor and to bear the commissions for advising and payment to bank in Japan for banking services based upon the Banking Arrangement
(4) To ensure prompt unloading and customs clearance of the goods for the project at the port of disembarkation in Jordan
(5) To accord Japanese nationals whose services may be required in connection with the supply of products and services under the verified contract such facilities as may be necessary for their entry into Jordan and stay there for the performance of their works.
(6) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies that may be imposed in Jordan with respect to the supply of the products and services under the verified contract, and to take necessary measures for such tax exemption.
(7) To use, operate and maintain properly the facilities and equipment constructed or procured under the Japan's Grant Aid program.
(8) To bear all the expenses, other than those to be borne by the grant aid, necessary for construction of the facilities

2-4 Project Operation Plan

2-4-1 Basic Principle of Operation and Maintenance

Basic policies for operation and maintenance (O&M) of proposed facilities are listed below.

a) Under the project, the new water supply system will be established adding new water supply facilities and disposing of existing pump stations. The O&M of the established system would be much easier than the current complicated transmission and distribution system. Therefore, these facilities should be capable of being operated and maintained by the current strength of the staff without any increase.

b) The capacity of water distribution management which is required for effective utilization of the proposed facilities will be enhanced through the soft component of this project.

c) It is recommended to assign a distribution manager who will be responsible for distribution monitoring system, and planning and implementation of efficient management of water distribution by utilizing the established monitoring system.

2-4-2 Responsibility of Distribution Manager

The distribution manager will collect all the data and information related to water distribution system from the O&M department and other engineering departments. The collected information would be digitized and compiled in digital formats, based on which analysis will be carried out for preparation of distribution plans. These data and plans will be also used for effective operation and maintenance activities of other departments. The distribution manager will be trained through soft component. The following are the responsibilities of the distribution manager.

- To collect and compile the data and information related to water distribution from the relevant departments
- To collect water monitoring data, interpret the data for improvement of water distribution management, and prepare improvement plans
- To study effective water transmission and distribution and prepare study reports
- To prepare annual water distribution plan
- To prepare fair water rationing plan
- To disseminate the reports and plans with the relevant departments

2-4-3 Organization of Operation and Maintenance

(1) Organization of Operation and Maintenance

The main component of the project is restructuring of the water distribution system. In the proposed water distribution system, the O&M efforts of the WAJ staff can be reduced because the proposed

system will reduce the daily valve operation for water rationing in the service area and the number of pumping stations to be operated. Therefore, increase in operation staff is not required under the project. In addition, it is assumed that leakage accidents will be reduced as water supply pressure is optimized. Therefore, the staff has time to spare for preventive leakage control.

The existing Ma'adi pumping station located in the WAJ Deir Alla office is currently operated by resident operators by shift work. Since the existing one will be disposed of under the project, the new pumping station will be operated and maintained with the current organization structure.

The existing distribution reservoirs are being operated and maintained by a patrolling system. Three new distribution reservoirs will be operated and maintained by the same patrolling system as the existing one.

Technology on related to distribution management will be transferred to the current WAJ staffs through the soft component. The new water distribution monitoring system will be managed by the distribution manager who receives the technology transfer.

(2) Major Facility and Monitoring Equipment

The monitoring and control method/item by major existing and new facility of the project are shown in the table below. The monitoring and maintenance items are the same as the WAJ staff's daily monitoring and control items. This enable new facility and equipment to be operated and maintained by the WAJ staffs without difficulty.

Table 2-37 Monitoring and control item by major facility and equipment

Type	Facility name		Monitoring/control method	Monitoring/control item
Distribution reservoir	Existing	Safout (Ain Al Basha)	Resident	Distribution management by open/close of valve, flow meter and water level gauge
		Al Baqa'a (Ain Al Basha)	Resident	
		Rajeb (Deir Alla)	Resident	
	Proposed	Abu Nussair 1 (Ain Al Basha)	Patrol	
		Abu Nussair 2 (Ain Al Basha)	Patrol	
		Ma'adi (Deir Alla)	Patrol	
Pumping station	Proposed	New Ma'adi	Resident	Flow meter, pressure gauge and pump operation
PRV	Proposed	5 (Ain Al Basha) 6 (Deir Alla)	Periodic inspection	Pressure gauge
Distribution monitoring	Proposed	7 (Ain Al Basha) 11 (Deir Alla)	Periodic inspection	Flow meter

(3) Periodic Inspection

The inspection items and interval for pumping station, distribution reservoirs, and transmission and distribution pipelines are shown below.

Table 2-38 Standard inspection/intervals for pumping stations

Equipment	Inspection interval	Inspection items
Pumps	Daily inspection (in operation)	・ Daily operation record a) Recording of water transmission volume b) Visual check of various sections c) Check for abnormal sounds d) Check for axial temperature e) Check for water leakage f) Recording of suction and discharge pressures
	Monthly inspection	・ Check bearings (bearing oil deterioration, measuring of bearing temperature)
	Three-month inspection	・ Change bearing oil and replenish bearing grease ・ Measure shaft center accuracy ・ Measure vibrations and noise levels
	Six-month inspection	・ Change bearing grease and gland packing
	Annual inspection	・ Overhaul ・ Check accessories and auxiliary machines
Motors	Daily inspection (in operation)	・ Daily operation record a) Measure current value b) Check of various sections visually c) Check for abnormal sounds d) Check for axial temperature
	Six-month inspection	・ Replenish bearing grease ・ Measure vibrations and noise levels, axial temperature
	Annual inspection	・ Check bearings ・ Measure insulation resistance

Table 2-39 Periodic inspection for reservoirs

Inspection item	Inspection interval	
	Monthly	Annually
a) State of water leakage, if any		○
b) Damage due to uneven ground subsidence, etc.		○

Table 2-40 Periodic inspection for transmission and distribution pipes

Inspection item	Inspection interval	
	Monthly	Annually
a) State of leakage, if any		○
b) State of ground subsidence, if any	○	
c) Conditions of valves, plugs and lids	○	
d) State of damage, if any	○	
e) Availability of emergency equipment and tools		○
f) Blow-off valve function	○	
g) State of lid of manhole	○	
h) State of interior of manholes		○
i) State of damage to aqueduct painting, if any		○

Table 2-41 Periodic inspection of flow meter and pressure reducing valve

Equipment	Inspection items
a) Flow meter	- To measure accuracy and adjust equipment by periodic inspection and arrangement
b) Pressure reducing valve	- To maintain data of pressure reducing valve (Setting pressure, manufacturer, installation year and date of periodic inspection, etc.). - Periodic inspection by visual check for cavitation damage by six-month inspection. - Periodic inspection for soil and debris removal from strainer.

(4) Operation and Maintenance of Pressure Reducing Valve (PRV)

Pressure reducing value (PRV) is a specialty valve to maintain adequate water supply pressure to reduce leakage. For continuous and normal functioning of PRV, adjusting, periodical check and preparation of spare parts are required. The following are required maintenance of PRV, which will be trained through on-the-job training (OJT) by the contractor and soft component.

1) Adjusting of water pressure value

In periodical check of PRV, water pressure at the gauge of PRV shall be checked by pressure gauges equipped in PRV. It happens that the water pressure value changes from the initial setting after long time operation or by intermittent water supply. If the value is changed from the original setting, the pressure value shall be reset at the original value using the pilot valve (needle valve) according to instruction manuals.

2) Maintenance

a) Periodical check

PRV consists of a main valve and a pilot valve. The main valve is activated by the diaphragm built in it. The pilot valve makes the diaphragm activate by detecting differential pressure between primary and secondary sides using pilot tubes. A filter is installed for preventing clogs since the pilot tube is very narrow. Some of existing PRVs are reported as malfunction due to negligence of filter cleaning. To avoid this, following periodical checks and maintenance are required for PRV. During periodical check, water flows through by-pass pipe by stopping flow in the main pipe which is closed by sluice valve.

Item of Periodical Check

Item	Contents
Visual inspection	Leakage, malfunction, abnormal sound
Pressure value	Reading of water pressure at pressure gauges
Filter for pilot tube	Filter cleaning
Main pipe strainer	Strainer cleaning

Periodical check and maintenance is to be conducted approximately every three month, but PRV is to be taken apart once a year to confirm on diagram status and so on. When leakage, malfunction or abnormal sound is observed during periodical check, PRV is also to be taken apart to replace valve seal, O-ring, etc. and confirm the status of diaphragm.

b) Preparation of Spare Parts

Consumables of PRV include valve seals, O-rings, diaphragms and filters, which are required to be secured as spare parts. In addition, the agent for procurement of spare parts shall be decided in advance. Spare parts are to be prepared in common use for any PRV because most of them are same type and same manufacturer. Spare parts of diaphragms are essential to secure spare parts for replacement since diaphragm, a rubber part that continuously expand and contract, deteriorates for 3 - 5 years in general.

2-5 PROJECT COST ESTIMATION

2-5-1 Initial Cost Estimation

The part of estimated costs for this project to be covered by the Jordanian side is summarized in the table below.

Table 2-42 Summary of estimated costs to be covered by the Jordanian side

Items	Project cost (thousand JD)	Remarks
1. Construction of reservoir (three distribution reservoirs)		
(1) Land acquisition	-	Public land for Ma'adi reservoir, and Abu Nussair 1 reservoir, Private land for Abu Nussair 2 reservoir
(2) Supply of primary power of required capacity for the reservoirs	-	Implementation by electricity company
(3) Land acquisition for access road to the site and asphalt paving	106.4	Excluding land acquisition cost Asphalt paving of access road for Ma'adi reservoir
(4) Road pavement at the reservoir site, setting of lights, construction of fences, gates and planting along the site boundary of reservoirs	104.3	
(5) Provision of necessary water and chemicals (chlorine) for trial operation and disinfection of the constructed facilities	11.7	
2. Construction of Ma'adi Pumping Station		
(1) Provision of land for the pumping station	-	Public land
(2) Supply of primary power of required capacity for the pump station, including power receiving equipment if necessary	-	Engineered with WAJ equipment and materials.
3. Laying of transmission and distribution pipelines	-	

Items	Project cost (thousand JD)	Remarks
(1) Provision of necessary water and chemicals (chlorine) for trial operation and disinfection of the constructed facilities	4.6	
4. Others		
(1) Provision of temporary stock yards for construction materials and machinery and land for temporary works	-	
(2) Preparation of disposal site for waste soil	-	
(3) Provision of equipment and training room for soft component activity	-	
5. Commissions for issue of A/P (Authorization to pay) and B/A (Banking Arrangement)	5.0	
Total	232.0	JPY32.5million

Estimated conditions

1) Date of Estimation : June 2013
2) Exchange rate : 1US$ = JPY98.92, 1JD = JPY140.17
3) Work Period : The work period for detailed design and construction is shown in the implementation schedule stated above.
4) Other : The estimation of the project cost is made in accordance with the grant aid scheme of the Government of Japan

2-5-2 Operation and Maintenance Cost

The profit and loss statement of WAJ Balqa office for the fiscal year 2011 was collected from the WAJ Balqa office. As shown in Table 2-43, the ratio of revenue to expenditure in the WAJ Balqa office is 59 %, and the deficit is covered by subsidy. Salaries & wages, electricity, and water imports account for 77 % of the total expenditure. As other expenditures such as vehicles expense account for 23 % and appear to be flat after completion of the project, the O&M cost for facilities constructed in the project can be discussed by examining the expenditures of salaries and wages, electricity, and water imports. In addition, the increase of operational revenue is studied assuming reduction of non-revenue water (NRW) ratio in the target year.

Table 2-43 Income statement of WAJ Balqa office

(Unit: JD)

Item		In fiscal year 2011	
Revenue	Operational revenue	7,217,944	90%
	Non-operational revenue	807,680	10%
	Total	8,025,624	100%
Expenditure	Salaries & wages	3,550,057	26%
	Electricity	2,359,279	17%
	Water imports	4,554,001	34%
	Vehicles expense	576,390	4%
	Network expense	913,315	7%
	PSP charges	1,075,080	8%
	Sludge transfer	251,718	2%
	Other expense	235,275	2%
	Total	13,515,115	100%
Profit/Loss		-5,489,491	
Recovery ratio		59.8%	

Source: WAJ Balqa Office

(1) Salaries and wages

After completion of the project the number of staff members in charge of O&M of both district offices will not be changed, and that of the WAJ Balqa office will not be changed as well. Therefore, the implementation of the project will not increase the expenditure of salaries and wages.

(2) Electricity cost

The electricity cost of WAJ Balqa office in 2012 was JD2,359,579 per year and the electricity consumption was estimated at 35,751,157 kWh per annum during the same period using the electricity tariff of JD0.066 per kWh. The electricity cost of Ain Al Basha and Deir Alla in 2011 accounted for 15.6 % of the total electricity cost of the WAJ Balqa office.

After the project, the existing six pumping stations will be disposed of and one new pumping station will be constructed. Therefore, the electricity consumption and the electricity cost will reduce with the project. The reduction in electricity consumption and cost of the WAJ Balqa office in the target year 2020 is estimated at 2,809,824 kWh and JD185, 447, respectively as shown in Table 2-44 In addition, the reduction in the electricity cost in 2020 compared to the electricity cost in 2011 is JD78,429.

Table 2-44 Reduction of electricity consumption and cost

Districts	Study case	Current status (in 2012)		Target year (in 2020)	
		Electricity consumption (kWh/year)	Electricity cost (JD/year)	Electricity consumption (kWh/year)	Electricity cost (JD/year)
Ain Al Basha	Without Project	3,349,008	221,035	4,571,078	301,691
	With Project	-	-	2,376,961	156,879
	Difference	-	-	2,194,117	144,812
Deir Alla	Without Project	2,244,240	148,120	2,643,669	174,482
	With Project	-	-	2,027,962	133,847
	Difference	-	-	615,707	40,635
Total	Without Project	5,593,248	369,155	7,214,747	476,173
	With Project	-	-	4,404,923	290,726
	Difference	-	-	2,809,824	185,447
Balqa total	-	35,751,157	2,359,279	-	-

Note: Electricity consumption for "Without Project at the current status is from actual records.
Tariff 1kWh=0.066JD, (pump efficiency) x (motor efficiency) = 0.65
The "Difference" indicates reduced electricity consumption and cost.

(3) Imported water cost

Water sources of WAJ Balqa office include its own resources and imported water from outside of the Balqa governorate or Miyahuna. The imported water cost in 2011 amounted to JD4,554,001 and accounted for 34 % of the total expenditure, which is the largest item in the expenditures.

The plan in this project is to cover the increased water demand in the target year by imported water. 2.63 MCM of imported water should be purchased in 2020.

Table 2-45 Water supply in target districts

(MCM/year)

Districts	Current status (in 2012)			Target year (in 2020)			Increase		
	WAJ resource	Imported water from outside	Total	WAJ resource	Imported water from outside	Total	WAJ resource	Imported water from outside	Total
Ain Al Basha	2.28	5.03	7.31	2.28	7.78	10.06	0	2.75	2.75
Deir Alla	1.32	2.13	3.45	1.32	2.01	3.33	0	-0.12	-0.12
	3.6	7.16	10.76	3.6	9.79	13.39	0	2.63	2.63
Balqa Governorate	13.69	16.03	29.72						

The present unit price of the imported water is calculated as 0.284JD/m^3 by dividing JD 4,554,001 by 16.03MCM. The increase in imported water purchase is estimated as shown in the table below. The increase in imported water cost is estimated as 478,029 JD/year in 2020 with the project compared to the current imported water cost.

Table 2-46 Estimation of imported water purchase with the project

Item	Unit	Current status in 2012		Target year in 2020		Difference	
		Ain Al Basha + Deir Alla	Target areas	Ain Al Basha + Deir Alla	Target areas	Ain Al Basha + Deir Alla	Target areas
Estimated imported water unit price	JD/m^3	0.284		0.284			
Imported water amount	MCM/y	7.16		9.79			
Imported water cost	JD/y	2,033,440	1,301,402	2,780,360	1,779,430	746,920	478,029

Note: Target areas indicate the target distribution zones and the cost for the target areas are calculated using the ratio of water supply amount of the target areas to that of all districts.

(4) Operational revenue

The current unit price of water supplied is estimated as 0.243 JD/m^3 obtained by dividing the operational revenue by the supplied amount in the Balqa governorate.

It is assumed that the ratio of non-revenue water is reduced to 40 % from the current value of 60 % in this plan. Accordingly, the unit price of supplied water is estimated to increase to 0.3645 JD/m^3 (0.243JD/m^3 ÷ 0.4 * 0.6) in 2020. Therefore, the operation revenue will increase by 1,450,224 JD/year assuming the NRW ratio is reduced to 40 % in 2020 from the current value of 60 %.

Table 2-47 Estimation of operational revenue increase with NRW reduction

Item	Unit	Current status in 2012		Target year in 2020		Difference	
		Ain Al Basha + Deir Alla	Target areas	Ain Al Basha + Deir Alla	Target areas	Ain Al Basha + Deir Alla	Target areas
NRW	%	60		40		20	
Estimated unit price of supplied water	JD/m^3	0.243		0.3645			
Total water supply	MCM/y	10.76		13.39			
Estimated operational revenue	JD/y	2,614,680	1,673,395	4,880,655	3,123,619	2,265,975	1,450,224

Note: Target areas indicate the target distribution zones and the cost for the target areas are calculated using the ratio of water supply amount of the target areas to that of all districts.

(5) Conclusions

Based on the discussions above, the following table is given that summarizes the increase and decrease in revenue and costs. With the project implementation assuming the reduction of NRW ratio, the balance will be increased by 1,050,624 JD/year. Therefore, the project will contribute to the financial improvement of WAJ.

Table 2-48 Estimation of increase and decrease in revenue and expenditure in 2020 with the project assuming reduction of NRW ratio

Items	Current status (2012)	Target year (2020)	Difference
Operating revenue	1,673,395	3,123,619	1,450,224
Electricity	369,155	290,726	-78,429
Imported water purchase	1,301,402	1,779,430	478,029
Difference (Balance)	2,839	1,053,463	1,050,624

Assumption: The NRW ratio reduces from 60 % in 2012 to 40 % in 2020.

In addition, the balance assuming the current NRW ratio in the target year is estimated as shown in the table below. With the project implementation and assuming the current NRW ratio, the balance will increase by 9,418 JD/year. Therefore, the project will contribute to the financial improvement of WAJ.

Table 2-49 Estimation of increase and decrease in revenue and expenditure in 202 with the project assuming current NRW ratio

Items	Current status in 2012	Target year in 2020	Difference
Operating revenue	1,673,395	2,082,413	409,018
Electricity	369,155	290,726	-78,429
Imported water purchase	1,301,402	1,779,430	478,029
Difference (Balance)	2,839	12,256	9,418

Assumption: The NRW ratio does not reduce with the current 60 % in 2012.

Chapter 3 PROJECT EVALUATION

3-1 Preconditions

(1) Land acquisition for proposed facilities

The Jordanian side is required to acquire and prepare the construction land for the three reservoirs and one pumping station. It is not difficult to acquire the land for Ma'adi reservoir as it is public land but special care should be taken for land acquisition for Abu Nussair 1 and Abu Nussair reservoirs because of its private land ownership. Lands should be acquired according to the relevant laws of Jordan by the end of September 2014.

(2) Budget preparation for the construction borne by the recipient country

The effect of the project will be fully materialized once the construction borne by the Jordanian side is executed. Therefore, in order to proceed with the construction borne by the Jordanian side simultaneously with the construction of the Japanese side, the Jordanian side must secure required budget.

(3) Tax Exemptions

The both sides confirmed that the tax exemption including Value Added Tax (VAT), customs duty, and any other taxes and fiscal levies in Jordan, which is to be imposed in relation to the Project activities, will be ensured by the Jordanian side. WAJ will take any necessary procedures for tax exemption, and in case that tax exemption is not secured, the cost of tax will be borne by WAJ.

(4) Securing bulk water supply to Balqa Governorate

As a prerequisite to the Project, an additional bulk water of 4 MCM a year shall be allocated to the Balqa Governorate by completion of the Project expected in 2017. Total amount of 1.09 MCM a year shall be secured to Deir Alla from the existing Abu Zeghan RO Plant owned by Miyahuna LLC, and total amount of 7.7 MCM a year of water to Ain Al Basha from Zai/Dabouq Conveyer to utilize the pressure for providing reservoirs with water.

3-2 Necessary Inputs by Recipient Country

(1) Ensuring performance of obligatory work of the recipient country

The works to be undertaken by the Jordanian side, such as pavement of access road, cabling for

APPENDICES

APPENDICES

1 Member List of the Study Team

(1) 1st and 2nd Survey

Name	Job title	Occupation
Mr. Yoshiki OMURA	Team Leader	Senior Advisor, JICA
Mr. Yuko NOBUHARA	Sector Programme Management	Middle East Div. 2, Middle East and Europe Dept., JICA
Mr. Ryuji OGATA	Survey Planning	Water Resources Management Div. 1, Water Resources and Disaster Management Group, Global Environment Dep., JICA
Ms. Mina YARIUCHI	Survey Planning	Water Resources Management Div. 1, Water Resources and Disaster Management Group, Global Environment Dep., JICA
Mr. Hirotaka SATO	Chief Consultant	Director Group Manager, Engineering Department TEC International Co., Ltd.
Mr. Makoto Homma	Deputy Chief Consultant	Senior Engineer, Technical Team 2 Engineering Department TEC International Co., Ltd.
Dr. Phatta Thapa	Transmission and Distribution Planning	Senior Engineer, Technical Team 1 Engineering Department TEC International Co., Ltd.
Mr. Hayato Nakazono	Coordinator/Cost Estimation/Pipe Planning(2)	Staff Engineer, Technical Team 2 Engineering Department TEC International Co., Ltd.

(2) Explanation of Draft Outline Design

Name	Job title	Occupation
Mr. Yoshiki OMURA	Team Leader	Senior Advisor, JICA
Ms. Mina YARIUCHI	Survey Planning	Water Resources Management Div. 1, Water Resources and Disaster Management Group, Global Environment Dep., JICA
Mr. Hirotaka SATO	Chief Consultant	Director Group Manager, Engineering Department TEC International Co., Ltd.
Mr. Makoto Homma	Deputy Chief Consultant	Senior Engineer, Technical Team 2 Engineering Department TEC International Co., Ltd.

2 Study Schedule

(1) 1st Survey

Date		Team Leader	Sector Program Management	Project Coordinator	Chief Consultant/ Operation & Management	Deputy Chief Consultant/ Water Supply Facilities	System Planning of Transmission and Distribution	Pipeline Planning	Equipment Planning	Construction Planning/ Cost Estimation	Coordinator/ Assistant Cost Estimation/ Pipeline Planning (2)
		Yoshiki OMURA	Yuko NOBUHARA	Ryuji OGATA	Hirotaka SATO	Makoto HOMMA	Phatta THAPA	Takashi MORIGUCHI	Yoichi HARADA	Hiroto IWASHIGE	Hayato NAKAZONO
7th Feb	Thu.	Arriving at Amman									
8th Feb	Fri.		Leaving Narita								Leaving Narita
9th Feb	Sat.		Arriving at Amman								Arriving at Amman
10th Fe.	Sun.	Meeting with WAJ Headquarter, MOPIC, GIZ					Material Collection				Material Collection
11th Feb	Mon.	Meeting with WAJ Balqa, Field Survey (Ain Al Basha)									Same as on the left
12th Feb	Tue.	Field Survey (Deir Alla)									Same as on the left
13th Feb	Wed.	MD meeting, Meeting with JVA (only Mr. Ogata)					Material Collection				Material Collection
14th Feb	Thu.	Modification of MD and Signing of MD	Modification of MD and Signing of MD, Leaving Amman	Modification of MD and Signing of MD							
15th Feb	Fri.		Arriving at Narita		Internal Meeting			Leaving Narita			Internal Meeting
16th Feb	Sat.				Material Collection			Arriving at Amman			Material Collection
17th Feb	Sun.	Report to JCA Jordan office, Leaving Amman		Report to JCA Jordan office, Leaving Amman	Report to JCA Jordan office		Internal Meeting				Same as on the left
18th Feb	Mon.	Arriving at Narita		Arriving at Narita	Survey Preparation, Material Collection						Same as on the left
19th Feb	Tue.				Field Survey (Water Supply Facilities, Existing Wells)						Same as on the left
20th Feb.	Wed.										
21st Feb	Thu.										
22nd Feb	Fri.				Internal Meeting						Same as on the left
23rd Feb	Sat.										
24th Feb	Sun.				Field Survey (Existing Wells, Reservoir)						Material Collection
25th Feb	Mon.				Leaving Amman	Field Survey (Pumping Stations, Transmission and Distribution Pipelines)					Leaving Amman
26th Feb	Tue.										Arriving at Narita
27th Feb	Wed.										
28th Feb	Thu.										
1st Mar	Fri.					Internal Meeting					
2nd Mar	Sat.										
3rd Mar	Sun.					Field Survey (Transmission and Distribution Pipelines, Other facilities)					
4th Mar	Mon.										
5th Mar	Tue.										
6th Mar	Wed.										
7th Mar	Thu.										
8th Mar	Fri.					Internal Meeting					
9th Ma.	Sat.										
10th Ma.	Sun.				Arriving at Amman	Field Re-survey			Meeting with WAJ, Leaving Amman		
11th Mar	Mon.				Field Re-survey				Arriving at Narita		
12th Mar	Tue.				Material Collection						
13th Ma.	Wed.				WAJ Meeting Leaving Amman						
14th Mar.	Thu.				Arriving at Narita						

(2) 2nd Survey

Date		Chief Consultant/ Operation & Management	Deputy Chief Consultant/ Water Supply Facilities	System Planning of Transmission and Distribution	Pipeline Planning	Equipment Planning	Construction Planning/ Cost Estimation	Coordinator/ Assistant Cost Estimation/ Pipeline Planning (2)
		Hirotaka SATO	Makoto HOMMA	Phatta THAPA	Takashi MORIGUCHI	Yoichi HARADA	Hiroto IWASHIGE	Hayato NAKAZONO
13th Apr.	Sat.		Leaving Narita					
14th Apr.	Sun.	Leaving Narita	Arriving at Amman					
15th Apr.	Mon.	Arriving at Amman	Field Survey	Field Survey (Planned Site of Reservoir, Transmission Pipeline between Zai WTP and Dabouq Reservoir), Confirmation of Hydraulic Model				
16th Apr.	Tue.	Field Survey						
17th Apr.	Wed.							
18th Apr.	Thu.	Check of Facility Planning						
19th Apr.	Fri.	Internal Meeting						
20th Apr.	Sat.							
21st Apr.	Sun.	Meeting with WAJ about Facility Planning		Material Collection for Sector Survey Report	Study of comparison PC tank with RC Tank			
22nd Apr.	Mon.	Meeting with MPU about Sector Survey Report						
23rd Apr.	Tue.	Report to JCA Jordan office					Leaving Narita	
24th Apr.	Wed.	Report to EOJ					Arriving at Amman	
25th Apr.	Thu.	Leaving Amman	Field Survey				Field Survey	
26th Apr.	Fri.	Arriving at Narita	Internal Meeting				Same as on the left	
27th Apr.	Sat.							
28th Apr.	Sun.		Data Completion of Socio Condition Study, Preparation of Subcontracting Agreement, Conclusion of Contract	Meeting with people involved in Disi project, Meeting with ISSP staff, Miyafuna	Field Survey		Collection of Quatation, Surveys of Construction Planning, Acquisition of Materials for Cost Estimation	Measurement of Water Quality of Existing Wells, Measurement of water pressure, Preparation of Material for Social and Environmental Considerations, Meeting with ISSP
29th Apr.	Mon.							
30th Apr.	Tue.							
1st May	Wed.							
2nd May	Thu.							
3rd May	Fri.		Internal Meeting				Same as on the left	
4th May	Sat.							
5th May	Sun.		Study of reduction of electric energy and CO2, Meeting with JICA	Confirmation of Survey Area with Subcontractors, Confirmation of connection points with existing pipelines, Meeting with ISSP staff			Collection of Quatation, Surveys of Construction Planning, Acquisition of Materials for Cost Estimation	Measurement of Water Quality of Existing Wells, Measurement of water pressure in existing network
6th May	Mon.							
7th May	Tue.							
8th May	Wed.					Leaving Narita		
9th May	Thu.					Arriving at Amman		
10th May	Fri.		Leaving Amman	Internal Meeting				
11th May	Sat.		Arriving at Narita					
12th May	Sun.			Coordination of Road Cutting and Road Crossing, Confirmation with MPWH, Material Collection of Sector Survey Report		Field Survey, Meeting with database section of MWI, maintenance section of WAJ	Collection of Quatation, Surveys of Construction Planning, Acquisition of Materials for Cost Estimation	Acquisition of a Letter from the Ministry of Environment, Meeting with ISSP staff
13th May	Mon.							
14th May	Tue.							
15th May	Wed.							
16th May	Thu.							
17th May	Fri.			Internal Meeting				
18th May	Sat.							
19th May	Sun.			Study of Road Crossing Construction Method		Meeting with laboratory section of WAJ, Environmental Health Section of Ministry of Health	Collection of Quatation, Surveys of Construction Planning, Acquisition of Materials for Cost Estimation	Data Collection
20th May	Mon.							
21st May	Tue.			Leaving Amman				
22nd May	Wed.			Arriving at Narita				Leaving Amman
23rd May	Thu.							Arriving at Narita
24th May	Fri.					Internal Meeting		
25th May	Sat.							

Date		Chief Consultant/ Operation & Management	Deputy Chief Consultant/ Water Supply Facilities	System Planning of Transmission and Distribution	Pipeline Planning	Equipment Planning	Construction Planning/ Cost Estimation	Coordinator/ Assistant Cost Estimation/ Pipeline Planning (2)
		Hirotaka SATO	Makoto HOMMA	Phatta THAPA	Takashi MORIGUCHI	Yoichi HARADA	Hiroto IWASHIGE	Hayato NAKAZONO
26th May	Sun.					Meeting with maintenance section and groundwater survey section of WAJ	Collection of Quatation, Surveys of Construction Planning, Acquisition of Materials for Cost Estimation	
27th May	Mon.							
28th May	Tue.							
29th May	Wed.							
30th May	Thu.							
31st May	Fri.						Leaving Amman	
1st Jun.	Sat.						Arriving at Narita	
2nd Jun.	Sun.					Measurement of water pressure in existing network		
3rd Jun.	Mon.							
4th Jun.	Tue.							
5th Jun.	Wed.							
6th Jun.	Thu.					Leaving Amman		
7th Jun.	Fri.					Arriving at Narita		
8th Jun.	Sat.		Leaving Narita, Tokyo					
9th Jun.	Sun.	Arriving at Amman	Arriving at Amman					
10th Jun.	Mon.	Material Collection						
11th Jun.	Tue.	Report to JCA Jordan office						
12th Jun.	Wed.	Report to EOJ						
13th Jun.	Thu.	Leaving Amman	Field Survey					
14th Jun.	Fri.	Arriving at Narita	Leaving Amman					
15th Jun.	Sat.		Arriving at Narita					

(3) Explanation of Draft Outline Report

Date		Team Leader	Project Coordinator	Chief Consultant/ Operation & Management	Deputy Chief Consultant/ Water Supply Facilities
		Yoshiki OMURA	Mina YARIUCHI	Hirotaka SATO	Makoto HOMMA
26th Jan	Sun	Arrive at Amman Internal meeting Meeting at JICA Office			
27th	Mon	Meeting with WAJ HQ			
28th	Tue	Field survey in Balqa			
29th	Wed	MD meeting			
30th	Thu	Signing of MD Report to JICA Office Report to EOJ			Leaving Amman for Irbid
		Leaving Amman			
31st	Fri				
1st Feb	Sat				
2nd	Sun		Data collection at PMU Visit at WAJ Marka Training Center		
3rd	Mom			Data collection at Balqa GWA	
4th	Tue		Data collection at Financial Department Leaving Amman		

3 Lists of Parties Concerned in the Recipient Country

(1) 1st and 2nd Survey

＜Jordan Side＞

1. Planning and International cooperation

Ms. Eba'a Q. Al-Eysa'a	Project Engineer
Ms. Wa'ed T. Al-Ja'afreh	Project Engineer

2. Ministry of Water and Irrigation: MWI)

Eng. Iyad Dahiyat	Director, Performance Management Unit(PMU)
Eng. Waleed Sukkar	Director, PMU
Dr. Mohammad Al-Waqfi	Monitoring and Accounting manager, PMU
Eng. Nabil Zou'bi	Project Manager, Jordan Red Sea Project
Mr. Ibrahim Obadah	Project Coordinator, ISSP Program
Mr. Saddam Khleifat	Technical Manager, Water Supply, ISSP program
Eng. Bassam Saleh	Disi Project Disi Project, SWECO

3. Water Authority of Jordan (WAJ)

Eng. Tawfiq Z. Habashneh	Secretary General
Eng. Malek Rawashdeh	Assistant Secretary General, Technical Affairs
Eng. Reham Bani-Hani	Director, Study, Design and Plan and Feasibility Study Directorate
Eng. Haneen Qablan	Study, Design and Plan and Feasibility Study Directorate
Eng. Asma'a Alwahadneh	Study, Design and Plan and Feasibility Study Directorate
Eng. Khalid Al-Obaidiyn	Director, Balqa Governorate Water Administration
Eng. Jamal Alkharabsheh	Director, Non-revenue water directorate, Balqa GWA
Eng. Mohammed Hossam Sallam	Manager, Ain Al Basha Directorate, Balqa GWA
Eng. Ghazi Aladwaw	Manager, Deir Alla Directorate, Balqa GWA
Dr. Muna Hirdiyeh	Assistant Secretary General, Laboratory
Mr.Abed Al-Raheem	Director, Operation and Maintenance Directorate
Mr.Kamil Wabsh	Engineer, Operation and Maintenance Directorate
Mr.Kamil Wabsh	Engineer, Operation and Maintenance Directorate
Mr. Osama Al-Samhouli	Engineer, Operation and Maintenance Directorate
Mr.Ayman Jaber	Engineer, National Water Master Plan Directorate
Ms. Rania Shabun	Engineer, Laboratories and Water Quality
Dr. Khair Hadidi	Director, Water Production and Bulk Water Supply

4. Royal Jordanian Geographic Center

Dr. Awni Moh'd Kasawneh	Secretary General
Mr. Tayseer Darweesh	Director, GIS Directorate

5. Ministry of Health

Mr.Mohamed Abadi	Engineer, Environment and Health Directorate

＜Donors＞

6. KfW

Ms. Sandra Gmelin	Project Manager, Water Resources and Solid Waste
Dr. Manuel Schiffler	Senior Water Supply Expert, Middle East and North Africa

Ms. Anna Lena Muller	International Economist, Water and Solid Waste Section, Department of Water Sector Institution
Dr. Stefan Gramel	Engineer, Middle East Water and Solid Waste Section, Department of Water Sector Institution

7. GIZ

Mr. Elke Zimmermann	Technical Adviser, Water Resources, Germany and Jordan Program
Mr. Dieter Rothenberger	Program Manager, Water Resources, Germany and Jordan Program
Eng. Guy Honore	Program Coordinator, Water Resources, Germany and Jordan Program

8. Ministry of Public Works and Housing: MPWH

Eng. Reema Aaydl	Technical Director, Road Department

＜Japanese Side＞

1. JICA Jordan Office

Mr. Junji Wakui	Additional Resident Representative
Mr. Kenji Takada	Representative
Ms. Tomomi Hirata	Representative
Mr. Hani H. Al-Kurdi	Program Officer

2. Embassy of Japan in Jordan

Mr. Takanori Hukube	First Secretary
Mr. Shinya Kuwana	Second Secretary

(3) Explanation of Draft Outline Report

＜Jordan Side＞

1. Ministry of Water and Irrigation: MWI)

Eng. Waleed Sukkar	Director, PMU

2. WAJ

Eng. Tawfiq Z. Habashneh	Secretary General
Eng. Malek Rawashdeh	Assistant Secretary General, Technical Affairs
Eng. Reham Bani-Hani	Director, Study, Design and Plan and Feasibility Study Directorate
Eng. Asma'a Alwahadneh	Study, Design and Plan and Feasibility Study Directorate
Mr. Mohamad	Assistant Director, Financial Directorate
Eng. Khalid Al-Obaidiyn	Director, Balqa Governorate Water Administration
Eng. Jamal Alkharabsheh	Director, Non-revenue water directorate, Balqa GWA
Eng. Ghazi Aladwaw	Manager, Deir Alla Directorate, Balqa GWA
Eng. Firas Zriqat	Mechanical Engineer, Marka Training Center

＜Japanese Side＞

1. JICA Office

Mr. Junji Wakui	Additional Resident Representative
Ms. Tomomi Hirata	Representative
Mr. Hani H. Al-Kurdi	Program Officer

2. Embassy of Papan in Jordan

Mr.Norimasa Yoshida	First Secretary

4 Minutes of Discussions（M/D）

(1) Survey Stage

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
FOR
THE PROJECT FOR REHABILITATION AND EXPANSION OF THE WATER NETWORKS IN BALQA GOVERNORATE IN THE HASHEMITE KINGDOM OF JORDAN

In response to the request from the Government of the Hashemite Kingdom of Jordan (hereinafter referred to as "Jordan"), the Government of Japan decided to conduct a Preparatory Survey (hereinafter referred as "the Survey") for the Project for Rehabilitation and Expansion of the Water Networks in Balqa Governorate (hereinafter referred to as "the Project") and entrusted the survey to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Jordan the Preparatory Survey Team (hereinafter referred to as "the Team"), which is headed by Mr. Yoshiki OMURA, Senior Advisor, JICA, and is scheduled to stay in the country from February 9, 2013 to March 14, 2013 for the first phase and from middle of April 2013 to middle of June, 2013 for the second phase.

The Team held discussions with the officials concerned of the Government of Jordan and conducted a field survey at the survey area.

In the course of discussions and field survey, both parties confirmed the main items described in the attached sheets.

Amman, February 14, 2013

Mr. Yoshiki OMURA
Leader,
Preparatory Survey Team
Japan International Cooperation Agency

Eng. Basem Telfah
Secretary General,
Ministry of Water and Irrigation and
Acting Secretary General,
Water Authority of Jordan
The Hashemite Kingdom of Jordan

Dr. Saleh Kharabsheh
Secretary General,
Ministry of Planning and International Cooperation
(Witness)

ATTACHMENT

1. Objective of the Project

The objective of the Project is to reduce non-revenue water and electricity consumption for water supply in the target areas by controlling water pressure of distribution network.

2. Project site

Tentative site of the Project is Deir Alla and Ain Al-Basha Districts in Balqa Governorate as shown in **Annex-1**.

3. Responsible and Implementing Agency

3-1) The Responsible Agency is the Ministry of Water and Irrigation (hereinafter referred to as "MWI").

3-2) The Implementing Agency is the Water Authority of Jordan (hereinafter referred to as "WAJ"). The Organization chart of WAJ is shown in **Annex-2**

4. Items requested by the Government of Jordan

After discussions with the Jordanian side and the Team (hereinafter referred to as " both sides"), the items described in **Annex-3** were requested by the Jordanian side.

The both sides confirmed that the appropriateness of the request would be examined in accordance with the further studies and analysis in Japan and the final components of the Project would be decided by the Japanese side.

5. Japan's Grant Aid Scheme

5-1) The Jordanian side understands the Japan's Grant Aid Scheme explained by the Team, as described in **Annex-4**.

5-2) The Jordanian side will take the necessary measures, as described in **Annex-5**, for smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented.

6. Schedule of the Survey

6-1) The consultant members of the Team will conduct studies in Jordan until March 14, 2013 for the first phase and from middle of April 2013 to middle of June 2013 for the second phase. Main purpose of the first phase is to collect basic information and examine the scope of the Project including the confirmation of the target area. Main purpose of the second phase is to conduct outline design of the Project.

6-2) JICA will prepare the draft Preparatory Survey report in English and dispatch a mission in order to explain its contents to Jordanian side around October 2013.

6-3) In case that the contents of the report are accepted in principle by the Jordanian side, JICA will finalize the report and send it to the Jordanian side around December 2013.

1

The Jordanian side understands that execution of the Preparatory Survey does not necessarily imply the Japanese Government's commitment of the project implementation.

7. Other relevant issues

7-1) Review of the existing water supply plan

The both sides confirmed that the Team will review the feasibility study, "Technical and Feasibility Study and Final Design of the Upgrading and Expansion of Water Facilities in Central Governorates" (hereinafter referred to as "the F/S") conducted in April 2005.

7-2) Target year

The Team explained that the target year of the Project is set up as the year immediately after the construction because Japan's grant aid aims to implement the project components to meet the urgent and immediate needs in the Project area. The both sides confirmed that the target year of the Project shall be 2020 though the Project is requested based on the target year of "the F/S" (2025). However, the target year for pipelines would be 2025 because of the difficulty of the stepwise expansion of pipe capacity.

7-3) Target areas

The tentative target areas are as follows. The target areas will be examined by the Survey (first phase) and confirmed through discussion between both sides.

i) Deir Alla District
ii) Ain Al-Basha District

7-4) Policy of the outline design

The Both sides agreed that the outline design will be done according to the following technical consideration to establish efficient water supply systems:

- Separation of transmission from distribution system
- Gravity distribution from service reservoir
- Optimization of energy use in the system, especially for pumping facilities
- Definition of District Metered Area (DMA)
- Selection and location of pressure reducing facilities
- Replacement of existing pipes including asbestos pipes

7-5) Branch pipelines of diameter less than 100 mm and replacement of the service connection

The procurement and installation of tertiary network of diameter less than 100 mm and service connections are not mentioned in the request from the Jordanian side. The present status and the necessity of replacement of the tertiary network and service connections will be examined by the Team. The measure to be taken for future will be confirmed through the discussion between both sides based on the result of the Preparatory Survey.

2

7-6) Pump Facilities for the Target Areas

The water distribution system in the target area will be converted from the direct pumping system to gravity flow system by construction of distribution reservoirs at high land and other facilities through the Project activities. The Team will examine the present status of water distribution system, which may be necessary to be improved for distribution system conversion and recommend necessary measures for establishment of appropriate distribution system.

7-7) Measures to be taken by the Jordanian side

Other than measures described in **Annex-5**, Jordanian side will take the following measures:

1) The Jordanian side agreed to secure water resources which are necessary for ensuring the outcome of the Project by the study mission of draft report around October 2013.
2) The Jordanian side agreed to submit a document that certified to secure enough budgets for implementation of necessary measures to be taken by Jordanian side for 2014 and the schedule of implementation of the measures by the study mission of draft report around October 2013.
3) The Jordanian side agreed to assign the counterpart personnel in charge of the following works during the Team`s stay in Jordan:

- Project coordination
- Facility design and cost estimation
- Operation and maintenance for water supply systems

7-8) Technical assistance ("Soft Component" of the Project)

The Jordanian side requested the technical assistance on the appropriate distribution management of water flow and pressure for the overall water supply system to promote the sustainable and effective operation of the facilities constructed in the Project. The Team agreed to study its necessity and if it was confirmed, the implementation of technical assistance as soft component program would be considered in the Project.

7-9) Tax exemption

Both sides confirmed that the tax exemption including Value Added Tax (VAT), custom duty, and any other taxes and fiscal levies in Jordan which is to be arisen from the Project activities will be ensured by WAJ. WAJ will take any procedures necessary for tax exemption, and in case that tax exemption is not secured, the cost of tax will be covered by WAJ.

7-10) Sector Survey Report

The Team will also study present status of water works management and organization structure of WAJ, progress of non-revenue water reduction activities, relevant laws and regulations, and recommend effective technical cooperation project(s) to complement the efforts done by WAJ. The Team will make a separate report based on the result of sector survey.

7-11) Coordination with other projects

Both sides confirmed that the Project would be coordinated with any other project supported by other development partners, NGOs, and Jordanian official organizations rather than making duplication.

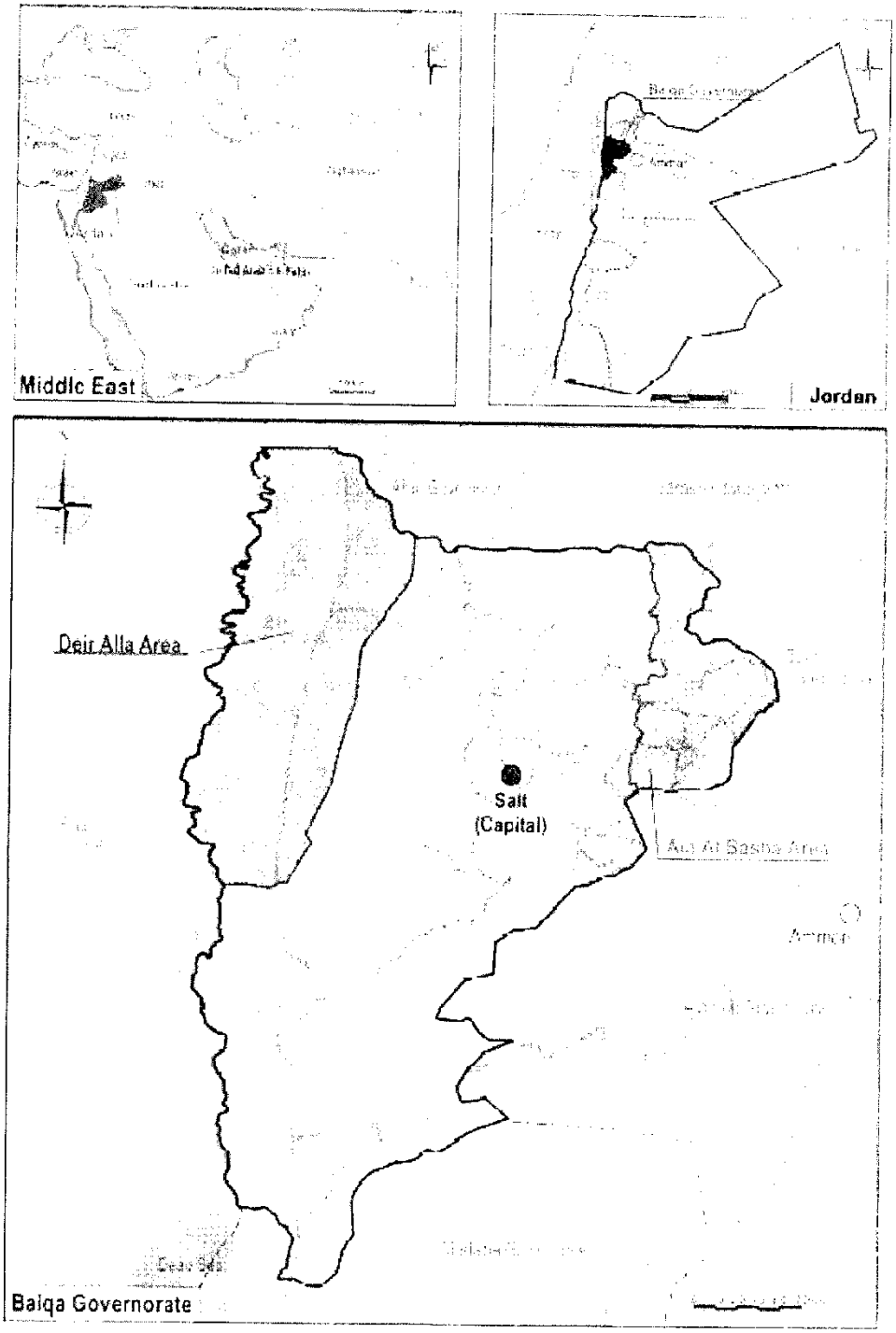
7-12) Environmental Impact Assessment (EIA)

Both sides confirmed that the Jordanian side is responsible for taking any measures to complete EIA, in case that the Survey indicates necessity of EIA for implementing the Project.

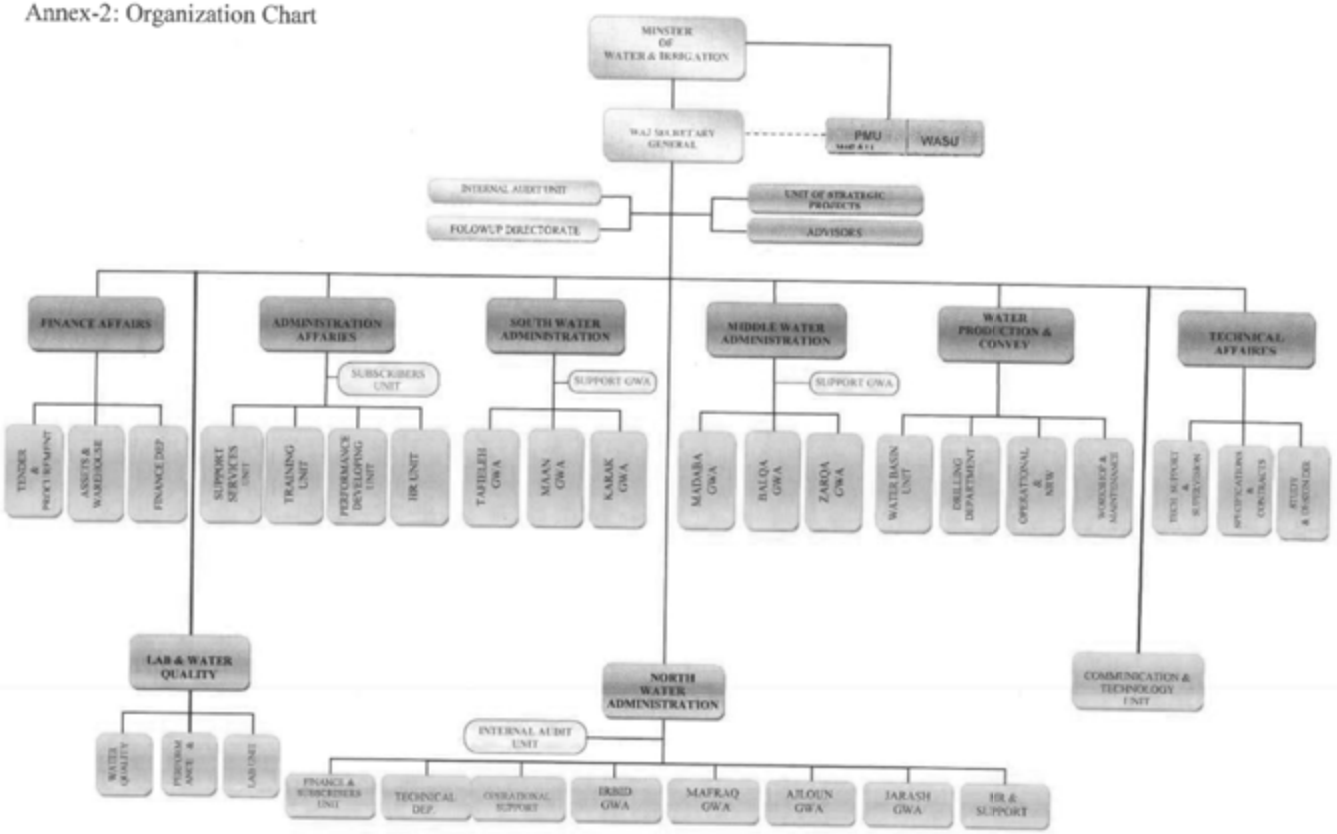
Annex-1	Project Sites Map
Annex-2	Organization Charts
Annex-3	Items Requested by the Jordanian Side
Annex-4	Japan's Grant Aid Scheme
Annex-5	Major Undertakings to be taken by Each Government

4

Annex-1: Project Sites Map



Annex-2: Organization Chart



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Annex-3: Items Requested by the Jordanian Side

Component	Deir Alla district	Ain Al Basha district
1. Installation of transmission and distribution pipeline	Ductile pipes, L=24,600m Dia.150mm× 7,000m Dia.200mm×13,000m Dia.250mm× 2,800m Dia.300mm× 1,300m Dia.400mm× 500m	Ductile pipes, L=27,200m Dia.100mm×15,000m Dia.150mm× 2,700m Dia.200mm× 7,000m Dia.400mm× 2,500m
2. Construction of pumping station	[Ma'adi Pumping Station] Pump Q=200m^3/hr, Head=140m, 2 nos. [New Rajeb Pumping Station] Pump Q=500m^3/hr, Head=52m, 2 nos.	None
3. Construction of reservoirs	[New Ma'adi High reservoir] V=2,500 m^3, 1 No. [New Rajeb Upper Tank] V=6,000 m^3, 1 No	[Baqaa] V=8,000 m^3, 1 No. [Safout] V=2,000 m^3, 1 No [New Eskandanavian] V=2,000 m^3, 1 No. [New Abu Nasir 1] V=1,000 m^3, 1 No [New Abu Nasir 2] V=1,000 m^3, 1 No.

Annex-4: JAPAN'S GRANT AID SCHEME

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as part of this realignment, JICA was reborn on October 1, 2008. After the reborn of JICA, following the decision of the Government of Japan (hereinafter referred to as "the GOJ"), Grant Aid for General Project is extended by JICA.

Grant Aid is non-reimbursable fund to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures (Attachment 1)

Japanese Grant Aid is conducted as follows-

- Preparatory Survey (hereinafter referred to as "the Survey")
  - the Survey conducted by JICA
- Appraisal & Approval
  -Appraisal by The GOJ and JICA, and Approval by the Japanese Cabinet
- Determination of implementation
  -The Notes exchanged between the GOJ and a recipient country
- Grant Agreement (hereinafter referred to as "the G/A")
  -Agreement concluded between JICA and a recipient country
- Implementation
  -Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide a basic document necessary for the appraisal of the Project by JICA and the GOJ. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the implementation of the Project.

- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.

- Confirmation of items agreed on by both parties concerning the basic concept of the Project.

- Preparation of an outline design of the Project.

- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Outline Design of the Project is confirmed considering the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually

implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

The Report on the Survey is reviewed by JICA, and after the appropriateness of the Project is confirmed, JICA recommends the GOJ to appraise the implementation of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the E/N will be singed between the GOJ and the Government of the recipient country to make a plead for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

The consultant firm(s) used for the Survey Will be recommended by JICA to the recipient country to also work on the Project's implementation after the E/N and the G/A, in order to maintain technical consistency.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(4) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Attachment 1.

(6) Proper Use

The Government of recipient country is required to maintain and use the facilities constructed and the equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(7) Export and Re-export

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

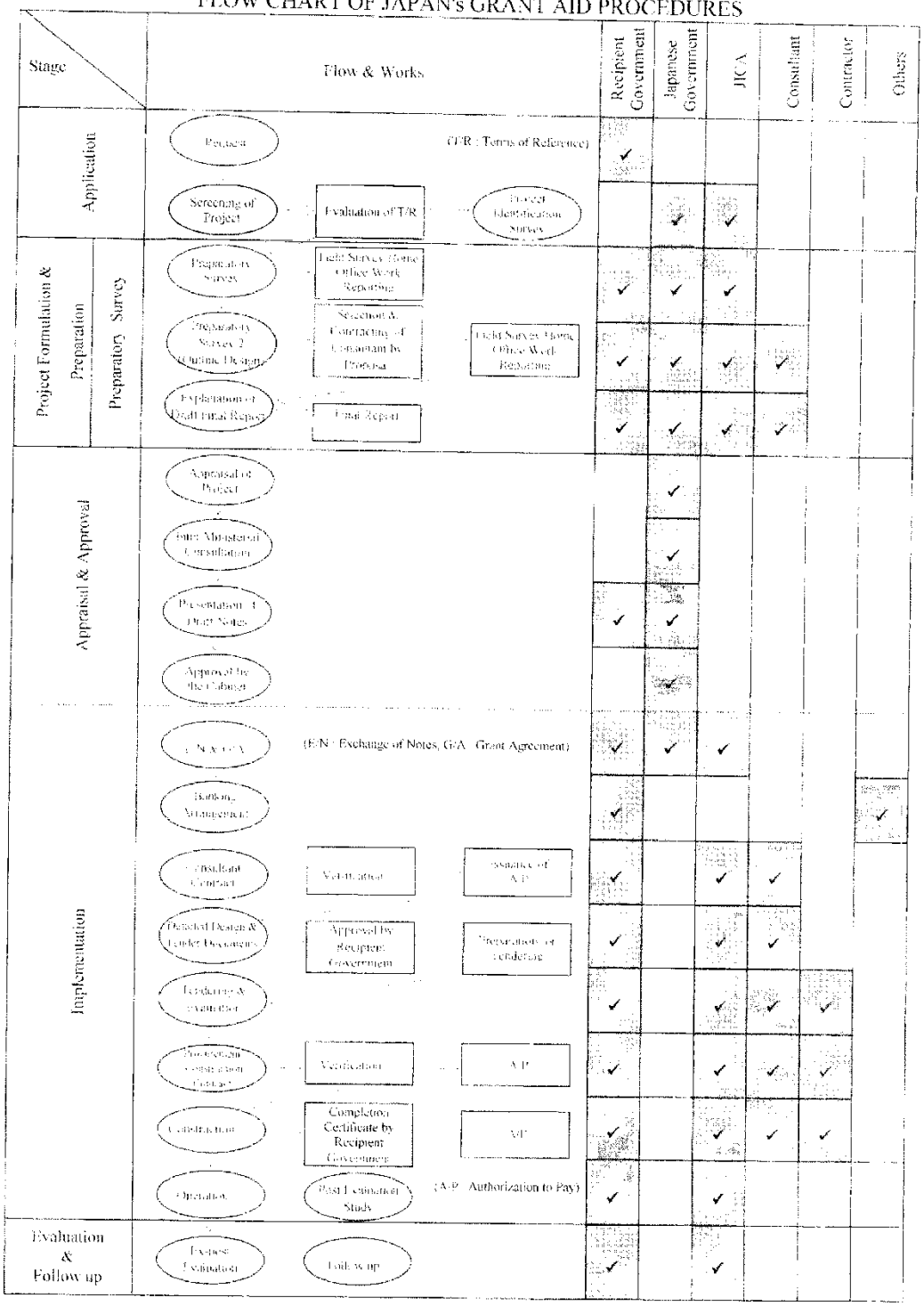
The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.

(10) Social and Environmental Considerations

A recipient country must ensure the social and environmental considerations for the Project and must follow the environmental regulation of the recipient country and JICA socio-environmental guideline.

Attachment 1 for Annex-4

FLOW CHART OF JAPAN's GRANT AID PROCEDURES



Annex-5: Major Undertakings to be taken by Each Government

NO	Items	To be covered by the Grant	To be covered by Recipient side
1	To secure land		●
2	To clear, level and reclaim the site when needed		●
3	To construct gates and fences in and around the site		●
4	To construct the parking lot	●	
5	To construct roads		
	1) Within the site	●	
	2) Outside the site		●
6	To construct the building	●	
7	To provide facilities for the distribution of electricity, water supply.		
	1)Electricity		
	a.The distributing line to the site		●
	b.The drop wiring and internal wiring within the site	●	
	c.The main circuit breaker and transformer	●	
	2)Water Supply		
	a.The city water distribution main to the site		●
	b.The supply system within the site (receiving and/or elevated	●	
	3)Drainage		
	a.The city drainage main (for storm, sewer and others) to the		●
	b.The drainage system (for toilet sewer, ordinary waste, storm drainage and others) within the site	●	
	4)Gas Supply		
	a.The city gas main to the site		●
	b.The gas supply system within the site	●	
	5)Telephone System		
	a.The telephone trunk line to the main distribution frame / panel (MDF) of the building		●
	b.The MDF and the extension after the frame / panel	●	
	6)Furniture and Equipment		
	a.General furniture		●
	b.Project equipment	●	
8	To bear the following commissions to a bank of Japan for the banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
9	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
	1) Marine(Air) transportation of the products from Japan to the recipient country	●	
	2) Tax exemption and customs clearance of the products at the port of disembarkation		●

	3) Internal transportation from the port of disembarkation to the project site	(●)	(●)
10	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
11	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract		●
12	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		●
13	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for construction of the facilities as well as for the transportation and installation of the equipment		●

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

(2) Explanation of Draft Outline Report

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
FOR
THE PROJECT FOR REHABILITATION AND EXPANSION OF THE WATER NETWORKS IN BALQA GOVERNORATE IN THE HASHEMITE KINGDOM OF JORDAN

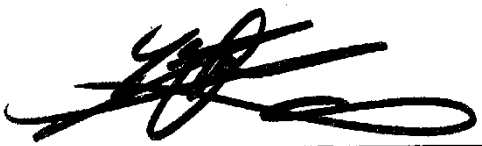
(EXPLANATION OF THE DRAFT REPORT)

The Government of Japan decided to conduct the Preparatory Survey on the Project for Rehabilitation and Expansion of the Water Networks in Balqa Governorate (hereinafter referred to as "the Project") and entrusted the survey to the Japan International Cooperation Agency (hereinafter referred to as "JICA"), therefore JICA has conducted the Preparatory Survey on the Project. Through discussions, field surveys, and technical examination of the study results in Japan, JICA prepared a draft final report of the survey.

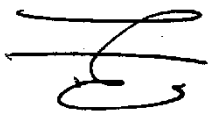
In order to explain and to consult with the Government of the Hashemite Kingdom of Jordan (hereinafter referred to as "Jordan") on the components of the draft final report, JICA dispatched to Jordan the Draft Final Report Explanation Team (hereinafter referred to as "the Team"), headed by Mr. Yoshiki OMURA, Senior Advisor, JICA, from the 26th day to the 30th day of January 2014.

As a result of discussions, both sides confirmed the main items described in the attached sheet.

Amman, 30th January 2014



Mr. Yoshiki OMURA
Leader
Preparatory Survey Team,
Japan International Cooperation Agency



Eng. Tawfiq Z. Habashneh
Secretary General,
Water Authority of Jordan
Ministry of Water and Irrigation

ATTACHMENT

1. Components of the Draft Final Report

The Jordanian side agreed and accepted in principle the components of the draft final report explained by the Team. The Project sites map and components of the Project are respectively shown in **Annex-1** and **Annex-2**.

2. Responsible and implementation agency

2-1) The Responsible Agency is the Ministry of Water and Irrigation (hereinafter referred to as "MWI").

2-2) The Implementing Agency is the Water Authority of Jordan (hereinafter referred to as "WAJ").

3. Japan's Grant Aid Scheme

3-1) The Jordanian side understood the Japan's Grant Aid Scheme explained by the Team, as described in **Annex-3**.

3-2) The Jordanian side will take the necessary measures, as described in **Annex-4**, for smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented.

4. Submission of the Final Report

JICA will complete the final report in accordance with the confirmed items and send it to the Government of Jordan in April 2014.

5. Other Relevant Issues

5-1) Project cost estimate and fairness

The Team explained to the Jordanian side the estimated project cost as attached in **Annex-5**. Both sides confirmed that this cost estimate is provisional and would be examined further by the Government of Japan for its final approval. Furthermore, both sides confirmed that this project cost estimate is CONFIDENTIAL, and should never be duplicated in any forms or released to any other parties until the relevant contracts are awarded by the Government of Jordan, in order to secure fairness of tender procedure.

5-2) Necessary budget to be covered by the Jordanian side

The Japanese side explained necessary project cost to be covered by the Jordanian side as attached in **Annex-5** and necessary annual operation and maintenance cost. The Jordanian side agreed to secure

necessary budget.

5-3) Tax Exemption

The both sides confirmed that the tax exemption including Value Added Tax (VAT), customs duty, and any other taxes and fiscal levies in Jordan, which is to be imposed in relation to the Project activities, will be ensured by the Jordanian side. WAJ will take any necessary procedures for tax exemption, and in case that tax exemption is not secured, the cost of tax will be borne by WAJ.

5-4) Undertakings of the Jordanian side

The Team explained to the Jordanian side its undertakings as listed in **Annex-4**, and the Jordanian side understood and agreed to execute them. The following items are to be emphasized:

1) Land Acquisition

WAJ agreed to take necessary procedures to acquire land for the sites of the Project for construction of three reservoirs as described in the draft final report, and complete them by the end of September 2014.

2) Securing bulk water supply to Balqa Governorate

The both sides confirmed that, as a prerequisite to the Project, an additional bulk water of 4 MCM a year shall be allocated to the Balqa Governorate by completion time of the Project expected in 2017. Total amount of 1.09 MCM a year shall be secured to Deir Alla from the existing Abu Zeghan RO Plant owned by Miyahuna LLC, and total amount of 7.7 MCM a year of water to Ain Al Basha from Zai/Dabouq Conveyer to utilize the pressure for providing reservoirs with water.

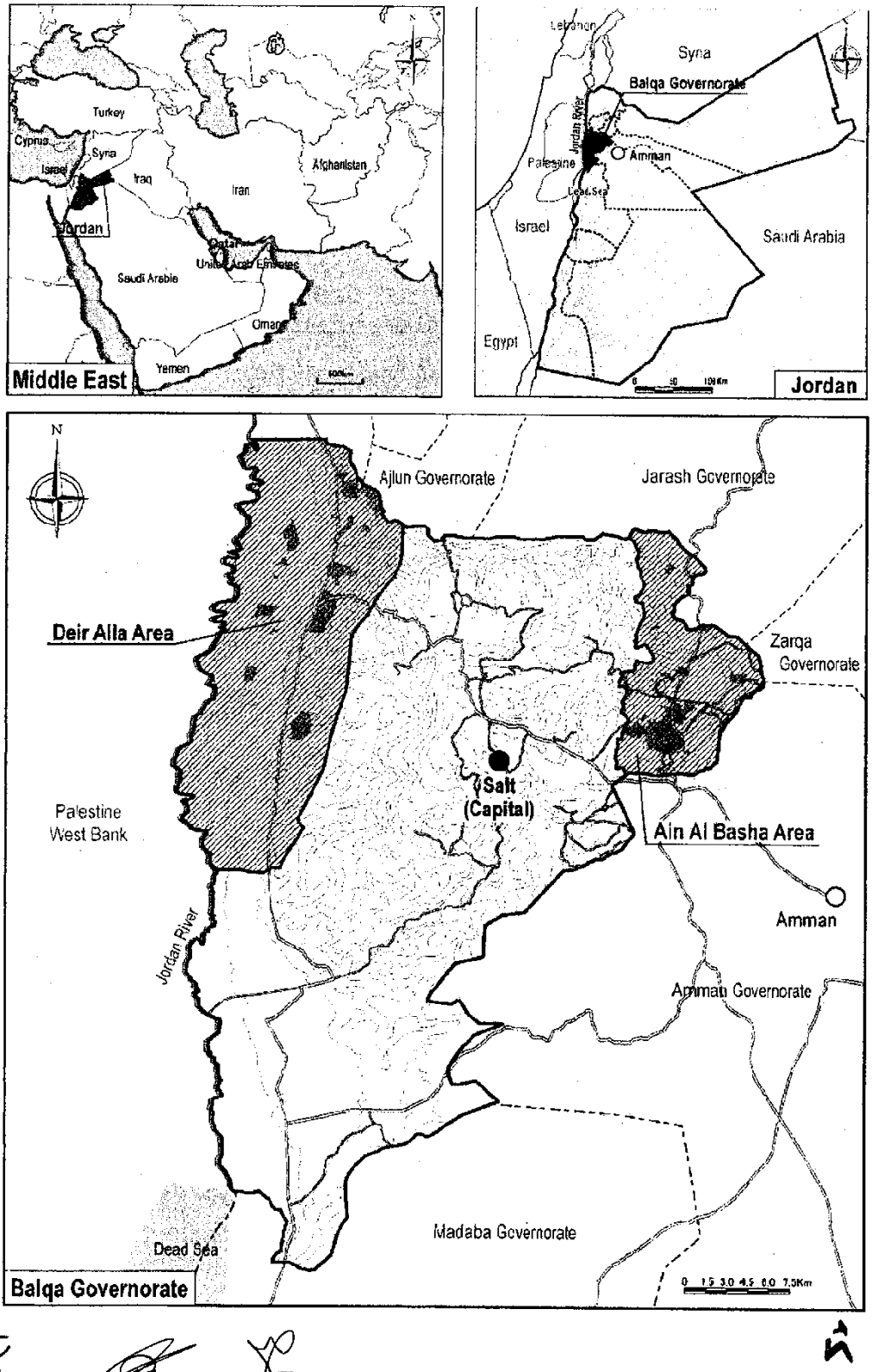
WAJ agreed to secure a MWI approval by March 2014 to allocate said volume of water to the Balqa Governorate upon to the Project completion.

3) Technical assistance ("Soft Component" of the Project)

Both side confirmed that the technical assistance on the effective operation and maintenance of distribution network is provided as a soft component of the Project. To secure the effectiveness of the soft component, WAJ shall assign competent and appropriate staff who can acquire the necessary skills and knowledge to apply to their jobs.

Annex- 1 Project Sites Map
Annex- 2 Component of the Project
Annex- 3 Japan's Grant Aid Scheme
Annex- 4 Major Undertakings to be taken by Each Government
Annex- 5 Cost borne by the Japanese and the Jordanian sides

Annex- 1 Project Sites Map



Annex- 2 Component of the Project

Item	Area	Component		Unit	Capacity and Quantity
Procurement and Construction	Ain Al Basha	Pipeline	100mm DI	M	350
			150mm DI	M	5,740
			200mm DI	M	4,700
			250mm DI	M	540
			300mm DI	M	8,750
			Total	M	20,080
		Distribution Reservoir	New Abu Nsair 1	m^3	900
			New Abu Nsair 2	m^3	1,100
			Total	m^3	2,000
		Pressure Reducing Valve		units	5
		Flow Meter		units	7
	Deir Alla	Pipeline	150mm DI	m	1,090
			250mm DI	m	4,450
			300mm DI	m	9,620
			Total	m	15,160
		Distribution Reservoir	Ma'adi	m3	3,300
		Pump Station	Ma'adi Pump Station	No.	1
		Pressure Reducing Valve		units	6
		Flow Meter		units	11
	Grand Total	Pipeline	100mm DI	M	350
			150mm DI	M	6,830
			200mm DI	M	4,700
			250mm DI	M	4,990
			300mm DI	M	18,370
			Total	M	35,240
		Distribution Reservoir		units	3 (5,300m^3 in total)
		Pump Station		units	1
		Pressure Reducing Valve		units	11
		Flow Meter		units	18
Soft Component	Technical Assistance for Capacity Development of Management of Water Distribution System			Lot	1

Annex- 3 Japan's Grant Aid Scheme

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as part of this realignment, JICA was re-organized on October 1, 2008. After the re-organization of JICA, following the decision of the GOJ, Grant Aid for General Project is extended by JICA.

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- Grant Agreement (hereinafter referred to as "the G/A")
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  - -Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide a basic document necessary for the appraisal of the Project by JICA and the GOJ. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed on by both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Outline Design of the Project is confirmed considering the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

The Report on the Survey is reviewed by JICA, and after the appropriateness of the Project is confirmed, JICA recommends the GOJ to appraise the implementation of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the E/N will be singed between the GOJ and the Government of the recipient country to make a plead for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

The consultant firm(s) used for the Survey Will be recommended by JICA to the recipient country to also work on the Project's implementation after the E/N and the G/A, in order to maintain technical consistency.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(4) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Attachment 2

(6) Proper Use

The Government of recipient country is required to maintain and use the facilities constructed and the equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(7) Export and Re-export

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.

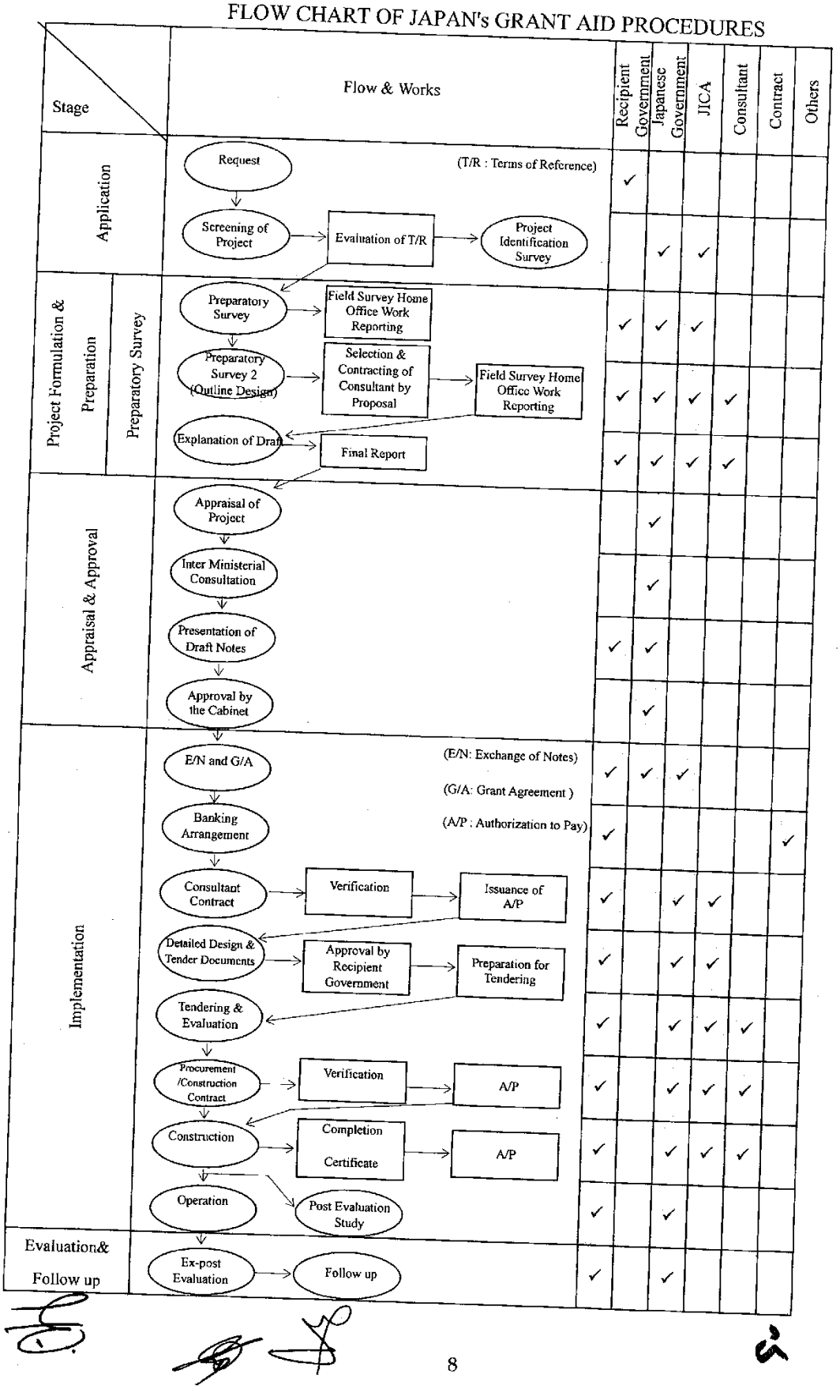
(10) Social and Environmental Considerations

A recipient country must ensure the social and environmental considerations for the Project and must follow the environmental regulation of the recipient country and JICA socio-environmental guideline.

(End)

Attachment 1 for Annex-3

FLOW CHART OF JAPAN's GRANT AID PROCEDURES



Annex-4: Major Undertakings to be taken by Jordanian Government

NO	Items	To be covered by the Grant	To be covered by Recipient side
1	To secure land		•
2	To clear, level and reclaim the site when needed	•	
3	To construct gates and fences in and around the site		•
4	To construct the parking lot	•	
5	To construct access roads		
	1) Within the site	•	
	2) Outside the site	• (base course)	• (asphalt)
6	To construct the building	•	
7	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities		
	1)Electricity		
	a. The distributing line to the site		•
	b. The drop wiring and internal wiring within the site	•	
	c. The main circuit breaker and transformer		•
	2)Water Supply		
	a. The municipal water service pipe to the site		•
	b. The supply system within the site	•	
	3)Drainage		
	a. The municipal drainage main (for storm, sewer and others) to the site	N/A	N/A
	b. The drainage system (for toilet sewer, ordinary waste, storm drainage and others) within the site	N/A	N/A
	4)Gas Supply		
	a. The municipal gas main to the site	N/A	N/A
	b. The gas supply system within the site	N/A	N/A
	5)Telephone System		
	a. The telephone trunk line to the main distribution frame / panel (MDF) of the building	N/A	N/A
	b. The MDF and the extension after the frame / panel	N/A	N/A
	6)Furniture and Equipment		
	a. General furniture	N/A	N/A
	b. Project equipment	•	
8	To bear the following commissions to a bank of Japan for the banking services based upon the B/A		
	1) Advising commission of A/P		•

9

	2) Payment commission		•
9	To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
	1) Marine (Air) transportation of the products from Japan to the recipient country	•	
	2) Tax exemption and customs clearance of the products at the port of disembarkation		•
	3) Internal transportation from the port of disembarkation to the project site	•	
10	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		•
11	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contract		•
12	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		•
13	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for construction of the facilities as well as for the transportation and installation of the equipment		•

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

Confidential

Annex-5: Project Cost to be borne by Each Government

1. Project Components by the Japanese Grant Aid

   This Page is closed due to the confidentiality.

2. Project Components by the Jordanian Government

   Total Project Cost to be borne by the Jordanian Government: Approximately JPY 32.5 Million. (equivalent to approx. JD 232 Thousand).

(Applied conversion rate: JD 1 = JPY 140.17)

Study on the Rehabilitation and Expansion Plan of the Transmission and Distribution System for the Balqa Governorate in the Hashemite Kingdom of Jordan

Soft Component Plan

March 2014

TEC International

Study on the Improvement to Transmission and Distribution Network and Preparations for Expansion Plan for the Balqa Governorate in the Hashemite Kingdom of Jordan

Soft Component Plan

Table of Contents

List of Tables & Figures

Sheet 1: Details of estimated project cost of soft component

1. Background of soft component plan

The grant-in-aid cooperation project “The Rehabilitation and Expansion Plan for Water Transmission and Distribution Network for the Balqa Governorate in the Hashemite Kingdom of Jordan” has the following objectives: (1) Fair and equal distribution of water to distribution zones; (2) Restricting the distribution pressure to an appropriate level to reduce water leakage; (3) conversion of system to a high energy efficient system by rehabilitating and expanding the water supply facilities of Ain El Basha area and Deir Alla area in the Balqa Governorate of the Hashemite Kingdom of Jordan (hereafter referred to as "Jordan"). This project includes setting of distribution zones and DMA, construction of distribution reservoirs, renewal of transmission pipelines, and installation of pressure reducing facilities and bulk meters including components. By implementing this project, the water supply status to the project area will be improved, revenue earning water will increase due to reduction in water leakage, and power consumption will also reduce; therefore, the project can contribute to the soundness of the water supply works of WAJ.

1) Status

The waterworks supply systems of both Ain El Basha and Deir Alla depend on well water sources and other water sources for supply. In addition to well water sources, Ain El Basha receives water from the Zai Water Treatment Plant and Deir All from RO plants at two locations. Most of the water from water sources for both areas is transmitted first to the distribution reservoir and pump receiving tank, and is then delivered under pressure either by gravity flow or by using pumps. The installed level of the existing distribution reservoir, however, is not adequately high, and the capacity too is inadequate. For this reason, water is being supplied by distribution pumps and booster pumps to most of the target areas of this project.

In both areas, no pressure-reducing facilities exist to maintain appropriate supply water pressure in spite of the rugged undulating terrain; moreover, zones have not been delineated. Most of the pumps are aged pumps; there are very few with performance suitable to the status of the distribution destination. Areas with low altitude have high water pressure, and areas with high altitude have low water pressure, and the result is water leakage and unsatisfactory water supply. Because of lack of maintenance of distribution reservoirs and inadequate pump performance, proper supply of water is difficult; moreover, fair and equitable distribution of water to the supply zones is also difficult. Power consumption is also high because pump is being operated at a low efficiency. Rehabilitation of waterworks was demanded in order to improve such a water supply status; however, projects with aid were few compared to other governorates. Particularly, there was practically no assistance given to Deir Alla area, so practically no waterworks rehabilitation project was implemented in this area.

The WAJ zonal office is in charge of water distribution management in this area under an environment

with inadequate provision of waterworks facilities, and it faces issues such as the following:

① Practically no monitoring equipment exists for quantitatively measuring the status (supply area, supply timing, supply amount, supply pressure and so on) at the water distribution destination at the existing distribution zone. Since data collection is not being carried out in the water distribution zone, personnel are not familiar with the method of data collection, and do not understand how to utilize data.

② Flow meters will be fitted at the required locations in this project; therefore, by comparing the amount of water used by the consumer, non-revenue water ratio can be determined. However, depending on the level of the regional WAJ Office, the method of determining non-revenue ratio has not been understood since the personnel have not had the experience in determining the same.

③ Pressure reducing equipment is essential for maintaining appropriate supply pressure. The setting for pressure reduction range and operation and maintenance technology are especially important. Although pressure reducing valves have been partially installed in Ain El Basha, there are non in Deir Alla. In both zonal offices, there are practically no staff members familiar with the operation of pressure-reducing valves and operation and maintenance technology.

2) Need for soft component

The water transmission and distribution facilities, and the water distribution zones of Ain El Basha and Deir Alla areas will be rehabilitated as the outcome of this project, and the water transmission and distribution system will be improved. However if the management and utilization of transmission and distribution data and the operation and maintenance of distribution pipeline network are not implemented appropriately and continuously, the effects of this project will not be demonstrated to the maximum. In practice, however, the knowledge and technical level of staff members of the Ain El Basha and Deir Alla zonal offices operating and managing the water transmission and distribution systems are in adequate. Moreover, the skills and abilities of the staff members of the WAJ Balqa Office to provide guidance to these two offices are also in adequate. In view of this situation, technical support should be given by this soft component to the staff members of the two zonal offices in charge of actual water distribution management and also to the staff members of the WAJ Balqa Office. The skills and abilities related to management of water transmission and distribution and related to management of non-revenue water needs to be reinforced bearing in mind future activities through coordination of concerned organizations.

This soft component plans to utilize the outcomes of the “Project to Enhance Non-revenue Water Skills” (2005 to 2008), and the “Project to Enhance Non-revenue Water Skills Phase 2” (2009 to 2011), which are technical cooperation projects implemented by the government of Jordan. The technical cooperation project supports enhancement of skills and provision of the WAJ organizational

system related to non-revenue water (leakage detection, water meter installation, distribution network management, and so on). Appropriate monitoring of water distribution, transfer of technology and skill development related to calculation of non-revenue water through management and analysis of water distribution data will be carried out through this soft component. Therefore, the staff members of both zonal offices and WAJ Balqa Office will acquire techniques for distribution water management.

2. Goal of soft component

To enhance the abilities of staff members of Ain Al Basha and Deir Alla offices related to water distribution management.

3. Deliverables of soft component

The deliverables and main activities of soft component are as given below. This soft component enables the staff members of the Ain Al Basha and Deir Alla offices to collect flow data continuously from installed bulk meters. This assists in calculating the non-revenue water and managing appropriate water distribution.

Deliverable 1: Staff members of the Ain Al Basha and Deir Alla area offices and staff members of the WAJ Balqa Office will develop the ability to collect and analyze flow data from bulk meters continuously, understand zone and DMA distribution amounts and will be able to adopt the approach to fair and equitable distribution of water.

Deliverable 2 Staff members of the Ain Al Basha and Deir Alla area offices and staff members of the WAJ Balqa Office can calculate the non-revenue water from water distribution data of bulk meters and from water meter readings, and will be able to utilize this data for reducing non-revenue water.

Deliverable 3 Staff members of the Ain Al Basha and Deir Alla area offices and staff members of the WAJ Balqa Office will be able to control the water supply pressure within the appropriate range.

4. Method of confirming outcome achievement level

The outcome achievement level of soft component can be confirmed by the method given in Table 1. Two staff members from the WAJ Balqa Office who guide and supervise the water supply operations in WAJ Balqa governorate, and two staff members each from the Ain Al Basha and Deir Alla area offices who actually perform the water supply operations will be selected as research team members.

All research staff members will aim to satisfy the confirmatory items below for outcome achievement level of soft component.

Table 1 Method of confirming outcome of soft component

Field	Outcomes	Items for confirming achievement level
Management of water distribution data	Staff members of the WAJ Balqa Office will develop the ability to collect and analyze flow data from bulk meters continuously, understand zone and DMA distribution amounts and will be able adopt the approach to fair and equitable distribution of water.	➢ Is there awareness on the importance of monitoring? ➢ Has the ability to perform O&M of bulk meters been acquired? ➢ Can data collection from bulk meters, tabulation, analysis and plotting be done properly? ➢ Can problems be extracted from analyzed results and proper approach to water distribution control be specified?
Calculation of non-revenue water	Staff members of the WAJ Balqa Office can calculate the non-revenue water from water distribution data of bulk meters and from water meter readings, and will be able to utilize this data for reducing non-revenue water.	➢ Are staff members aware of the concept of non-revenue water? ➢ Can non-revenue water be calculated by comparing water distribution data and data from water meter readings? ➢ Is the method of evaluation of non-revenue water understood by staff members? ➢ Can measures for reducing non-revenue water be specified?
Water supply pressure control	Staff members of the WAJ Balqa Office will be able to control the water supply pressure to within the appropriate range.	➢ Are staff members aware of the appropriate range of water distribution pressure? ➢ Have the principles of pressure-reducing valve been understood? ➢ Have the O&M of pressure-reducing valves and method of adjusting range of reduced pressures been understood and mastered?

5. Soft component activities (introduction plan)

The detailed activities include the items indicated in Table 2.

Table 2 Detailed activities of soft component

No.	Activity	Introduction	
		Japanese side	No. of participants on Jordan side
1	Preparations for training		
1)	Domestic preparations (1 expert)		
(1)	Preparation of transfer of technology plans	1 person x 1 day= 1 person.day	—
(2)	Test preparation, questionnaire preparation, training text (draft) preparations	1 person x 4 day= 4 person.days	—
	Sub-total	5 person.days	
	Transfer	1 person x 2 times x 2 days= 4 person.days	—
2)	Implementation preparations and introductory technical briefing		
(1)	Training room establishment, C/P meeting, implementation preparations, briefing preparations	1 person x 3 days= 3 person.days	1 person x 4 day= 4 person.days: CE

No.	Activity	Introduction	
		Japanese side	No. of participants on Jordan side
(2)	Selection of trainees (pre-test training, questionnaire, evaluation, selection)	1 person x 1 day= 1 person.day	1 person x 1 day= 1 person.day: CE
(3)	Implementation briefing	1 person x 1 day= 1 person.day	5 persons x 1 day= 5 person.days
	Sub-total	5 person.days	10 person.days
2	Training		
1)	Distribution data management (Distribution management engineer)		
(1)	Explanations on purpose and method of collecting distribution data, outline of equipment and O&M method (bulk meter, pressure gauge) (Lecture)	1 person x 1 day= 1 person.day	5 persons x 1 day= 5 person.days
(2)	Data format preparation and data acquisition	1 person x 7 days= 7 person.days	3 persons x 7 days= 21 person.days
(3)	Input, processing and analysis of water distribution data (lecture and exercise)	1 person x 4 day= 4 person.days	5 persons x 4 days= 20 person.days
(4)	Evaluation of water distribution management from analyzed data and measures	1 persons x 2 days= 2 person.days	5 persons x 2 days= 10 person.days
2)	Calculation of non-revenue water		
(1)	Explanation on the purpose and method of calculating non-revenue water (Lecture)	1 person x 1 day= 1 person.day	5 persons x 1 day= 5 person.days
(2)	Calculation of non-revenue water from water distribution data and meter readings (Lecture and exercise)	1 persons x 2 days= 2 person.days	5 persons x 2 days= 10 person.days
(3)	Evaluation of the amount of non-revenue water and measures	1 persons x 2 days= 2 person.days	5 persons x 2 days= 10 person.days
3)	Water supply pressure control		
(1)	Standards for appropriate range of water supply pressures	1 persons x 2 days= 2 person.days	5 persons x 2 days= 10 person.days
(2)	Outline of pressure-reducing valve (Lecture)	1 persons x 2 days= 2 person.days	5 persons x 2 days= 10 person.days
(3)	Method of adjusting pressure reduction range and O&M of pressure-reducing valves	1 person x 3 days= 3 person.days	3 persons x 3 days= 9 person.days
	Sub-total	26 person.days	110 person.days
3.	General report		
1)	General seminar		
(1)	Preparations (Ain Al Basha and Deir Alla)	1 persons x 2 days= 2 person.days	4 persons x 2 days= 8 person.days
(2)	Holding seminar (Ain Al Basha and Deir Alla)	1 person x 1 day= 1 person.day	10 persons x 1 days= 10 person.days
2)	Preparation of reports and provision of manual		
(1)	Soft component evaluation report	1 person x 1 day= 1 person.day	—
(2)	Preparation and submission of general report	1 person x 1 day= 1 person.day	—
	Sub-total	5 person.days	18 person.days
	Transfer	1 person x 2 times x 2 days= 4 person.days	—
	Total	49 person.days	138 person.days

6. Method of procuring resources for implementing soft components

The soft component will be implemented through direct support by dispatching distribution management engineers (Japanese consultant) for about 1.6 months. The necessary requirements of

engineer for implementing the soft component are as given below.

1) The engineer fully understands pipeline network hydraulics
2) Can propose water transmission and distribution operation plans
3) Has the ability to manage training for the technical personnel of Jordan

The engineer is required to have experience related to formulating plans for transmission and distribution and related to hydraulics. In addition, the engineer is required to have the language skills for coming to a mutual understanding with Jordanian engineers, and the ability to understand issues on O&M of transmission and distribution system in developing countries.

Distribution management engineers may be utilized from Jordan or from a third country, but it is difficult to find engineers with the overall understanding of these techniques who can implement training. Consequently, Japanese consultants who satisfy the requirements above and can understand the status of the transmission and distribution system in Jordan are appropriate for the task.

Details of staff assignment plan are given in Table 3.

Table 3 Staff assignment plan for soft component

Field	No. of persons	Belonging to	Description
Distribution management	1	Japan	The distribution management technology of Japan will be applied to the technical levels of the trainees and to conditions on site, and the following items will be implemented: ・ Preparation of text for training, implementation of training ・ Preparation and evaluation of tests and homework reports ・ Provision of various formats ・ Implementation of seminars ・ Data collection, editing and modeling ・ Evaluation

7. Soft component implementing stages

The construction work of the facilities of this project will be implemented in 19.5 months. The implementation of the soft component will require distribution amount data and water pressure data measured in the distribution reservoirs, DMA, etc., proposed to be constructed. Accordingly, the soft component will be implemented after completion of these facilities. These data collection periods will be estimated and soft component implemented in two periods – the first period and the second period. During the first period, training will be implemented with the focus on lectures so that basic

knowledge can be acquired. Next, until the first month after the start of the second period, Jordan will collect the measurement data. During the second month training will be implemented with the aim of familiarizing the trainees with input, processing and analysis of collected data, distribution management from the analyzed results, non-revenue water measures and supply pressure control methods. The necessary person-days for the soft component period are about 3.2 months, as given below. The implementation plan is shown in Table 4, while the detailed activity plan is shown in Figure 1.

- Actual work days: 49 days, domestic preparations 5 days and on site 44 days
- Calendar days (see Figure 1): 65 days (domestic preparations 5 days and on site 60 days)
- Calendar months: Domestic preparation time: 0.17 MM (=5/30); dispatch period: 1.43 MM (=60/30)(60 days)

Table 4 Implementation plan

Activity	Domestic	Site First month	Site Second month	Site Third month
1. Preparations for training				
1) Domestic preparations (1 expert)				
2) Implementation preparations and introductory technical briefing				
2. Training				
1) Distribution data management (Distribution management engineer)				
2) Calculation of non-revenue water				
3) Water supply pressure control				
3. General report				
1) General seminar				
2) Preparation of reports and provision of manual				

Figure 1 Detailed activity plan

Items	No	Activity	Total days	Remarks
		Month		
		Days		
1) Preparation				
	1)	Domestic preparation		
	①	Preparation of report for technology transfer plan	1	
	②	Preparation of test, questionnaire and training text (draft)	4	
		Sub-total	5	
		Travel	4	
	2)	Explanatory meeting for the implementation and adopted technology		
	①	Setting of training room, meeting with C/P, preparation of implementation and explanatory meeting	3	
	②	Selection of trainees (Test before training, questionnaire, evaluation and selection)	1	Questionnaire and test
	③	Explanatory meeting	1	Report for technology transfer plan
		Sub-total	5	
2) Training	1)	Transmission and distribution data management		
	①	Objectives and methods of distribution data collection, and outline and mmaitenance of equipment (bulkmeter, pressure gage) (lecture)	1	Training manual
	②	Data format and data acquisition	7	Data processing tools
	③	Data input, processing and analysis (lecture & OJT)	4	
	④	Evalation and countereasure of water disribution management (lecture & OJT)	2	Data processing tools
		Sub-total	14	
	2)	Estimation of non return water		
	①	Objectives and methods of non return water estmation (lecture)	1	Training manual
	②	Non water return estimation from distribution water and bill water (lecture & OJT)	2	Data processing tools
	③	Evalation and countermeasure of non return water (lecture & OJT)	2	Data processing tools
		Sub-total	5	
	3)	Service water pressure management		
	①	Appropriate service water pressures (lecture)	2	Training manual
	②	Outline of Pressure Reducing Valve (PRV) (lecture)	2	Training manual
	③	Pressure reducing adjustment and maintenance of PRV (lecture and OJT)	3	Training manual
		Sub-total	7	
3) General report	1)	Comprehensive seminar		
	①	Preparation for Ain Al basha and Deir Alla	2	
	②	Seminar (Salt)	1	
		Sub-total	3	
	2)	Preparation of report and manual		
	①	Evaluation of soft component	1	
	②	Reporting of general report and submission of report	1	General report
		Sub-total	2	
Return		Travel	4	
Domestic			5	
Overseas		Net total	44	
Overseas		Total	60	

8. Deliverables of soft component

The following reports and deliverables will be prepared and submitted:

Reports & Deliverables	Description	Timing
Preparation of transfer of technology plans (English)	Description, achievement target, detailed schedule, implementation method, etc. of soft component	At the start
Completed report (in English with Japanese summary)	General report including description of transfer of technology, results of upgrading skills, training evaluation, transfer of technology manual and photos	At completion
Distribution data	Input distribution data	At completion
Manuals	Distribution data input and management manual	At completion
Others	Teaching records, outputs, training texts	At completion

9. Obligations of the counterpart agencies

The organization responsible for water supply in Balqa Governorate is WAJ Balqa office. The site offices of Ain Al Basha and Deir Alla areas operate the water supply works under the guidance of the WAJ Balqa office; therefore, the site office is the entity that makes the actual decisions related to water distribution management. These concerned organizations share the common awareness of the importance of distribution management in the water supply works, transfer technology for upgrading distribution management skills to the concerned staff members, and understand the need for improving technical skills. The, WAJ Balqa Office has been provided with a computer systems environment, and is also familiar with technology transfer and data processing. Although the zonal offices are well versed in the actual conditions on site, the staff members are not as familiar with the use of computers in work as the staff members in the WAJ Balqa office. Under such conditions, the counterpart organizations are required to efficiently perform soft component activities and adopt the measures listed below against anticipated hindrance factors so that the outcomes of soft component activities are effectively used in the operation and O&M of new facilities.

1) Selection of trainees

Many of the staff members unfamiliar with computers in the zonal offices may not be able to cope up with the training; therefore, proper selection of trainees is necessary. The training content will include data processing technology using computers in addition to distribution management technology. Therefore, trainees must be selected from among the staff members of the two zonal offices and the WAJ Balqa Office, which is the national implementation organization on the counterpart' side based on the conditions listed below as the pre-conditions, and the selected trainees must also be finally

selected by Japanese consultant after judging their appropriateness.

- Should have experience in distribution management
- Should be familiar with basic operations of the computer
- Should be familiar with the operations of basic software (MS-Excel and MS-Word)
- Should be able to devote adequate time for training (at least 3 hours per day)
- Should have keen interest in the training program and the will to learn.

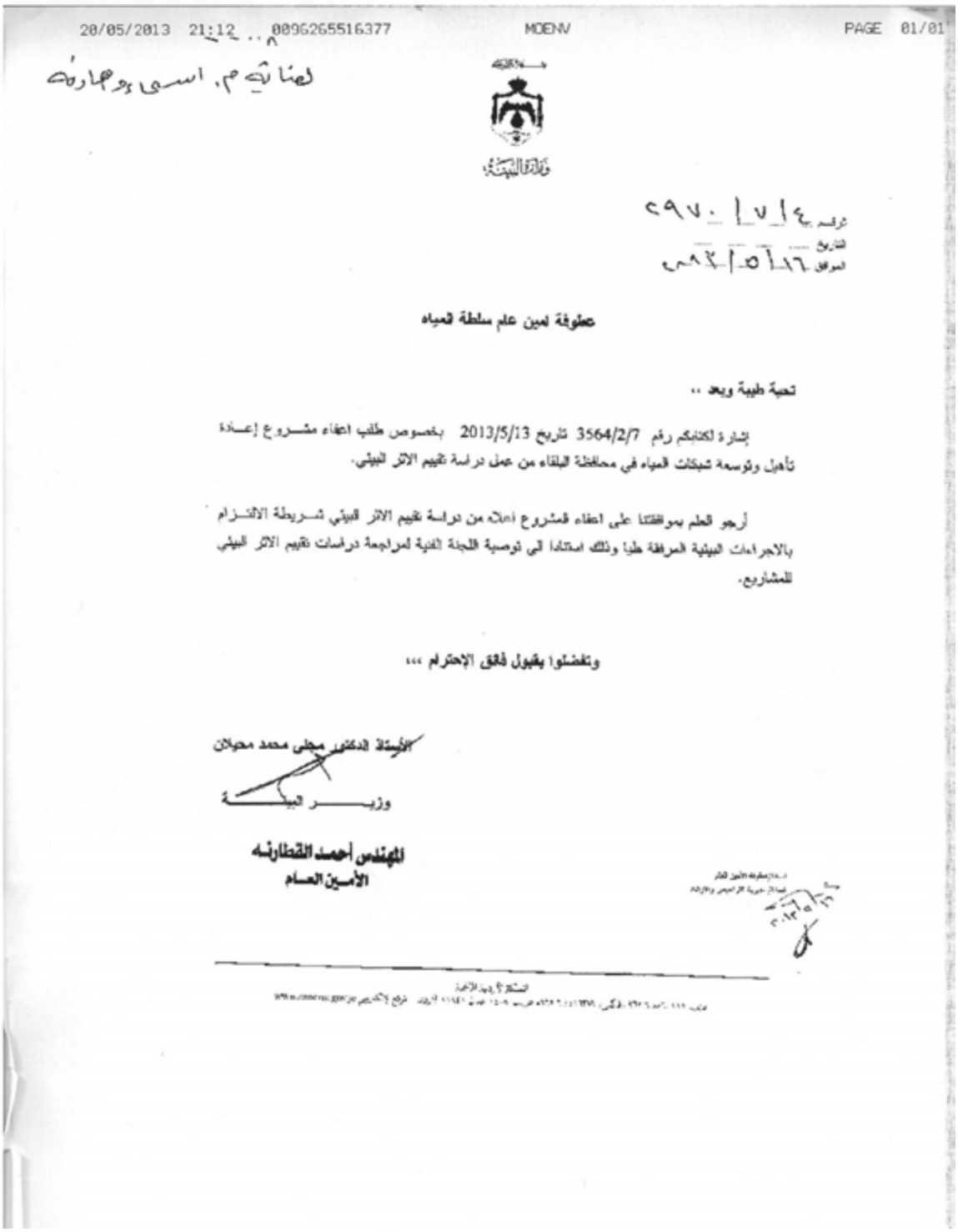
2) Coordination between WAL Balqa Office and zonal offices

The scope of management responsibilities of the WAJ Balqa Office and zonal offices is not clearly defined, so the sharing of information is inadequate. To effectively utilize the deliverables of soft component, the scope of responsibilities of the WAJ Balqa Office and all zonal offices must be clearly defined, and flow of information among all offices must be established. The scope of management responsibilities of each organization and the flow of information among organizations is closely linked. It is important to establish beforehand the flow of information including the type of information and frequency, and the response methods against issues among all organizations.

6 Other Relevant Data

6.1 Environment and Social Considerations

(1) Letter from Ministry of Environment



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لعنايتكم، اسمى بوهارون

وزارة البيئة

الرقم ٤/٧/٩٧٠
التاريخ ١٦/٥/٢٠١٣م
الموافق

معالوفة لمين عام سلطة المياه

تحية طيبة وبعد ،،

إشارة لكتابكم رقم 3564/2/7 تاريخ 2013/5/13 بخصوص طلب اعفاء مشروع إعادة تأهيل وتوسعة شبكات المياه في محافظة البلقاء من عمل دراسة تقييم الاثر البيئي.

أرجو العلم بموافقتنا على اعفاء المشروع اعلاه من دراسة تقييم الاثر البيئي شريطة الالتزام بالاجراءات البيئية المرفقة طيا وذلك استنادا الى توصية اللجنة الفنية لمراجعة دراسات تقييم الاثر البيئي للمشاريع.

وتفضلوا بقبول فائق الإحترام ،،،

الأستاذة الدكتورة مجلى محمد محيلان
وزيـــــر البيئـــــة

المهندس أحمد القطارنه
الأمين العام

(Translation)

The Hashemite Kingdom of Jordan
Ministry of Environment

No. : 4/7/2970
Date: 16/5/2013

His Excellency General Secretary of Water Authority

Greetings:

With reference to your letter No. 7/2/3564 of 13/5/2013 concerning the request of exemption of Rehabilitation and Expansion of Water Networks project in Balqa Governorate from undertaking an Environmental Impact Evaluation Study.

Please be informed of our approval to exempt the above project from the Environmental Impact Evaluation subject to adherence with the following environmental measures attached herewith based on the recommendation of the Technical Committee for Reviewing the Environmental Impact Evaluation for projects.

With kind regards.

p.p. Prof. Dr. Mujalli Mohammad Muhailan
(Signed)
Minister of Environment
(Original Signed by
Eng. Ahmad Qatarneh,
General Secretary)

Precautionary & Alleviation Measures

Precautionary & Alleviation Measures	Appearance Environment / Social Factor	No.
PUBLIC HEALTH		
Dust emission resulting from the establishment of water supply networks and water transmission lines must be reduced- particularly near the densely populated areas, by complying with the following:	**Quality of Air**	**1**
- Reduce motor vehicles speed on the unpaved roads so as not to exceed 20 km/h.		
- Piling of fine materials with minute particles should not be permitted at the places of work without its protection against flying away or movement due to wind.		
- The contractor should ascertain the cleanliness of motor vehicles and equipment leaving the project area.		
- The contractor should take measures to restrain the flying dust on the unpaved roads in the drilling areas, and to restrain the air carried particles during the transport of extracted drilling output near the densely populated areas or sensitive receivers during the blowing of wind and upon need.		
- The contractor should store cement and sand or other fine particles in a manner which would prevent its movement of dust due to wind.		
- The movement of equipment and machinery shall, at all times and when ever it is possible, be restricted to the routes specified thereto.		
- The areas and paved streets should be cleaned of dust caused by construction activities and according to the response plan, prevent spills which should be developed by the contractor as a part of environmental administration plan.		
Periodically monitor the emissions of machinery and construction vehicles and carry out the appropriate periodical maintenance in order to reduce the emission of pollutants therefrom so as to comply with the limits of the national specifications.		
The machinery should not be left running for long periods when not in use.		
The construction materials loaded in the trucks should be tightly covered during its transport in order to reduce the emission of dust therefrom.		
The appropriate work practices and engineering control methods should be followed to reduce the emission of vapours from asphalt during the asphalting operation. Also, the heated asphalt should be kept at the lowest possible temperature. The population living nearby the asphalting activities should be notified of such activities three days in advance.		
The areas should be linked to the new network during the none water distribution days as per the current water distribution programme so as the citizen will not suffer from additional water interruption.	**Availability of Water**	**2**
The contractor should take reasonable measures such as use of barriers in order to curtail the level of noise during work near the sensitive receivers. If such measures are not practical, the contractor should endeavor to attempt reducing noise through other means such as scheduling of activities accompanied by noise during times of less sensitiveness in consultation with the social sensitive receivers (such as consulting with schools in order to avoid the examination periods) or by use of alternative techniques which generate less level of noise.	**Noise and Vibration**	**3**
The execution activities shall continue, in the residential areas, from 8 am. until 5 pm. during the ordinary days of work in coordination with the engineer and work during Friday (week end) should be avoided .		
The contractor should carry out execution activities at night in the main business streets subsequent to obtaining an advance approval from the project engineer, police and local authority.		
The contractor shall bear the responsibility of rectifying the damages resulting from vibrations due to the use of equipment, machinery and transport vehicles.		
The contractor should use heavy equipment, engines and fuel according to the local		

Precautionary & Alleviation Measures	Appearance Environment / Social Factor	No.
instructions and should carry out the periodical maintenance on all equipment, machinery and sets for the prevention of noise.		
The contractor should restrain the use of engines if there is no need to curtail the level of noise.		
The contractor should prepare a plan for materials and solid refuse to the various work sites, so as to contain a system for recording the quantities of produced refuse, methods and locations of disposing of same. The plan should contain a plan to monitor the effectiveness of collection and methods of dealing with the refuse.	**Generated Garbage and Disposal Thereof**	**4**
The contractor should separate and store the different types of garbage such as hazardous, none hazardous recycles, building materials, plastic, paper and others to facilitate proper disposal thereof according to the garbage management plan.		
The contractor should provide a storage space for hazardous materials. A special poster should be used for hazardous materials which shows the hazardous nature and characteristics of such materials.		
The chemical refuse should be stored according to the provisions of MSDS document. The contractor should keep the papers of the MSDS document in the site.		
The contractor should provide refuse containers at every one of the execution sites in order to prevent throwing refuse in the project site and the surrounding areas.		
The contractor should collect the refuse at regular periods and dispose thereof according to the Garbage Department's plan.		
The organic waste and wastewater must be collected and disposed of on daily basis.		
The solid domestic refuse resulting from work should be collected in closed containers and transported to the garbage dump in coordination with the competent parties or by agreement with a contractor.		
The refuse may not be stored even on temporarily basis in places not assigned thereto such as valleys, canals, planted lands and farms.		
It is not permitted to dump any type of refuse in the open or incinerate same.		
The management of hazardous refuse should be made according to the instructions of the hazardous waste management and circulation of hazardous refuse for the year 2003 which was issued by the Ministry of Environment.		
The building materials rubbish and fill should be disposed on regular basis in coordination with the competent parties.		
The building materials remains should be disposed of on regular basis from the work sites to the licensed areas and in coordination with the municipalities. Also, the streets and roads from which work was finished should be cleaned immediately after the end of every day.		
The work should be executed in short sections (of a maximum length of 150 meters) or appropriate length for completing the work so as to complete it within one working day.	**General Safety**	**5**
The contractor should provide a maintenance team to deal with any breakdown in the water lines and wastewater lines which may be exposed to breakage during excavation. Also, he should coordinate with respect to such maintenance works with the ..... Water Directorate/ Water Authority.		
Pedestrian passages should be provided at a maximum distance of 30 meters.		
A 1.5 meter width should be left without obstacles to the pedestrian passages where ever it is possible in a manner that the free width of obstacles is one meter minimum. When ever it is not possible to provide the minimum passage width, a safe alternative road should be provided for the pedestrians and the width of the passage should not be less than one meter.		
For the protection of pedestrians from the traffic and machinery movement in addition to the excavations, solid barriers should be utilized to differentiate the temporary pedestrian passages. Lamps should be placed to light up the barriers at night . A barricade at (1) meter to 1.2 meters high over the ground surface should be placed and the bars should be fixed in the ground and the lower edge at 150 mm height above over		

Precautionary & Alleviation Measures	Appearance Environment / Social Factor	No.
the ground surface.		
A passage should be continuously provided without obstacles, safe and appropriate for pedestrians and vehicles to reach the fire extinguishing points, commercial and industrial installations, schools, mosques, car parks, service locations, police stations and hospitals.		
The priority of safety measures which can be employed are as follows: (1) Refill to the maximum possible extent (2) Bridges/fixed plates (for pedestrians protection in residential areas, facilitate the vehicles movement in the main streets) which should be placed over any open trench (3) In the cases where it is not possible to apply any of the aforesaid measures, barriers should be used together with supervision and monitoring.		
Watchman service should be provided at all trenches located near schools and houses irrespective of its width and throughout the period of schools work, direct supervision at all trenches is necessary in order to prevent any accidental falling down and sustaining of injuries by the public.		
The construction work should be stopped for half an hour during schooling days (Sunday up to Thursday) during school attendance and departure days at the work sites which are not farther more than 100 meters from schools. During this time, the health and safety official, who is appointed by the Contractor, may orientate workers of the general safety.		
The contractor should maintain safe passages to the public in the work sites.		
The contractor should ensure the proper training of workers on the topics of occupational health and safety.		
Prior to embarking on the construction activities, an orientation should be made of the traffic hazards and work sites for the public and workers. A plan for the Traffic Department should be prepared and applied by the contractor. It should comprise health matters and accompanying safety to the safe and effective movement for the public.		
The motor vehicles movement from and to the project area should be reduced to the maximum limit possible.		
Prior to embarking on construction activities at each site, a conspicuous notice should be posted in a manner enabling it to be seen by the public and comprised of the name and telephone of the concerned person to receive their complaints.		
When ever excavation works are in the main streets or highways, one lane should be kept open to the traffic movement at all times unless the contrary is received.		
The contractor should provide and maintain all the necessary barriers, warning signs, lights and other safety equipment according to the requirements of the Traffic Department for the protection of the traffic movement in the public and private streets.		
The barriers and obstacles should be lit at night, and lighting should be kept on from sunset up to sunrise. The Contractor should provide watchman service to such places and his measures should comply with the regulations relating to the safety of the traffic movement.		
The Representative of the Traffic Department should be permitted to reach to and monitor the traffic movement monitoring plan which was prepared by the contractor in order to make any changes when ever the field circumstances requires. Any modifications proposed by the Traffic Department should be implemented at the contractor's account.		
The contractor should remove all obstacles relating to the traffic movement when ever there is no need for them and all damages arising from its installation and removal, such as excavation and backfill, should be repaired.		
The contractor should give 3 days notification to the passage occupier in case of closing the road for more than 8 hours. The contractor should reduce the period during which the passage will be closed and must provide information to the passage user regarding the closure timing.		

Precautionary & Alleviation Measures	Appearance Environment / Social Factor	No.
The contractor should provide additional traffic lanes and traffic movement equipment (traffic signs, road signs) to prevent congestion and reduce the risk of occurrence of motor vehicle accidents at the cross road points.		
The traffic movement should remain smooth on the roads leading to the areas around the project particularly the residential and service buildings. Also, all barriers which may hinder the motor vehicles movement must be removed.		
The construction materials transport trucks must be driven be skilled drivers.		
The maintenance of motor vehicles must be maintained periodically and continually.		
The contractor must prepare a plan for managing and applying the traffic plan. The plan should contain: - Upon carrying out excavation works in multi lane streets, one lane must remain open in every direction. - The contractor should obtain prior approval in case of need to close down one of the streets during the construction works. Also, the contractor must suggest to the authorities to direct the alternative traffic and implement same.		
The building materials necessary for the project should not be placed in the roads and streets which would inflict harm on the safety of citizens particularly near the schools and worship places (the distance should not be less than 300 meters) and place the quantity required for use on daily basis.		
The work sites should be rehabilitated to its condition previous to the start up of work or to a condition better than same including re-asphalting of all the street in case more than half thereof has been excavated.		
Water Resources		
The contractor should use well cleaned and maintained machinery for excavation works and should be examined by an external approved party to minimize the spilling of oils on the soil.	**Dumping of Used Oils**	**6**
The contractor should conduct maintenance/change machinery and motor vehicles oil in designated places and not in the worksites. However, and due to an emergency event if the change of oil takes place at the work site, the contractor should take monitoring measures to prevent any leakage of oil on the ground through isolating the maintenance area at site and collect the used oils in closed containers.		
The contractor should provide tightly sealed containers and suitable for the collection and storage of used oils.		
The containers collected in the unapproved areas (i.e. valleys, sewer canals, muddy plains, farms and public areas) may not be stored.		
The contractor should comply with the instructions of the Ministry of Environment for managing and treating the used oils for the year 2003.		
The contractor should provide the necessary tools for removing the leaked oils as it contain absorbent materials, plastic bags and brooms for sucking oil leaks. Such contaminating materials should be dealt with and disposed of as hazardous refuse.		
The stored used oils should be handed over to the licensed collectors of used oils by the Ministry of Environment.		
A special record should be kept containing the quantities of used oils, dumping time and the receiving party thereof. All these records should be deposited in the project site.		
The following steps should be implemented with respect to dumping the water resulting from cleaning of pipes : - A quality test of water resulting from cleaning of pipelines in a water approved laboratory and compare the results with the Jordanian standard specification (JS 202: 2007) "Industrial Treated Waste Water". - In the event of acceptance of the test result, the contractor should prepare a plan for disposing of water in the canals, and the flow site should be designated.	**Dumping of Water Resulting from Pipeline Cleaning**	**7**

Precautionary & Alleviation Measures	Appearance Environment / Social Factor	No.
- The approval of the Ministry of Water & Irrigation should be obtained before disposing of the water in the valley/ water canals. - If the approval has been obtained, the contractor may not empty such waste water in the water canals during the rainy season. - The contractor should take control measures to restrict the soil erosion. By avoiding the flows which are expected to lead to soil erosion and increase the flow section in order to reduce the flow speed.		
The excavation waste should not be dumped inside the valley canals.		
The contractor should remove the silt at water discharge points.		
The contractor should formulate a response plan for emergency cases comprising alleviating measures of any probable leak into the water canals.		
The following steps should be implemented with respect to handling and dumping of domestic wastewater : - The contractor should place portable toilets which should be available at the work sites for use by workers and that the domestic wastewater be collected in a closed and insulated tank. - The wastewater collected in an environmental method to prevent any leak on the soil should be discharged subsequent to obtaining approval of the Water Authority of Jordan. - The disposed of quantities of wastewater, time of dumping and destination of dumping should be documented and such records be kept in a file.	**Handling and Dumping of Domestic Wastewater**	**8**
The following steps for management and control should be implemented in case of floods: - It is possible to control floods management by taking structural or none structural measures. The structural measures depend on the supporting walls, and earth barriers, transfer canals and small dams as effective examples to limit the impact of floods. - Ascertain the continued and successive monitoring of the height and drop of water level in the valley. - The building activities at the harmed discharge canals which are located near the valleys should be stopped and backfilled at an early time. - Transfer equipment, materiel and items existing in the hazardous points far from the two excavation banks to the high areas, if this is possible. - Fill sand bags and place them at certain distances from the excavation sites in order to alleviate the flow of water. - Pump water from the open trenches.	**Direct Impact on Surface Water Sources**	**9**
Bio Diversification		
As to the construction works within the boundaries of project sites along the strategic line, no excavations should be carried out within 8 meters from any tree or well without prior approval of the Engineer.	**Biodiversity**	**10**
Keep the surface soil layer along the strategic line in order to return same over the line after completing the construction works upon re-instating the situations to its original nature.		
Rehabilitate the construction areas and strategic line route by removing the construction debris and refuse as well as re-instate the situations to the same conditions as before the construction or better.		
Cultural Heritage & Antiquities		
The contractor should stop the excavation works in case of discovery of any antiquities	**Cultural Heritage &**	**11**

Precautionary & Alleviation Measures	Appearance Environment / Social Factor	No.
or antiques and follow the following : - Notify the Engineer immediately. - Notify the Antiquities Department immediately about any discoveries that appear according to article 15 of the Antiquities Department Law No. 21 for the year 1988. - Obtain a written approval from the General Antiquities Department before removing or moving any accidental antiquities discovery during work. Also, the discovered antiquities should be moved without causing any damage thereto and the General Antiquities Department should select and designate an appropriate location for subsequent utilization or in order to acquire this site or antiques which have appeared in favour of the General Antiquities Department. - Obtain written approval from the General Antiquities Department to continue work in the site after stoppage.	**Antiquities**	
To maintain the public safety, there are standard measures to which contractors should comply in order to alleviate the hazard on general safety, namely: - If it is discovered that the street width in the places where the pipes will be installed is not enough for excavation, consideration should be given for modifying the route particularly if the modification leads to reducing the impact on the population and commercial businesses. - The long pipelines should be divided to sub-sections of (150 m long as a maximum), complete the excavation and backfilling works in the sub-section prior to moving to the next one in order to avoid the open trenches existence for a long period of time. - A sufficient number of bridges with a barricade for the public for the entry of the excavated trenches in order to facilitate their movement so as the distance between every two bridges will not exceed 30 m. - In the cases where narrow roads or pavements are removed during the building stage, suitable temporary pavements should be placed and kept until completion of the work.	**Social & Economic Circumstances**	**13**
Remove soil, dust and excavations from road sides during the construction works particularly from the front of religious places, hospitals and schools.		
Utilize the road signs: Utilize the guiding, alerting and mandatory traffic signs as well as the reflecting pavement marks upon the need thereto during the construction works. Restrict the negative impacts on hospitals, schools and religious places by avoiding the carrying out of construction works near such places in as much as possible. If there is a need for conducting any excavations or any works in front of the religious places, hospitals and schools, the work should be carried out during the shortest possible time.		
The contractor should not tolerate any molestation (harassment) by his employees or consultants, provide orientation for all workers to prevent (physical, psychological and sexual) harassment amongst employees or directed towards members of the community (particularly women and children). Such training should educate employees on the Jordanian laws re sexual harassment and extent of contractor's response including the taking of penal actions against employees who take part in such type of conduct.		
Special attention should be given to the safety of male and female students who go to school on foot in so far as accidents. Additionally, safe lanes should be built for them to the school.		
The contractor should take into consideration the plants in the project area as it may be possible that the excavation works may be in front of some of these plants. The impact in such a case shall be towards the transport operations from and to such plants. For this reason, it is preferable that the final design be amended in a manner which would lead to the possibility of reaching to such plants continuously and without interruption.		

Precautionary & Alleviation Measures	Appearance Environment / Social Factor	No.
In the event of implementing part of the work in the houses, the foreign or local labour should respect the values and community traditions.		
The contractors should give priority of employment for the local population (if any) particularly those who are affected by the project and a clause will be inserted in the project documents requiring contractors to give priority of work opportunities to those qualified of unskilled and semi skilled labour of the local population including women and vulnerable categories when they possess the required qualifications and capability. In the event of their lack of skills, vocational training may be provided to them to enable them work during the construction stage.		
Health insurance and social insurance must be provided to employees according to Jordanian laws and relevant regulations.		
The method of tapping should be used to cut off the main streets and not the open excavation method for placing the main pipes.		
The contractor should coordinate with the service providers (electricity, telephones and water) and that a known a liaison officer be there for coordination and that a representative be at site when needed for cutting off one of the services.		
It is advisable, in the areas wherein it is expected that the pipeline will cut off the existing cables, to make explanatory holes by using manual excavation in order to avoid the occurrence of damage to these cables.		
Occupational Health & Safety		
A plan for occupational health & safety as well as an emergency plan must be prepared and then applied well. They should be reviewed periodically by management	**General Safety**	**15**
The contractor should complete evaluation of hazards at the work site prior to commencement of execution.		
The site of all facilities existing underground should be specified such as pipes, electric cables and the like, and isolate them if necessary.		
An excavation permit system must be applied.		
The contractor should draw out a system for entry into the restricted site.		
Endeavours must be made to prevent soil collapses by using means of support and the suitable excavation method and other methods according to the need.		
There should be facilities for the worker when working inside the trench.		
Provide clear and visible warning signs at a safe distance from the trenches to alert workers and visitors.		
The contractor should provide all work sites with first aid kits such as adhesive bandage, anti-biotic ointment, sterilized napkins, aspirin, none wax gloves, scissors, temperature scale …… and the like. All employees should be trained and qualified to carry out the work required from them.		
The contractor should provide a storage space for the dangerous items. A special poster for dangerous items should be used which shows the kind and dangerous characteristics of such items.		
The chemical materials should be stored according to the provisions of safety information document for MSDS item.		
All workers should be trained on how to deal with chemical materials.		
The safety signs and proper warnings should be used during the handling, storage and transport of hazardous materials.		
The suitable personal protection equipment must be utilized upon dealing with chemicals and entering into confined places.		
The personal general safety equipment must be maintained continuously and replaced after the expiry of its virtual life.		
The equipment operators should obtain the proper licenses and be able to operate the		

Precautionary & Alleviation Measures	Appearance Environment / Social Factor	No.
equipment efficiently.		
No work should be made on the live cables or near them if they pause a danger. However, if cutting off electricity from the cable is not practical, in this case, all necessary precautions should be taken to ensure safety.		
The carrying cables of over 65 volt tension other than those provided for welding purposes on a shield or metal casing to be effectively (well) earthed. As to the cable appropriated for connecting the electric power to the machines and moving equipment, such earthing should be in addition to the protection conductor which is originally existing on the cable.		
In the light of the risks of breakdown of electrical equipment, a fixed maintenance system should be formulated for all electrical equipment. It is important also that a periodical maintenance is carried out for the equipment according to the manufacturer's instructions.		
The contractor should ensure extinguishment of all equipment and machinery as well as separate them from the electricity source when not in use.		
Clothes with reflective and clear colours from remote distances should be provided to building workers.		
The contractor should formulate and apply precautionary measures in case of fire according to the health and safety plan.		
The contractor should provide fire fighting equipment at the work site such as fire extinguishers, and such equipment should be periodically maintained.		
Smoking should be prevented in all places where there may be a risk of fire.		
The contractor should notify the Civil Defense prior to commencing any activity which may pause potential fire.		
The contractor should apply the work permit system with respect to some of the construction works such as welding.		
The protection from fire program which is prepared by the contractor should be compatible with the local requirements and specifications.		
All workers must be provided with the necessary safety equipment such as masks, anti slip safety shoes, helmet, hearing protective, whereby the object will be the provision of additional protection for workers from work hazards in addition to other applicable safety measures. The safety equipment should be maintained periodically and replaced upon the expiry of its virtual life.		
All machinery and vehicles should make a sound when in reverse condition.		
Medical supplies should be available at the work sites during the construction stage as represented by first aid clinic and an ambullance car.		
The emergency telephone numbers should be placed on the employees notice board.		
A rest room for workers should, at work areas, be available by placing a portable office container at the work sites. Provide suitable facilities for men and women including toilets/ change rooms and separate prayers rooms, if required.		

(2) Letter from WAJ to Ministry of Environment

وزارة المياه والري
سلطة المياه

الرقم ٢٥٦٤/٢/١٧
التاريخ .....
الموافق ٢٠٠٤/١٠/١٢

عطوفـــــة أميـن عـــام وزارة البيئة

المشـــروع: اعادة تأهيل وتوسعة شبكات المياه في محافظـــة البلقـــاء

الموضـوع : تقييـــــم الاثر البيئي

اشارة الى مشروع اعادة تأهيل وتوسعة شبكات المياه في محافظة البلقاء (عـين الباشا ، ديـر عـلا) الممول من خلال منحة من الوكالـة اليابانيـة للتعاون الـدولي(JICA) والمحال على الاستشاري السـادة TEC INTERNATIONAL CO. لانجاز اعمال الدراسة لمشروع موضوع البحث.

يرجى الموافقة على اعفـاء المشروع المذكور اعلاه مـن عمـل دراسـة تقييـم الاثـر البيئي حيث ان هذا المشروع والمبينـة مكوناتـه ومواقعـه على المخططات المرفقـة طيا يهـدف الى تـوفير الطاقـة وتقليـل نسبة فاقد المياه.

و اقبلـــوا الاحتـــرام ،،،

امين عـــام سلطـة الميـاه

المهندس توفيق الحباشنه

مساعد الأمين العام
للشؤون الفنية
المهندس مالك الرواشدة

نسخة: مساعد الامين العام للشؤون الفنية/مديرية الدراسات والتصاميم
نسخة: الوكالة اليابانية للتعاون الدولي/JICA .
نسخة :التداول
المرفقات: ملخص عن اعمال المشروع.

المملكة الأردنية الهاشمية
هاتف: ٥٦٨٠١٠٠ - ٥٦٨٣١٠٠ فاكس: ٥٦٧٩١٤٣ ص.ب: ٥٠١٢ عمان ١١١٨١ الأردن. الموقع الإلكتروني www.waj.gov.jo

Attachment

1. Objective of the Project

The objective of the Project is to reduce non-revenue water and electricity consumption for water supply in the target areas by controlling water pressure of distribution network.

2. Project site

Tentative site of the Project is Deir Alla and Ain Al-Basha in Balqa Governorate as shown in **Annex-1**.

3. Responsible and Implementing Agency

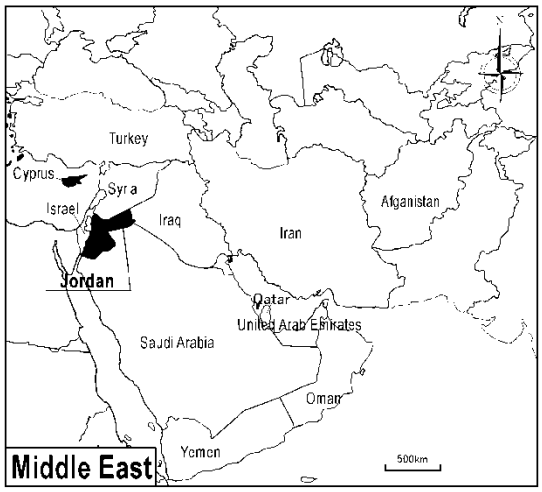
3-1) The Responsible Agency is the Ministry of Water and Irrigation (hereinafter referred to as "MWI").

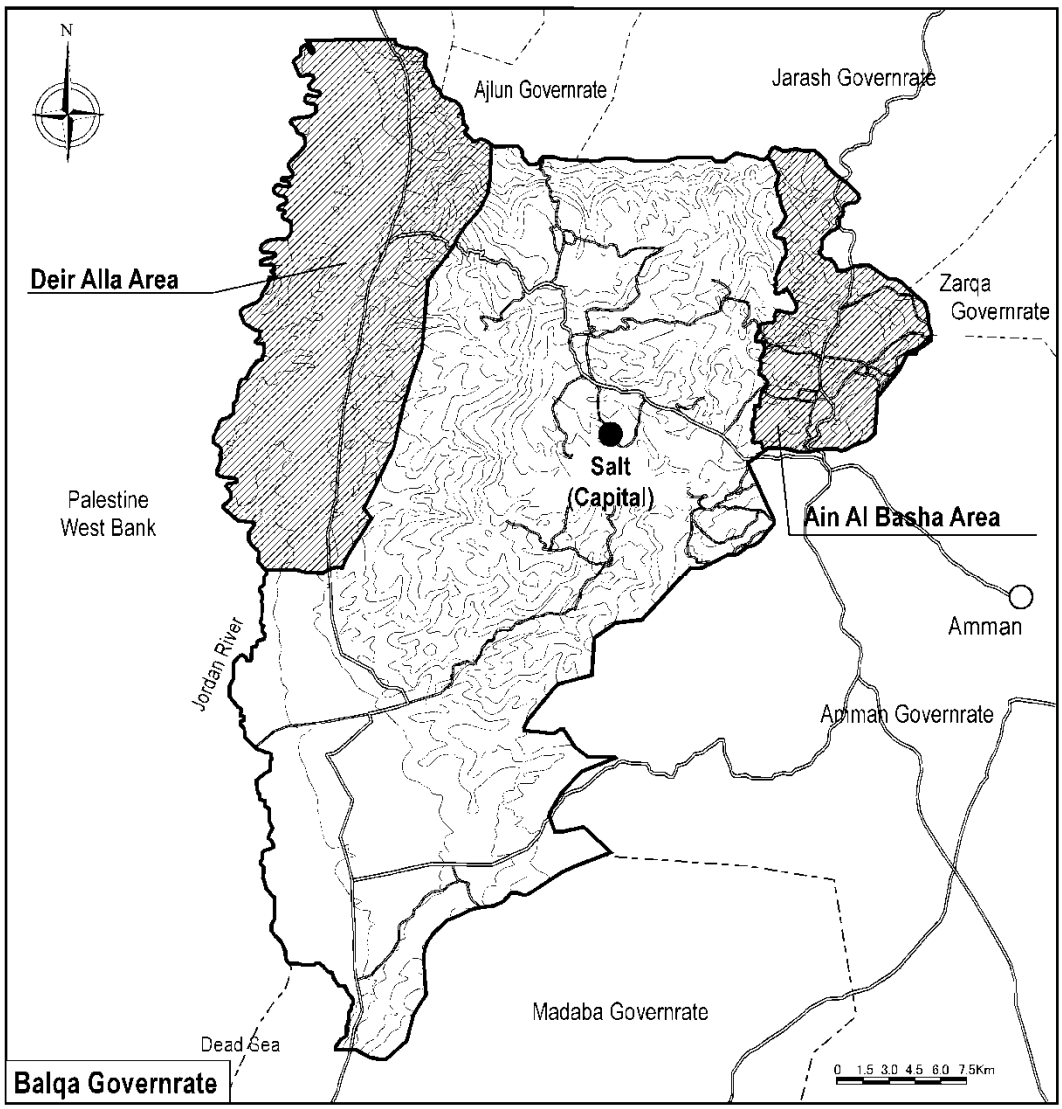
3-2) The Implementing Agency is the Water Authority of Jordan (hereinafter referred to as "WAJ").

4. Project Components

The project components are shown in **Annex-2**.

Annex-1: Project Sites Map





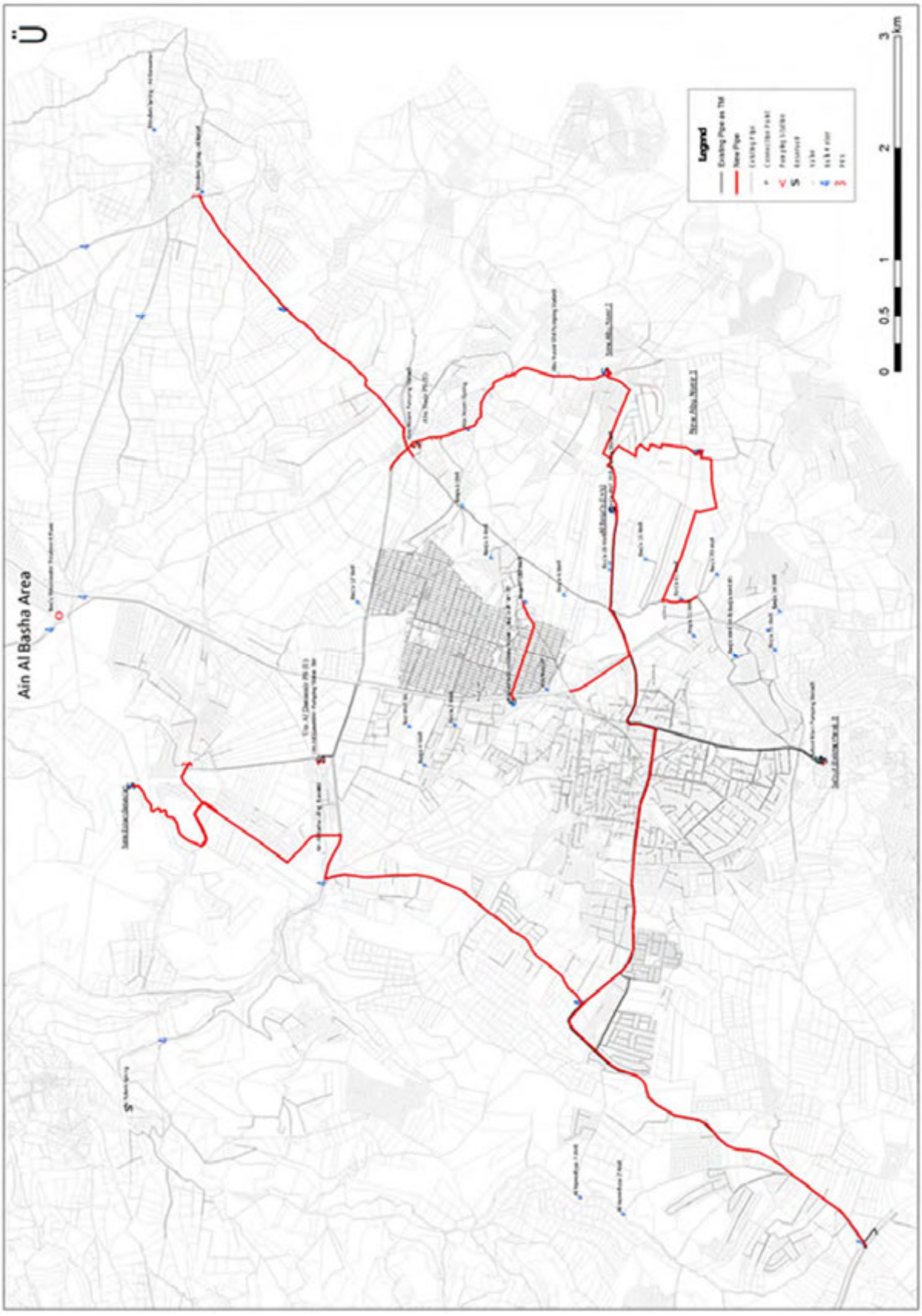
Annex-2: Project Components

Table1: Major Components in Ain Al Basha

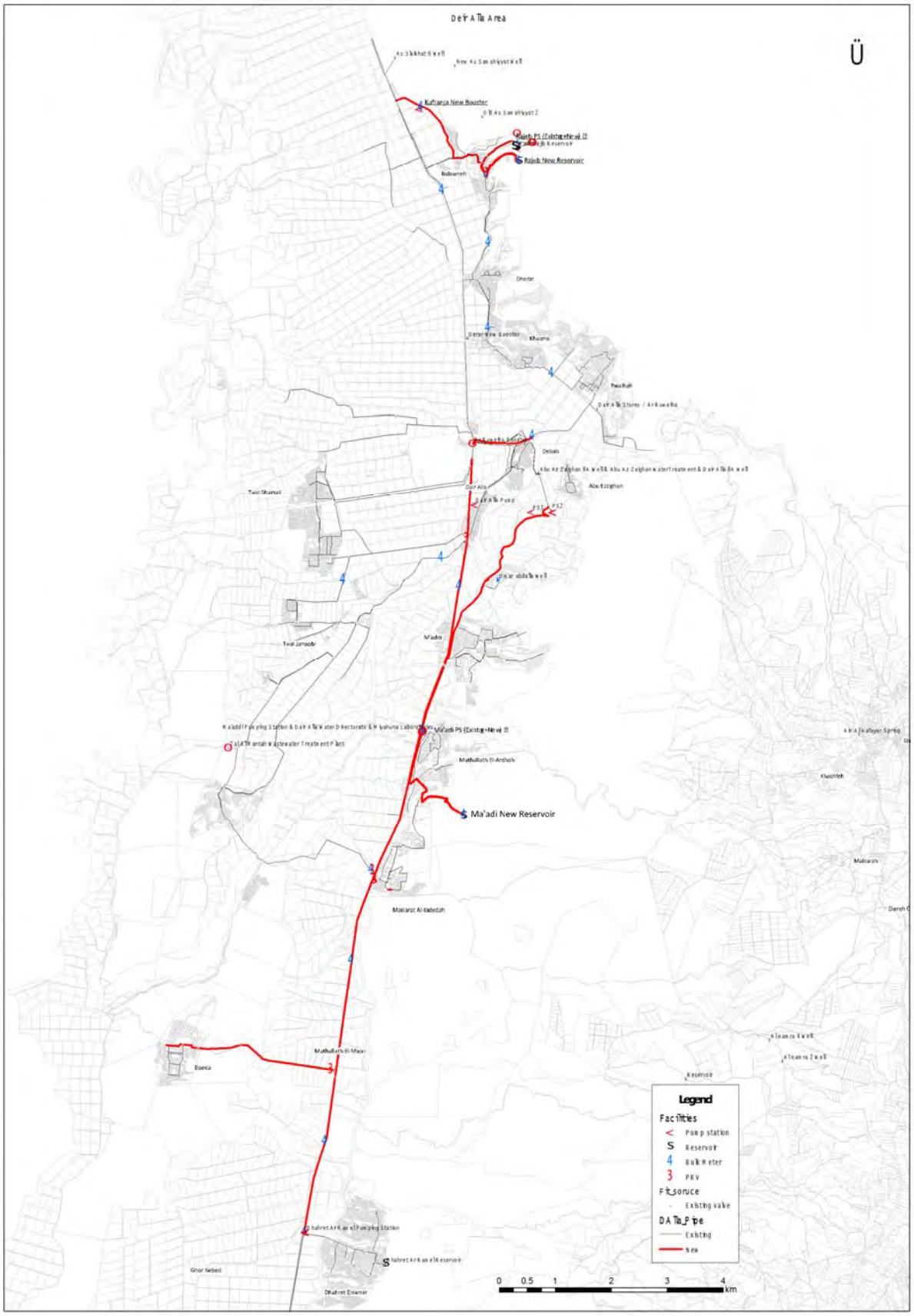
Major Components	Ain Al Basha				
	Baqqa Reservoir	Abu Nussair 1 Reservoir	Abu Nussair 2 Reservoir	Eskandanavian Reservoir	Safout Reservoir
Site Area	70m×70m ($4,900m^2$)	50m×50m ($2,500m^2$)	50m×40m ($2,000m^2$)	50m×50m ($2,500m^2$)	Within Existing Safout Pumping Station ($2,500m^2$)
Storage Capacity	6,100 m^3	900 m^3	1,200 m^3	900 m^3	3,900 m^3
Reservoir Size	φ36.6m×H5.8m	16m×16m×H3.51m	25m×13m×H3.69m	16m×16m×H3.51m	φ18.0m×H15.33m

Table2: Major Components in Deir Alla

Major Components	Deir Alla				
	Slaikhat Pump Station	Rajib Existing Pump Station	Rajib High Reservoir	Maadi Reservoir	Maadi Pump Station
Site Area	($2,300m^2$)	Within Existing Rajib Pumping Station ($600m^2$)	60m×60m ($3,600m^2$)	60m×60m ($3,600m^2$)	Within Existing Maddi Pumping Station ($2,900m^2$)
Storage Capacity	-	-	2,000 m^3	3,300 m^3	-
Reservoir Size	-	-	26m×26m× H2.96m	28.5m×28.5m× H4.06m	-
Pump Capacity	$50m^3$/h, H=166m, 2 sets	$150m^3$/h, H=114m, 2 sets	-	-	$282m^3$/h, H170m, 2 sets



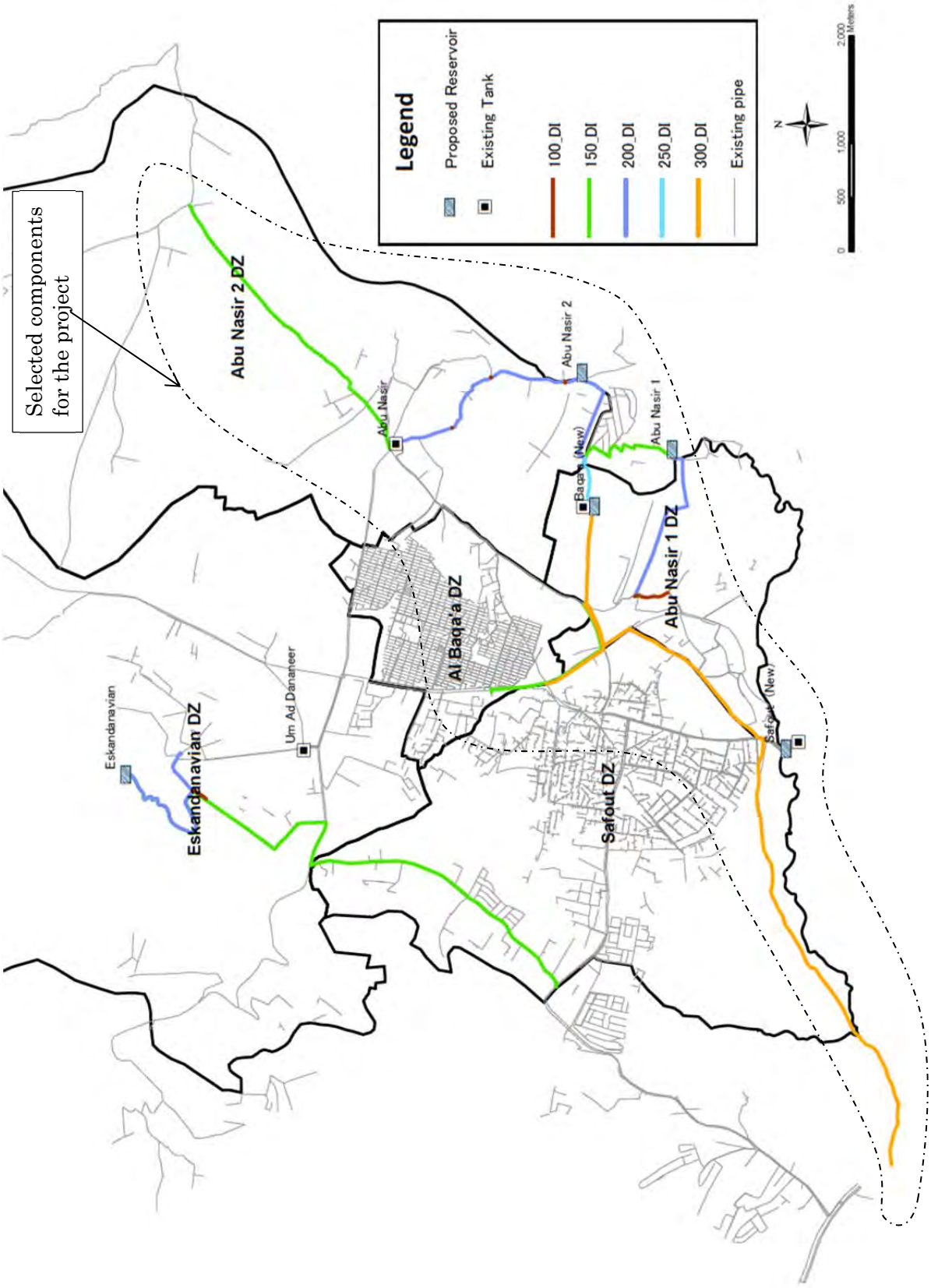
Ain Al Basha


Deir Alla Area
Ü
Kafr anja New Booster
Rajeb New Reservoir
Ma'adi New Reservoir
Legend
Facilities
Pump station
Reservoir
Bulk Meter
PRV
Fit_soruce
Existing valve
DA Tia_Pipe
Existing
New
0 0.5 1 2 3 4
km

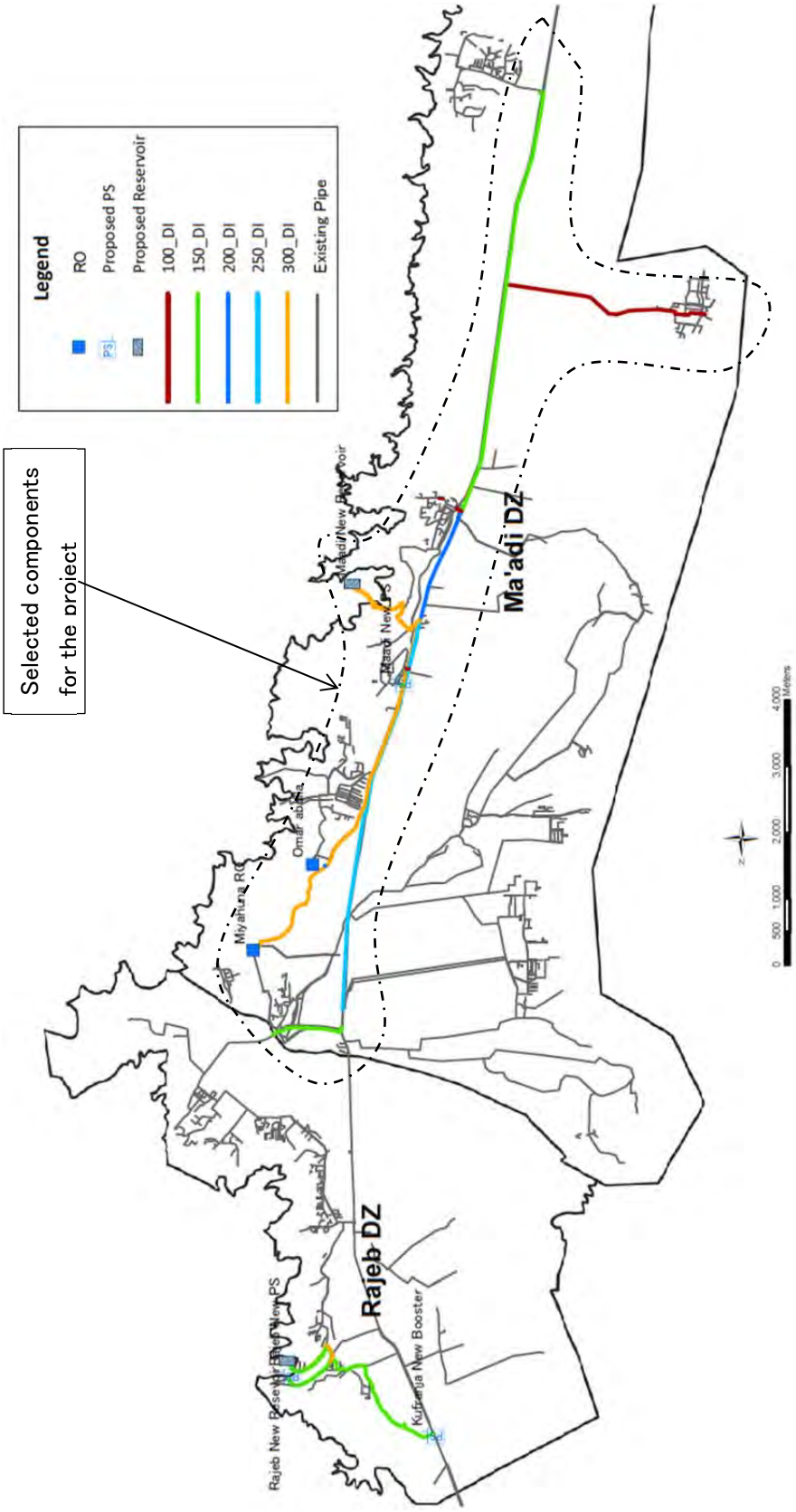
Deir Alla

6.2 Facility Plan for All Distribution Zones

(1) Ain Al Basha



(2) Deir Alla


Legend
RO
Proposed PS
Proposed Reservoir
100_DI
150_DI
200_DI
250_DI
300_DI
Existing Pipe
Selected components for the project
Ma'adi DZ
Rajeb DZ
Miyahuna RC
Omar abad
Rajeb New Booster
Kufranja New Booster
0 500 1,000 2,000 3,000 4,000 Meters

6.3 Existing Water Sources and Water Sources Plan for the Project

(1) Ain Al Basha

Distribution Zone	ID	Name	Water produced within and imported from outside in last three years (Data from WAJ Record) 2010 (m³/year)	2010 (m³/day)	2011 (m³/year)	2011 (m³/day)	2012 (m³/year)	2012 (m³/day)
DZ01: Abu Nasir 1 DZ	AL2707	Baqa'a 15	221,038	606	225,473	618	190,946	523
	AL3131	Baqa'a 16	0	0	0	0	0	0
		From Zai-Dabouq line						
				606		**618**		**523**
DZ02: Abu Nasir 2 DZ	AL1428	Baqa'a1 (Canceled)	0	0	0		0	0
	AL1541	Baqa'a 9	219,655	602	101,660	279	202,678	555
	AL3311	Baqa'a 19	200,183	548	161,723	443	123,426	338
	AL1393	Abu Nasir well	258,088	707	348,884	956	310,755	851
		From Miyahuna (Karbet Abu Nasir)	98,672	270			123,783	339
		From Zarqa (Abu Hamad)					36,079	99
		From Zai-Dabouq line						
				2,127		**1,678**		**2,182**
DZ03: Al-Baqa'a DZ		From Safout PS						
	AL1433	Baqa'a 6	279,386	765	272,726	747	161,797	443
	AL3357	Baqa'a 20 (not operated)	0	0	0	0	0	0
	AL3500	Baqa'a 26	224,963	616	190,437	522	151,998	416
		From Zai-Dabouq line						
				1,381		**1,269**		**859**
DZ04: Eskandanavian DZ	AL3573	Baqa'a 2	39,916	109	108,739	298	152,807	419
	AL2719	Baqa'a 12	60,083	165	57,998	159	81,774	224
		From Zarqa (Sahab, Um-Rumana)	35,659	98	39,252	108	28,872	79
		From Zai-Dabouq line						
				372		**565**		**722**
DZ05: Safout DZ	AL3454	Baqa'a 5 (B)	120,478	330	183,061	502	203,486	557
	AL1539	Baqa'a 11	117,404	322	135,102	370	153,808	421
	AL3487	Baqa'a 21	176,200	483	150,874	413	179,529	492
	AL3456	Baqa'a 22	25,094	69	22,618	62	20,081	55
		Zai-Dabouq line						
				1,204		**1,347**		**1,525**
Import from Zai- Dabouq line			**4,403,450**	**12,064**	**3,897,800**	**10,679**	**4,770,855**	**13,071**
Grand total			6,480,269	**17,754**	5,896,347	**16,156**	6,892,674	**18,882**

Additional water required from Zai compared to the quantity of year 2012:
(Considering transfer from Zarqa and Miyahuna (Karbet Abu Nasir) continues)
Additional water required from Zai compared to the quantity of year 2012:
(Considering transfer from Zarqa and Miyahuna (Karbet Abu Nasir) is stopped)

Distribution Zone	ID	Name	**Planned (Scenario 1):** Wells currently supplying to Abu Nasir PS and Um Al Dananer PS are to be diverted to Baqa'a. Abu Nasir 1, Abu Nasir 2 and Eskandavanian to have only direct water from Zai-Dabouq line. Water from Zarqa and Miyahuna (Karbet Abu Nasir) to be discontinued. (For Daily Maximum Demand) 2015 (m³/day)	2015 (m³/hr)	2020 (m³/day)	2020 (m³/hr)	2025 (m³/day)	2025 (m³/hr)
DZ01: Abu Nasir 1 DZ		From Zai-Dabouq line	1,780	74	1,859	77	1,920	80
			1,780	**74**	**1,859**	**77**	**1,920**	**80**
DZ02: Abu Nasir 2 DZ		From Zai-Dabouq line	2,007	84	2,096	87	2,164	90
			2,007	**84**	**2,096**	**87**	**2,164**	**90**
DZ03: Al-Baqa'a DZ	AL3311	Baqa'a 19	338	14	338	14	338	14
	AL1433	Baqa'a 6	443	18	443	18	443	18
	AL3500	Baqa'a 26	416	17	416	17	416	17
	AL3357	Baqa'a 20	0	0	0	0	0	0
	AL1428	Baqa'a 1	0	0	0	0	0	0
	AL1541	Baqa'a 9	555	23	555	23	555	23
	AL1393	Abu Nasir well	851	35	851	35	851	35
	AL3573	Baqa'a 2	419	17	419	17	419	17
	AL2719	Baqa'a 12	224	9	224	9	224	9
		From Zai-Dabouq line	12,186	508	12,867	536	13,403	558
			15,432	**641**	**16,113**	**669**	**16,649**	**694**
DZ04: Eskandanavian DZ		From Zai-Dabouq line	1,538	64	1,824	76	1,883	78
			1,538	**64**	**1,824**	**76**	**1,883**	**78**
DZ05: Safout DZ	AL3131	Baqa'a 16	0	0	0	0	0	0
	AL3456	Baqa'a 22	55	2	55	2	55	2
	AL1539	Baqa'a 11	421	18	421	18	421	18
	AL3487	Baqa'a 21	492	21	492	21	492	21
	AL3454	Baqa'a 5B	557	23	557	23	557	23
	AL2707	Baqa'a 15	523	22	523	22	523	22
		From Zai-Dabouq line	6,893	287	7,288	304	7,599	317
			8,941	**373**	**9,336**	**390**	**9,647**	**403**
Grand total			**29,698**		**31,228**		**32,263**	**1,345**

Quantity required from Zai-Dabouq line:	24,404	1,017	25,934	1,080	26,969	1,123
Additional quantity required compared to that of year 2012:	11,333	472	12,863	536	13,898	579

Distribution Zone	ID	Name	Water produced within and imported from outside in last three years (Data from WAJ Record)							**Planned (Scenario 0):** Continuation of all wells as in 2012, same amount from private wells (Omar Abdallah RO) and increased amount from Miyahuna-Zai (Abu Zeighan RO)					
			2010		2011		2012			2015		2020		2025	
			(m^3/year)	(m^3/day)	(m^3/year)	(m^3/day)	(m^3/year)	(m^3/day)	(m^3/hr)	(m^3/day)	(m^3/hr)	(m^3/day)	(m^3/hr)	(m^3/day)	(m^3/hr)
Rajeb DZ	AK1013	Wadi Rajeb	235,708	646	179,445	492	196,733	539	22	539	22	539	22	539	22
	AK1015	Wadi Rajeb 1b	235,708	646	179,445	492	196,733	539	22	539	22	539	22	539	22
	AK1018	Wadi Rajeb 8a	0	0	0	0	0	0	0	0	0	0	0	0	0
	AB3123	Wadi Rajeb 8	2,671	89	183,234	502	194,675	533	22	533	22	533	22	533	22
	AB3004	Samayet 2 new	345,177	946	411,982	1,129	464,162	1,272	53	1,272	53	1,272	53	1,272	53
	AB1357	Samayet al kadem	217,174	595	263,224	721	267,897	734	31	734	31	734	31	734	31
	AB1350	Krayymeh (Slaikhat) 4	405,351	1,111	411,556	1,128									
	AB1351	Krayymeh (Slaikhat) 5	97,138	266	126,825	347	219,912	1,047		1,047	44	1,047	44	1,047	44
	AB1377	Krayymeh (Slaikhat) 6	179,340	491	192,417	527									
		Sub-total		**4,790**		**5,338**		**4,664**		**4,664**	**194**	**4,664**	**194**	**4,664**	**194**
Zonal Demand										3,777		3,945		4,261	178
Surplus										887		719		403	17
Maadi DZ		Miyahuna (Abu Zeighan RO)	381,564	1,255	373,677	1,746	657,580	1,802	75	3,300	138	3,578	149	3,794	158
		Omar Abdallah RO	809,552	2,218	897,680	2,459	1,085,380	2,974	124	2,974	124	2,974	124	2,974	124
		Sub-total		**3,473**		**4,205**		**4,776**	**199**	**6,274**	**262**	**6,552**	**273**	**6,768**	**282**
Zonal Demand										6,274		6,552		6,768	
Surplus										0		0		0	
Additional water required from Zai compared to the quantity of year 2012:										1,498	62	1,776	74	1,992	83

6.4 Outline of Result of Network Analysis

(1) Network Analysis Result of Transmission Mains for Ain Al Basha

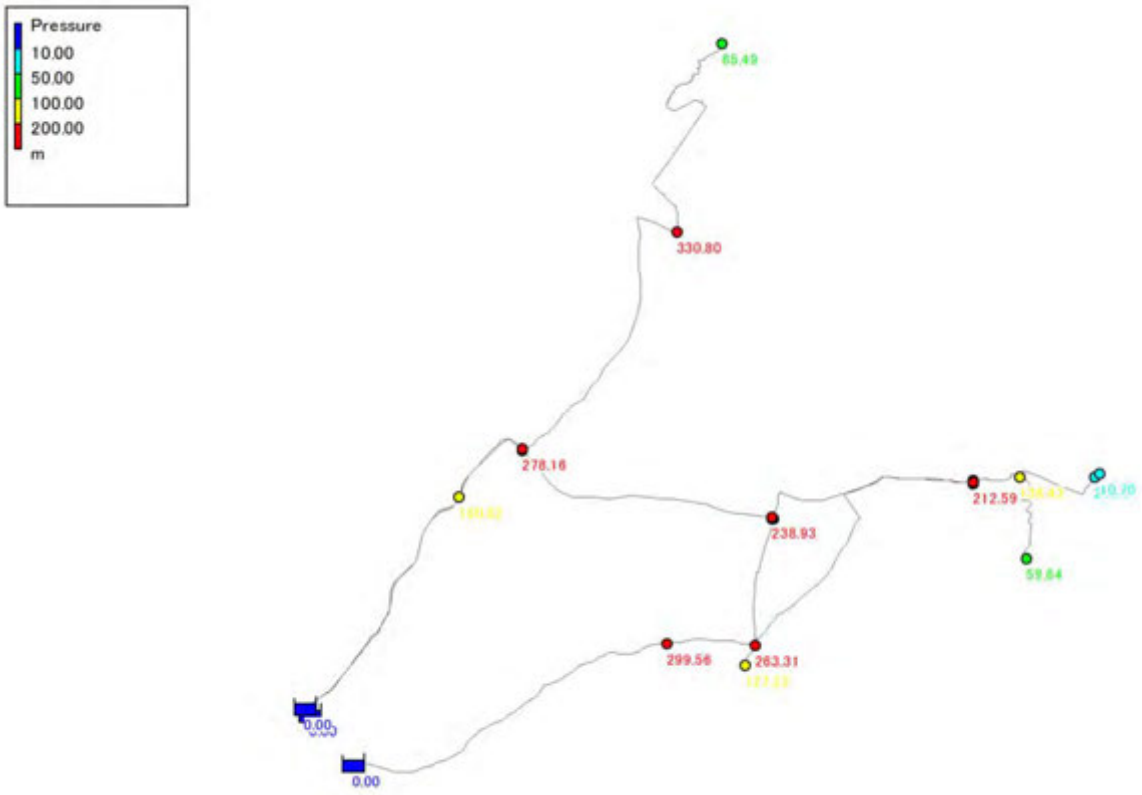
```
******************************************************************************
*                                  E P A N E T                               *
*                          Hydraulic and Water Quality                       *
*                          Analysis for Pipe Networks                        *
*                                  Version 2.0                               *
******************************************************************************

Input File: AABasha_TM_20140223.net

Link - Node Table:
------------------------------------------------------------------------
Link            Start           End                Length    Diameter
ID              Node            Node                    m          mm
------------------------------------------------------------------------
p1              n1              n2                  79.94         200
p2              n47             n4                1268.07         300
p3              R3              n6                2678.07         150
p4              n7              n4                  16.88         300
p5              n8              n9                  11.35         100
p6              n7              n10                 9.163         300
p9              R2              n14               3736.17         300
p10             n15             n33               3194.50         150
p15             n4              n8                2271.91         200
p18             n15             n21               2918.62         150
p19             n30             n16                  1103         150
p20             n30             n1                 970.71         200
p22             n14             n10                 2673         300
p24             n9              n30                520.97         250
p31             n6              n33                 969.9         150
p32             R1              J2                3500.11         300
p33             J3              J1                3285.82         300
p14             n47             n3                 314.21         300
p16             J1              n48                 23.00         300
p23             J1              n9                   9.72         300
p7              J2              J3                 885.84         300

Node Results:
------------------------------------------------------------------------
Node                Demand          Head     Pressure      Quality
ID                     CMH             m            m
------------------------------------------------------------------------
n1                     0.00        940.98        20.98         0.00
n2                    90.00        940.70        10.70         0.00
n3                   317.00        899.22       127.22         0.00
n4                     0.00        908.54       238.54         0.00
n6                     0.00        970.62       160.62         0.00
n7                     0.00        908.79       238.79         0.00
n8                   208.00        864.35       125.35         0.00
n9                   350.00        946.46       212.46         0.00
n10                    0.00        908.93       238.93         0.00
n14                    0.00        948.99       268.99         0.00

Node Results: (continued)
------------------------------------------------------------------------
Node                Demand          Head     Pressure      Quality
ID                     CMH             m            m
------------------------------------------------------------------------
n15                    0.00        922.80       330.80         0.00
n16                   80.00        931.64        59.64         0.00
n21                   78.00        890.49        65.49         0.00
n30                    0.00        944.43       136.43         0.00
n33                    0.00        958.16       278.16         0.00
n47                    0.00        901.07       176.07         0.00
n48                    0.00        946.59       207.59         0.00
J1                     0.00        946.59       212.59         0.00
```

J2	0.00	999.56	299.56	0.00
J3	0.00	988.31	263.31	0.00
R1	-520.00	1044.00	0.00	0.00 Reservoir
R2	-525.00	1005.00	0.00	0.00 Reservoir
R3	-78.00	1005.00	0.00	0.00 Reservoir

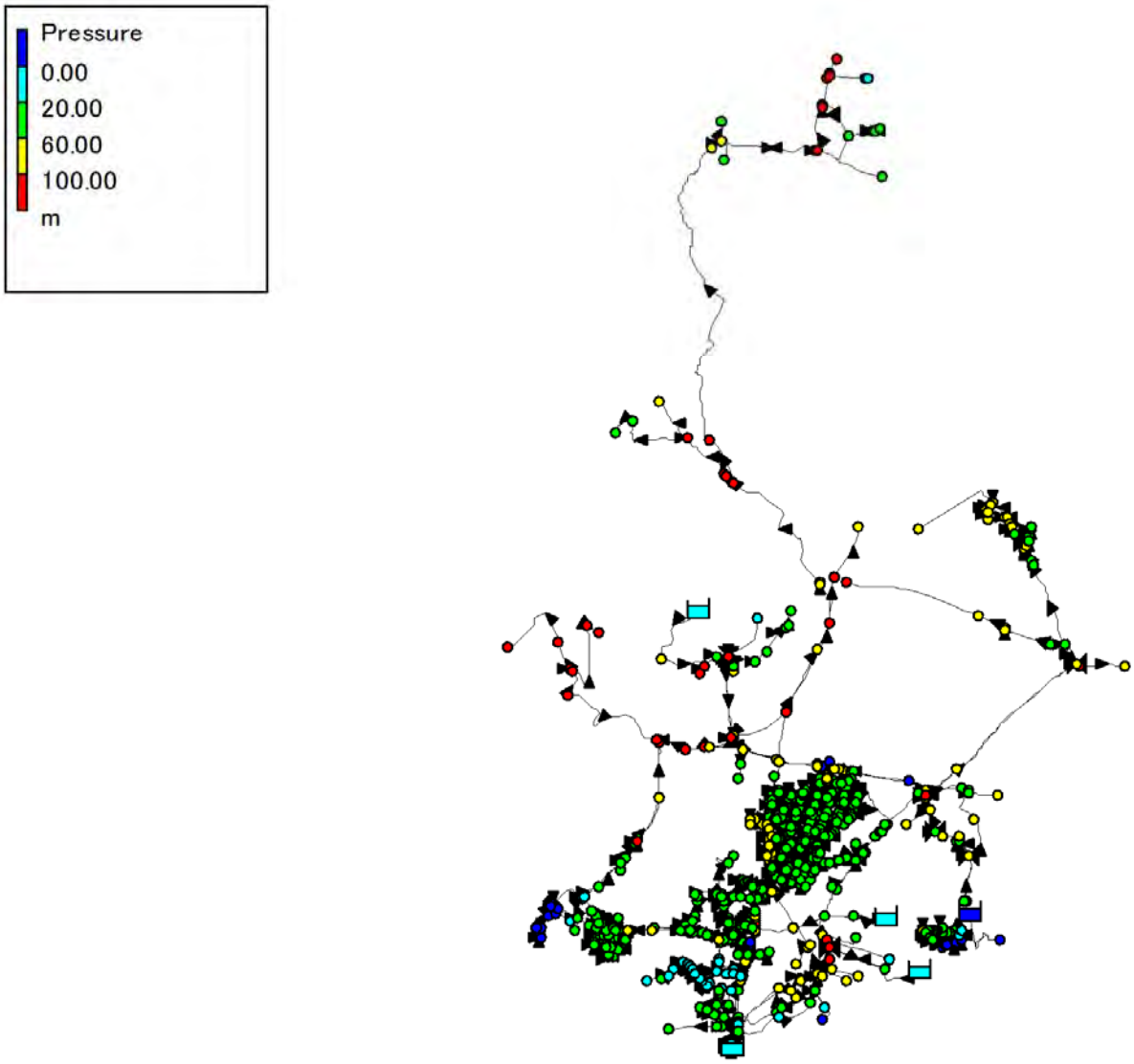
Link Results:

Link ID	Flow CMH	Velocity m/s	Unit Headloss m/km	Status
p1	90.00	0.80	3.55	Open
p2	-317.00	1.25	5.89	Open
p3	78.00	1.23	12.84	Open
p4	525.00	2.06	14.99	Open
p5	0.00	0.00	0.00	Closed
p6	-525.00	2.06	14.99	Open
p9	525.00	2.06	14.99	Open
p10	-78.00	1.23	11.07	Open
p15	208.00	1.84	19.45	Open
p18	78.00	1.23	11.07	Open
p19	80.00	1.26	11.60	Open
p20	90.00	0.80	3.55	Open
p22	525.00	2.06	14.99	Open
p24	170.00	0.96	3.89	Open
p31	78.00	1.23	12.84	Open
p32	520.00	2.04	12.70	Open
p33	520.00	2.04	12.70	Open
p14	317.00	1.25	5.89	Open
p16	0.00	0.00	0.00	Open
p23	520.00	2.04	12.70	Open
p7	520.00	2.04	12.70	Open

(2) Calculated Pressure of Transmission Mains for Ain Al Basha



(3) Calculated Pressure of Distribution Network for Ain Al Basha



(4) Network Analysis Result of Transmission Mains for Deir Alla

```
**************************************************************************
*                                E P A N E T                             *
*                        Hydraulic and Water Quality                     *
*                        Analysis for Pipe Networks                      *
*                                Version 2.0                             *
**************************************************************************
Link - Node Table:
--------------------------------------------------------------
Link               Start              End              Length    Diameter
ID                 Node               Node                  m          mm
--------------------------------------------------------------
p2                 J3                 n4                 2957         300
p4                 J2                 n5                 2810         300
p7                 R1                 n3                    2         200
p8                 R2                 n1                    2         300
p10                n3                 J3                 1815         250
p12                J4                 J5                 3472         150
p13                n1                 J1               391.75         200
p14                J1                 J3                 7.01         200
p1                 n6                 n7                 1973         150
P6                 T1                 n6                 #N/A       #N/A Pump
```

P9	T2	J2	#N/A	#N/A Pump
P11	T3	J4	#N/A	#N/A Pump

Node Results:

Node ID	Demand CMH	Head m	Pressure m	Quality
n1	0.00	-208.00	0.00	0.00
n3	0.00	-211.02	5.98	0.00
n4	282.00	-229.28	14.72	0.00
n5	282.00	-76.49	9.71	0.00
n6	0.00	54.00	164.00	0.00
n7	150.00	-19.33	0.67	0.00
J2	0.00	-65.00	179.00	0.00

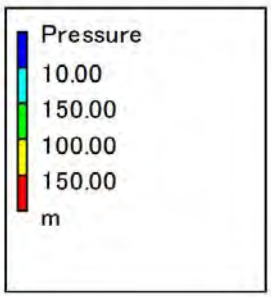
Node Results: (continued)

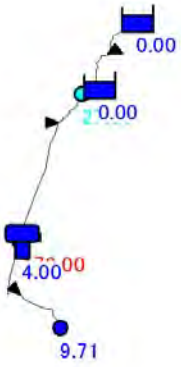
Node ID	Demand CMH	Head m	Pressure m	Quality
J3	-124.00	-217.19	17.81	0.00
J4	0.00	-2.50	210.00	0.00
J5	50.00	-19.37	0.63	0.00
J1	0.00	-208.00	27.00	0.00
R1	-158.00	-211.00	0.00	0.00 Reservoir
R2	0.00	-208.00	0.00	0.00 Reservoir
T1	-150.00	-106.00	4.00	0.00 Tank
T2	-282.00	-235.00	4.00	0.00 Tank
T3	-50.00	-208.50	4.00	0.00 Tank

Link Results:

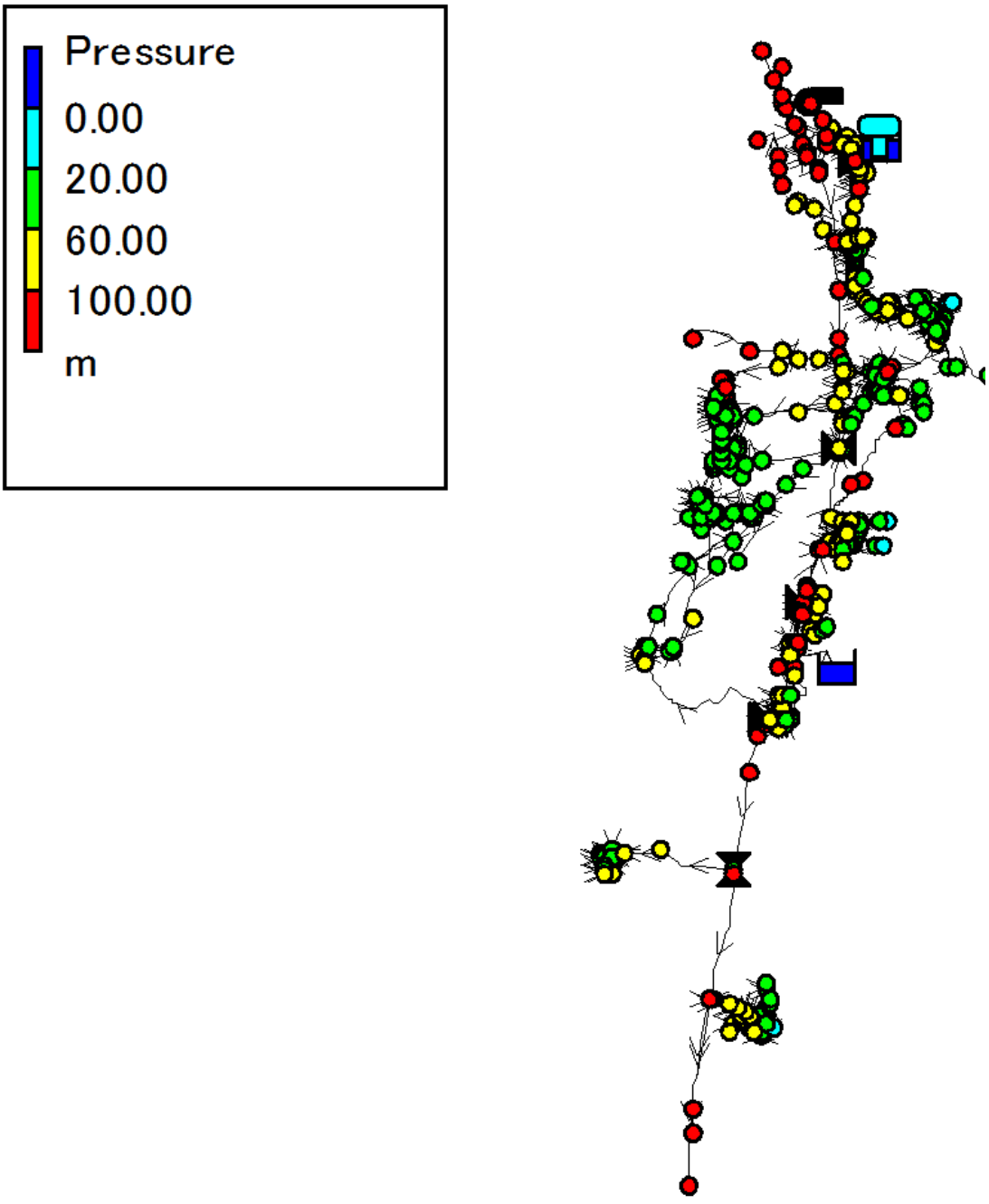
Link ID	Flow CMH	Velocity m/s	Unit Headloss m/km	Status
p2	282.00	1.11	4.09	Open
p4	282.00	1.11	4.09	Open
p7	158.00	1.40	8.79	Open
p8	0.00	0.00	0.00	Open
p10	158.00	0.89	3.40	Open
p12	50.00	0.79	4.86	Open
p13	0.00	0.00	0.00	Open
p14	0.00	0.00	0.00	Closed
p1	150.00	2.36	37.16	Open
P6	150.00	0.00	-160.00	Open Pump
P9	282.00	0.00	-170.00	Open Pump
P11	50.00	0.00	-206.00	Open Pump

(5) Calculated Pressure of Transmission Mains for Deir Alla





(6) Calculated Pressure of Distribution Network for Deir Alla



(7) Network Analysis Result of Transmission Mains for Zai-Dabouq Line

```
**************************************************************************
*                                E P A N E T                             *
*                        Hydraulic and Water Quality                     *
*                        Analysis for Pipe Networks                      *
*                              Version 2.0                               *
**************************************************************************

Input File: Zai-Dabouq_Model_Rev_08022014_9895CMH_HWC130.net

Link - Node Table:
--------------------------------------------------------------------
Link               Start              End                Length    Diameter
ID                 Node               Node                    m          mm
--------------------------------------------------------------------
p1                 n1                 n2                 172.36         150
p2                 n3                 n4                 220.33         150
p3                 n5                 n6                   5.53         100
p4                 n6                 n7                   9.07         100
p5                 n4                 n7                1269.82        1197
p6                 n8                 n9                  85.85         250
p7                 n9                 n10                 9.382         250
p8                 n10                n11                 4.973         250
p9                 n12                n13                 4.781         250
p10                n13                n14                 4.915         250
p11                n15                n14               1646.93        1197
p12                n15                n16               1638.59        1197
p13                n16                n17                  3375        1197
p14                n18                n28                  2729        1197
p15                n51                n21                 6.848         100
p16                n22                n23                  48.6         100
p17                n7                 n22                  5989        1197
p18                n16                n25                 15.01         250
p19                n25                n10                 10.42         250
p20                n11                n12                 4.538         250
p21                n14                n27                  4916        1197
p23                n29                n30                  3076        1197
p24                n21                n31                 61.26         100
p26                n1                 n29               1260.44        1197
p27                n30                n34                   322         150
p28                J2                 n27               2658.77        1197
p29                n37                n38                 40.63         300
p30                n28                n50                 36.46         150
p31                n38                n41                 3.568         100
p32                n27                n37                 1.521         300
p33                n44                n45                 12.39         150
p34                n46                n44                 51.22         150
p35                n18                n47                 46.54         100
p36                n30                n18                  2659        1197
p37                n46                n50                 168.1         200
p38                n51                n46                  14.1         200
p39                n52                n51                  18.6         200
p40                n50                n41                 10.48         100
p41                n5                 n54                 101.4         100
p42                n38                n56                 1.251         300
p43                n56                n57                 19.98         300
p44                n57                n58                 288.4         300
p45                n41                n60                 252.3         200
p46                n61                n1                  515.29        1197
p47                n62                n4                  242.48        1197
p50                J1                 n61                    10         1197
p51                J1                 n62                    10         1197
```

p53	n22	J2	113.70	1197
p54	J2	J3	52.71	300
p55	n28	J4	629.24	1197
p56	J4	n17	924.27	1197
P25	R1	J1	#N/A	#N/A Pump
P48	R1	J1	#N/A	#N/A Pump
P49	R1	J1	#N/A	#N/A Pump
P52	R1	J1	#N/A	#N/A Pump

Energy Usage:

Pump	Usage Factor	Avg. Effic.	Kw-hr /m^3	Avg. Kw	Peak Kw	Cost /day
P25	100.00	75.00	0.73	1795.89	1795.89	0.00
P48	100.00	75.00	0.73	1795.89	1795.89	0.00
P49	100.00	75.00	0.73	1795.89	1795.89	0.00
P52	100.00	75.00	0.73	1795.89	1795.89	0.00

Demand Charge: 0.00
Total Cost: 0.00

Node Results:

Node ID	Demand CMH	Head m	Pressure m	Quality
n1	0.00	1054.44	194.44	0.00
n2	0.00	1054.44	159.44	0.00
n3	0.00	1054.72	139.72	0.00
n4	0.00	1054.72	174.72	0.00
n5	0.00	1053.52	128.52	0.00
n6	0.00	1053.52	128.52	0.00
n7	0.00	1053.52	128.52	0.00
n8	0.00	1040.58	50.58	0.00
n9	0.00	1040.58	35.58	0.00
n10	0.00	1040.58	35.58	0.00
n11	0.00	1040.58	35.58	0.00
n12	0.00	1040.59	35.59	0.00
n13	0.00	1040.60	35.60	0.00
n14	0.00	1040.60	35.60	0.00
n15	9375.00	1039.12	0.12	0.00
n16	0.00	1040.54	35.54	0.00
n17	0.00	1043.33	128.33	0.00
n18	0.00	1047.46	167.46	0.00
n21	0.00	1044.86	144.86	0.00
n22	0.00	1047.83	167.83	0.00
n23	0.00	1047.83	162.83	0.00
n25	0.00	1040.56	35.56	0.00
n27	0.00	1045.20	155.20	0.00
n28	0.00	1044.74	154.74	0.00
n29	0.00	1053.18	97.18	0.00
n30	0.00	1050.11	105.11	0.00
n31	0.00	1044.86	144.86	0.00
n34	0.00	1050.11	60.11	0.00
n37	0.00	1045.20	155.20	0.00
n38	0.00	1045.20	155.20	0.00
n41	0.00	1045.11	155.11	0.00
n44	0.00	1044.86	144.86	0.00
n45	0.00	1044.86	144.86	0.00
n46	0.00	1044.86	144.86	0.00
n47	0.00	1047.46	162.46	0.00
n50	0.00	1044.86	154.86	0.00
n51	0.00	1044.86	144.86	0.00

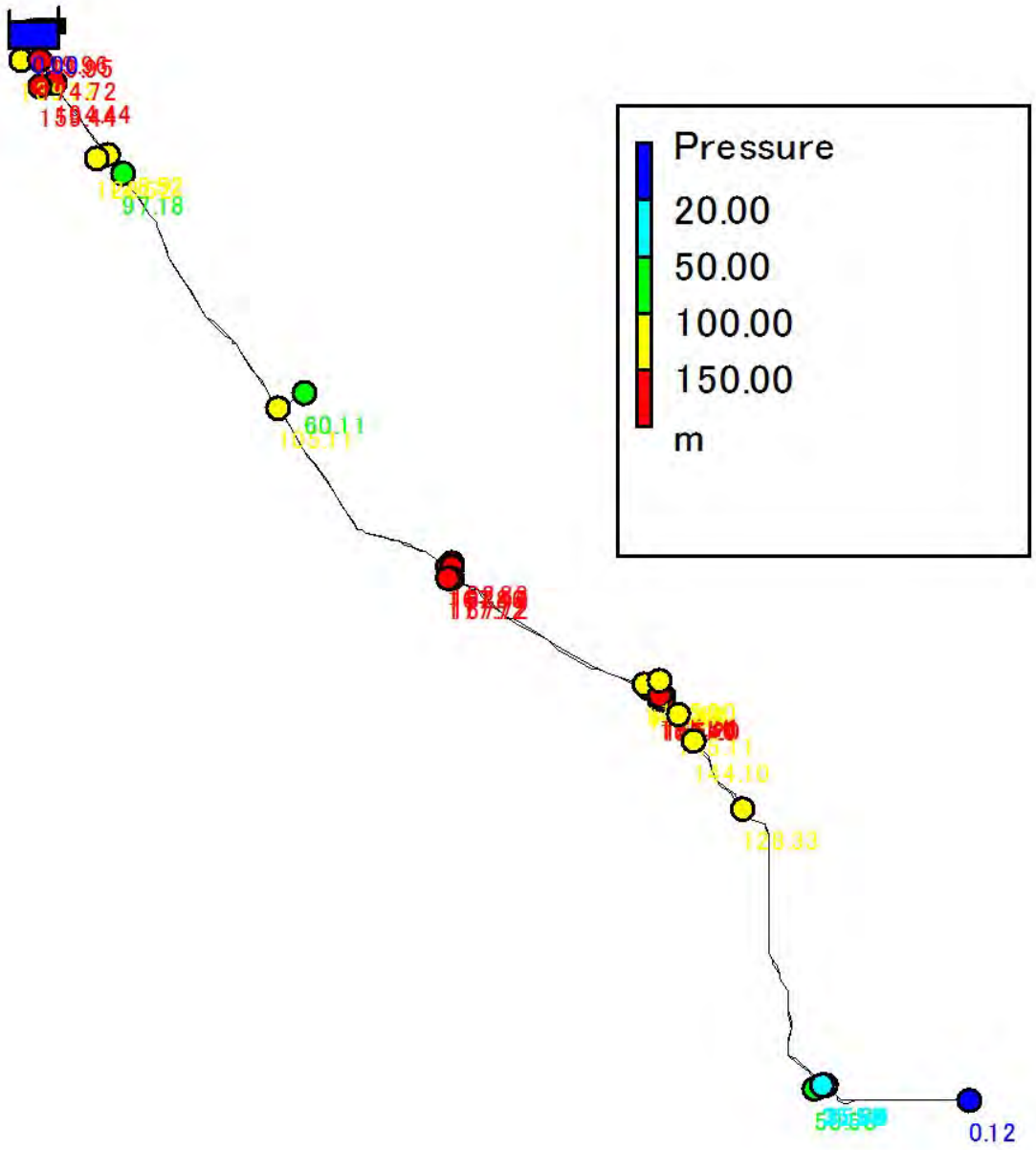
n52	0.00	1044.86	144.86	0.00
n54	0.00	1053.52	128.52	0.00
n56	0.00	1045.20	155.20	0.00
n57	0.00	1045.20	155.20	0.00
n58	0.00	1045.20	145.20	0.00
n60	0.00	1045.11	145.11	0.00
n61	0.00	1054.95	199.95	0.00
n62	0.00	1054.95	199.95	0.00
J1	0.00	1054.96	199.96	0.00
J2	0.00	1047.72	167.72	0.00
J3	0.00	1047.72	177.72	0.00
J4	520.00	1044.10	144.10	0.00
R1	-9895.01	855.00	0.00	0.00 Reservoir

Link Results:

Link ID	Flow CMH	Velocity m/s	Unit Headloss m/km	Status
p1	0.00	0.00	0.00	Open
p2	0.00	0.00	0.00	Open
p3	0.00	0.00	0.00	Open
p4	0.00	0.00	0.00	Open
p5	4881.17	1.20	0.95	Open
p6	0.00	0.00	0.00	Open
p7	0.00	0.00	0.00	Open
p8	-101.20	0.57	1.48	Open
p9	-101.20	0.57	1.49	Open
p10	-101.20	0.57	1.48	Open
p11	-4739.20	1.17	0.90	Open
p12	-4635.80	1.14	0.86	Open
p13	-4534.60	1.12	0.83	Open
p14	5013.83	1.24	1.00	Open
p15	0.00	0.00	0.00	Open
p16	0.00	0.00	0.00	Open
p17	4881.17	1.20	0.95	Open
p18	-101.20	0.57	1.49	Open
p19	-101.20	0.57	1.49	Open
p20	-101.20	0.57	1.49	Open
p21	-4840.40	1.19	0.93	Open
p23	5013.84	1.24	1.00	Open
p24	0.00	0.00	0.00	Open
p26	5013.84	1.24	1.00	Open
p27	0.00	0.00	0.00	Open
p28	4881.17	1.20	0.95	Open
p29	40.77	0.16	0.11	Open
p30	-40.77	0.64	3.33	Open
p31	40.77	1.44	23.98	Open
p32	40.77	0.16	0.15	Open
p33	0.00	0.00	0.00	Open
p34	0.00	0.00	0.00	Open
p35	0.00	0.00	0.00	Open
p36	5013.84	1.24	1.00	Open
p37	0.00	0.00	0.00	Open
p38	0.00	0.00	0.00	Open
p39	0.00	0.00	0.00	Open
p40	-40.77	1.44	23.99	Open
p41	0.00	0.00	0.00	Open
p42	0.00	0.00	0.00	Open
p43	0.00	0.00	0.00	Open
p44	0.00	0.00	0.00	Open
p45	0.00	0.00	0.00	Open
p46	5013.84	1.24	1.00	Open

p47	4881.17	1.20	0.95	Open
p50	5013.84	1.24	1.00	Open
p51	4881.17	1.20	0.95	Open
p53	4881.17	1.20	0.95	Open
p54	0.00	0.00	0.00	Open
p55	5054.60	1.25	1.01	Open
p56	4534.60	1.12	0.83	Open
P25	2473.75	0.00	-199.96	Open Pump
P48	2473.75	0.00	-199.96	Open Pump
P49	2473.75	0.00	-199.96	Open Pump
P52	2473.75	0.00	-199.96	Open Pump

(8) Calculated Pressure of Transmission Pipeline for Zai-Dabouq Line



6.5 Result of Water Hummer Measures of Ma'adi Pumping Station

Result

Station	Without measure			Measure of Flywheel			
	Fig. No.	Maximum negative pressure	Location of maximum negative pressure	Fig. No.	GD^2	Maximum negative pressure	Location of maximum negative pressure
Ma'adi Pump Station	Fig.1	Approx. 56m	Approx. 2510m	Fig.2	25.0kg・m^2	Approx. 5m	Approx. 1970m

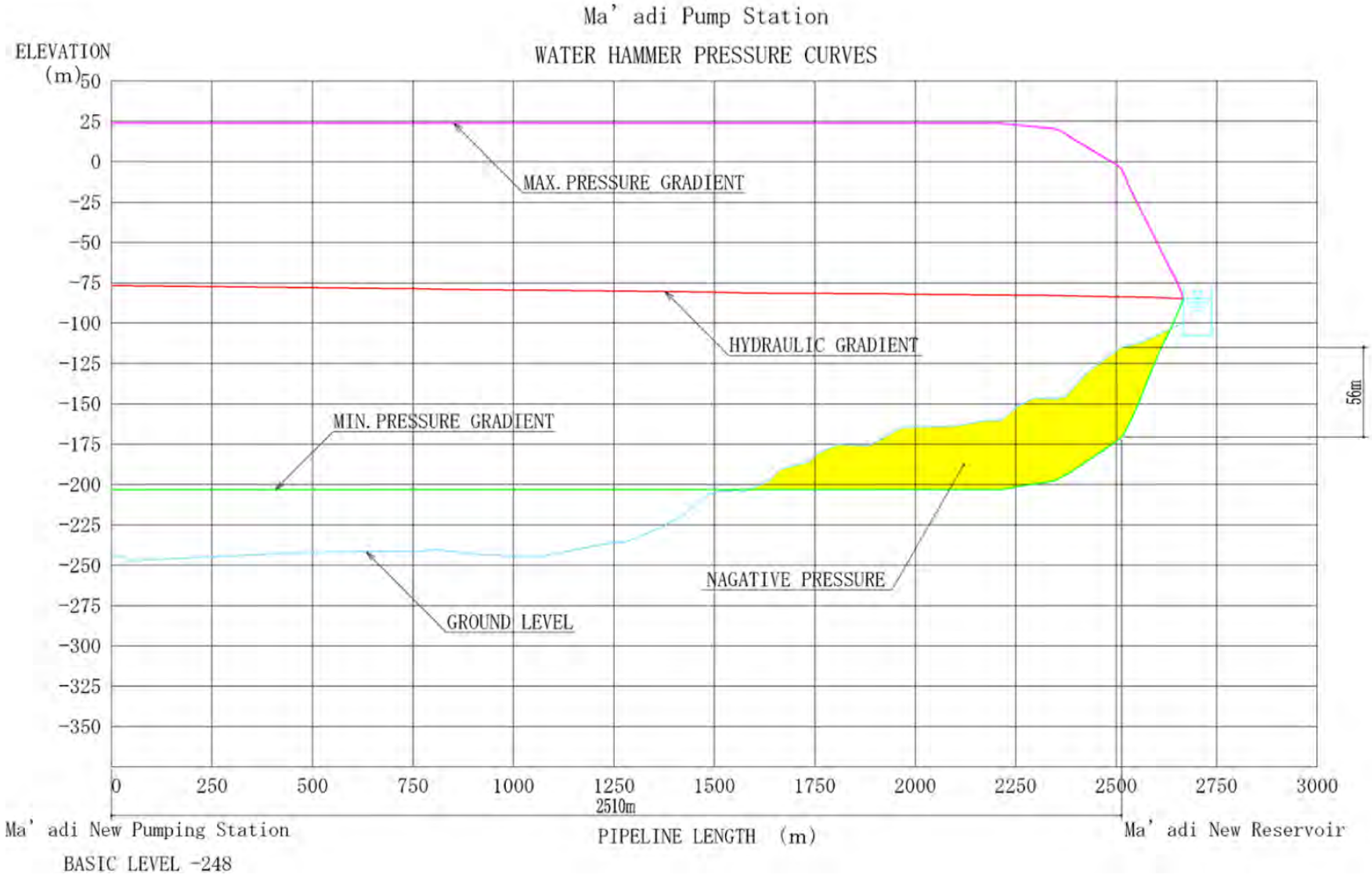


Fig.1 Without water hummer measures (FW GD^2=0.0kg·m^2)

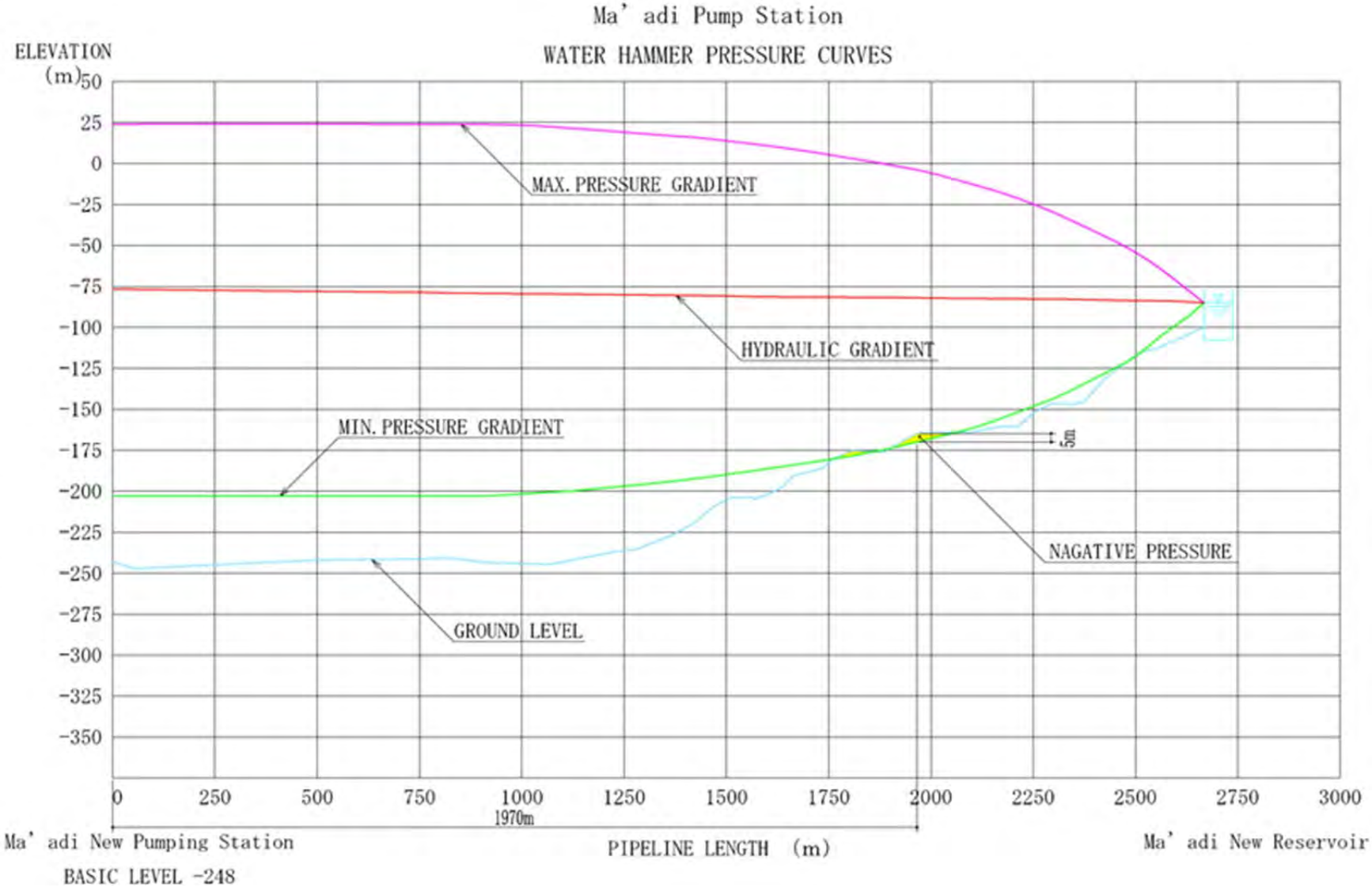
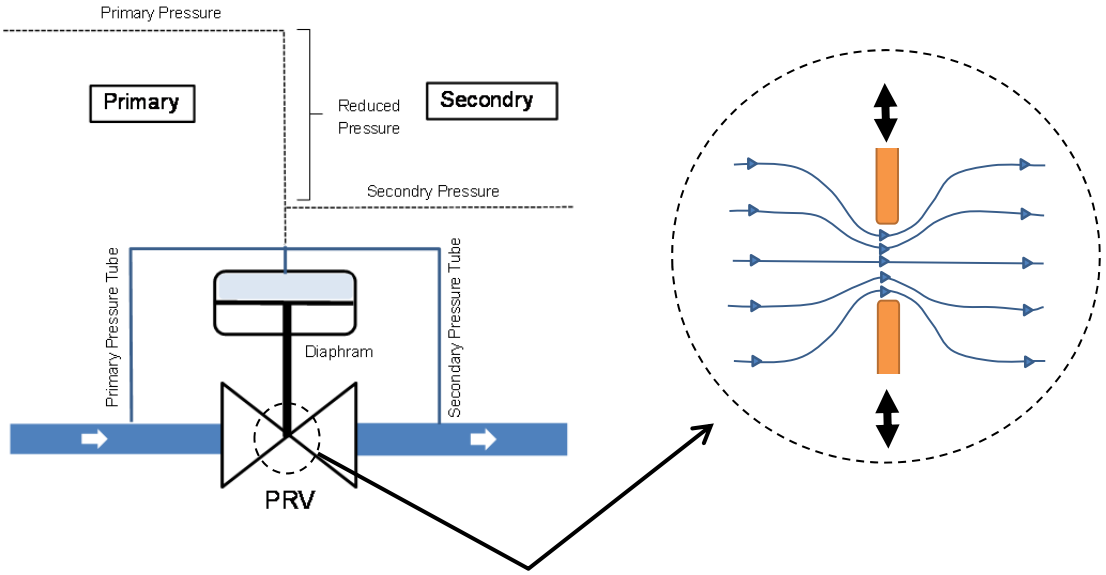


Fig.2 With water hummer measure (Flywheel) (FW GD^2=25.0kg·m^2)

6.6 Structure of Pressure Reducing valves

The pressure-reducing valve throttles the opening and accelerates the flow rate, increases friction loss and reduces the pressure. Even if the pressure on the primary side varies, the pressure on the secondary side will be maintained at a fixed level. The water pressures on the primary and secondary sides are detected, and the valve rod is raised or lowered by the diaphragm.



Mechanism of pressure reducing valve

If the valve is throttled and flow rate is increased, a wide range of reduced pressures can be obtained; however, when the flow rate increases, the water pressure decreases. If this pressure falls below the saturated steam pressure, water boils and bubbles are formed. After the fluid passes through the reduced opening, the flow rate returns to normal and the water pressure also increases. Bubbles explode vigorously and cause wear in the valve. This phenomenon is called cavitation. The pressure-reducing valve plan must be such that the pressure-reducing range is set appropriately and cavitation does not occur.

The pressure-reducing valve (PRV) is a special valve. The manufacturer of this valve has adopted proprietary measures to improve its features to resist cavitation. The valve shape generally differs depending on the manufacturer. All manufacturers have a selection chart for their proprietary products.

The plan for pressure-reducing valve was formulated for this project based on the selection chart of the PRV manufacturer expected to be used. The PRV manufacturers expected to be used for this plan are the following two companies:

Company A:German manufacturer widely used in Jordan. Often used particularly in kfW/GIZ

projects; also being used in the Ain Al Basha area.

Company B: Japanese manufacturer. Used in Japanese grant-aid projects such as the “Project for the Improvement and Expansion of the Water Supply Networks in North/Middle Jordan Valley” and the “Project for Rehabilitation and Improvement of Water Facilities in Tafieleh Governorate.”

6.7 Study on Effect of Reduction of Power Consumption and CO_2

Current financial condition of WAJ is severely poor. One of the primary reasons is excessive electricity expenses. The electricity consumption for waterworks reaches to 16% of the total consumption in Jordan. WAJ acknowledges restoring financial soundness as an urgent issue by decreasing electricity consumption and balancing financial condition.

Under such background, one of the purposes of the project is to improve energy efficiency of the existing water supply facilities and to reduce the electricity consumption. This report will evaluate the effects of this project by calculating electricity consumption both in case of “with-project” and “without-project” and identifying the difference as saving amount of electricity consumption. In addition, the reduction amount of CO_2 related to the issue of climate change will be assessed from the calculated saving amount.

1. “With Project” and “Without Project”

The objective of the project is to improve the existing water supply system in the target year 2020. The water supply volume will be increased with the growth of the served population. The served population and the daily average water supply both in present year 2012 and in the target year 2012 are shown in the following table.

Electricity consumption for pump operation is shared large portion of the total electricity consumption in water supply facilities. The improvement in efficiency of existing pump equipment contributes to establish the water supply system with high energy efficiency. Except for a part of the target area, water is distributed by distribution and booster pumps. Since a rationing system with the segmentalized distribution zones is applied for water distribution, the operating point of pumps is shifted according to water discharge. Hence, difficulty in maintaining high pump efficiency results in large electricity consumption.

Table 1 Served Population and Served Volume (Daily Average)

Item	Unit	Ain Al Bash		Deir Alla	
		Present（2012）	Target Year（2020）	Present（2012）	Target Year（2020）
Served population	person	156,860	191,505	57,440	70,125
Served Volume (Daily Average)	m^3/day	20,027	27,225	8,932	10,497

1) With Project

The distribution system will be shifted from a pumping distribution system using distribution and booster pumps to a gravity flow system, contributing to establish the system that the fluctuation of distribution volume does not effects to pump efficiency. The reservoirs are constructed at appropriate altitude levels and transmission pumps are newly installed as necessary. The energy consumption of a pumping distribution system and a gravity system is assumed to basically be same amount. However, energy consumption of a pumping distribution system by distribution pumps is fluctuated according to the flow volume change. In contrast, transmission pump operation enables constant water flow contributing to stabilize the steady energy efficiency of pumps. It is considered that the difference between them can be recognized as saving amount of electricity consumption.

The detail of improvement points of the water systems in both areas are shown as below.

Ain Al Bash

The 2 existing pumping stations will be out of use because 2 reservoirs are planned to be newly constructed. One existing distribution pumping station will shift to a transmission one for conveying water to the Al Baqa'a reservoir. (1) Groundwater is transmitted from existing source wells to new reservoirs by using the existing well pumps without replacement, (2) Since water is transmitted to new reservoirs by using residual water pressure from the diverging point of Zai-Dabouk transmission main, transmission pumps to new reservoirs are not necessary

Deir Alla

The existing water supply system does not show distinct zoning, but is composed of two distribution systems. For the water supply system with northern resource wells, water is transmitted from the wells to the existing Rajeb reservoir and distributed by gravity. For another system, water is distributed from two desalination plants to the existing distribution networks by using distribution pumps. However, since the altitude of Rajab reservoir is not sufficient high, water is distributed to the served areas with low water pressure by using both of distribution pumps and booster pumps. The project is designed to increase water supplied from RO plants for the lack volume in the target year. For fair water supply, the distribution area is divided into two distinct zones, with the zone covered by Rajeb Reservoir being narrow and with another zone being distributed by gravity from RO plants by constructing New Ma'adi Reservoir.

2) Without Project

In the case of "without-project", it is considered that to achieve the planned distribution volume in both areas shown in table 1 is difficult even if water distribution volume for the target year is secured. Hence, it is assumed to meet the target distribution volume only if the various measures such as installation of additional pumps, extension of operating hours are taken. In this "without-project" case, improvement of water supply system for increasing energy efficiency is not planned, therefore it is presumed that the present energy efficiency is not changed.

2. Estimation of electricity consumption and equivalent CO2 emissions

(3) Ain Al Basha

Electricity consumption can be estimated only for existing pump stations, because of no plans of new pump stations.

1) Current electricity consumption and equivalent CO_2 emissions (in Year 2012)

Current electricity consumption and equivalent CO_2 emissions in the existing pump stations are shown as below according to WAJ's actual records.

Table 2 Electricity Consumption and Equivalent CO_2 Emissions (in Year 2012)

Pumping Station	Type	Electricity (kWh/y)		Electricity charge (*1) (JD/y)	CO_2 (*2) (ton/y)
Abu Nussair P/S	Distribution pump	1,109,571	(33%)	73,232	688
Safout Reservoir P/S	Distribution pump	487,502	(15%)	32,175	302
Sub total		1,597,073	(48%)	105,407	990
Um Al Danannir P/S	Distribution pump	1,751,935	(52%)	115,628	1,086
total		3,349,008	(100%)	221,035	2,076

(WAJ records in year 2012)

Note)

(*1) : Electricity tariff 1kWh=0.066 JOD

(*2) : Emission gas conversion factor for CO2 reduction (tone CO_2 e/Mwh) according to JICA Project Study Progress Report (December, 2008). This report uses the factor of 0.62 kg-CO_2/kWh.

Without Project

- Electricity consumption : 3,349,008 kWh/y
- Electricity charge : 221,035 JD/y
- Equivalent CO2 emissions : 2,076 ton/y

With Project

'With Project' requires for electricity consumption of Um Al Danannir P/S.

- Electricity consumption : 1,751,935 kWh/y
- Electricity charge : 115,628 JD/y
- Equivalent CO_2 emissions : 1,086 ton/y

2) Target year electricity consumption and equivalent CO_2 emissions (in Year 2020)

Current electricity consumption per m^3 of the existing P/S can be estimated at as shown in following table.

Table 3 Electricity consumption per m^3 of Existing P/S (in Year 2012)

Electricity consumption (kWh/y)	Planned distribution (m^3/day)	Planned distribution (m^3/y)	Electricity consumption per m^3 (kWh/m^3)
3,349,008	20,027	7,309,855	0.46

Without Project

'Without Project' can be assumed that planned distribution of target year will be able to be achieved by increasing quantity of pumps or extension of water supply time without fundamental improvement of facilities to raise energy efficiency. In this case, electricity consumption per m^3 can be assumed not to be changed.

Table 4 Electricity Consumption and Equivalent CO_2 Emissions (in Year 2020)

Planned distribution (m^3/day)	Planned distribution (m^3/y)	Electricity consumption per m^3 (kWh/m^3)	Electricity consumption (kWh/y)	Electricity charge (*1) (JOD/y)	CO_2(*2) (ton/y)
27,225	9,937,125	0.46	4,571,078	301,691	2,834

With Project

Abu Nussair P/S and Safout Reservoir P/S will be out of use and Um Al Dananir P/S only will be oprating after completion of the Project. Electricity consumption of Um Al Dananir P/S can be estimated at 52% of the whole one of 'Without Project'.

- Electricity consumption : 2,376,961 kWh/y (=4,571,078 kWh x 0.52)
- Electricity charge : 156,879 JOD/y (=301,691 JOD/y x 0.52)
- Equivalent CO2 emissions : 1,474 ton/y (=2,834 ton/y x 0.52)

(4) Deir Alla

In Deir Alla, new Ma'adi pump station is planned to be constructed. Therefore, electricity consumption can be estimated for existing and new pump stations. As target year of new pump station

is 2020, current electricity consumption in year 2012 has to be calculated with planned distribution corrected to current condition.

1) Current electricity consumption and equivalent CO_2 emissions (in Year 2012)

Current electricity consumption and equivalent CO_2 emissions in the existing pump stations are shown as below according to WAJ's actual records.

Table 5 Electricity Consumption and Equivalent CO_2 Emissions (in Year 2012)

Pumping Station	Type	Electricity (kWh/y)	Electricity charge (*1) (JD/y)	CO_2 (*2) (ton/y)	P/S status
Waji Rajeb P/S	Distribution pump	175,840	11,605	109	Continue to operate
Derra P/S	Booster pump	273,100	18,025	169	Continue to operate
Sub total		448,940 (20%)	29,630	278	
Abu Ziegan P/S	Booster pump	466,480	30,788	289	Out of use
Al Rueiah P/S	Booster pump	452,320	29,853	280	Out of use
Ma'adi P/S	Booster pump	474,240	31,300	294	Out of use
Dharet Al Ramel P/S	Booster pump	91,280	6,024	57	Out of use
Miyahuna	Distribution pump	48,180	3,180	30	Out of use
Omar Abdalla	Distribution pump	262,800	17,345	163	Out of use
Sub total		1,795,300 (80%)	118,490	1,113	
total		2,244,240 (100%)	148,120	1,391	

(WAJ records in year 2012)

Without Project

- Electricity consumption : 2,244,240 kWh/y
- Electricity charge : 148,120 JD/y
- Equivalent CO_2 emissions : 1,391 ton/y

With Project

If existing water supply system is replaced by that of 'With Project', transmission water flow of new Ma'adi P/S is required to be adjusted to daily average distribution flow in Year 2012. As new Ma'adi P/S is designed based on the planned distribution flow (daily maximum flow) in Year 2020 and continuous 24hrs operation, the electricity consumption of new P/S is necessary to be calculated with operating time adjusted.

Table 6 Equivalent Operating Time at New P/S

Item	Planned distribution (daily average) (m^3/day)	Planned distribution (daily maximum) (m^3/day)	Distribution ratio	Equivalent operating time (daily maximum) (hour)	Equivalent operating time (daily average) (hour)
Current (in 2012)	8,932	10,450	85%	20.4	17.4
Target (in 2020)	10,497	12,281	100%	24.0	20.5

Note) seasonal fluctuation (daily maximum flow/daily average flow) = 1.17

Electricity consumption and equivalent CO_2 emissions of new Ma'adi P/S can be estimated based on equivalent operating time.

Table 7 Electricity Consumption and Equivalent CO_2 Emissions of New Ma'adi P/S (in Year 2012)

Pumping station	Pump specification				L (*) (kW)	Equivalent operating time (hour)	Elect. consumption		Elect. charge	CO_2(*)
	Q (m^3/h)	Q (m^3/min)	H (m)	kW			(kWh/day)	(kWh/y)	(JOD/y)	(ton/y)
New Ma'adi P/S (2duty+1stand-by)	141	2.35	170	110	100	17.4	1,743	636,258	41,993	394
	141	2.35	170	110	100	17.4	1,743	636,258	41,993	394
Total	-	-	-	-	-	-	3,486	1,272,516	83,986	788

Note) L (kW) = 0.163 x Q (m^3/min) x H (m) / η、 η = (pump efficiency) x (motor efficiency) = 0.65

From Table 5 and 7, 'With Project' is summarized as shown in Table 8.

Table 8 Reduction of Electricity Consumption and Equivalent CO_2 Emissions (in Year 2012)

Item	Elect. Consumption (kWh/y)	Elect. charge (*1) (JOD/y)	CO2 (*2) (ton/y)
Existing P/S	448,940	29,630	278
New P/S	1,272,516	83,986	788
Total	1,721,456	113,616	1,086

2) Target year electricity consumption and equivalent CO2 emissions (in Year 2020)

Current electricity consumption per m^3 of the existing P/S can be estimated at as shown in following table.

Table 9 Electricity consumption per m^3 of existing P/S (in Year 2012)

Electricity (kWh/y)	Planned distribution (m^3/day)	Planned distribution (m^3/y)	Electricity consumption per m^3 (kWh/m^3)
2,244,240	8,932	3,260,180	0.69

Without Project

'Without Project' can be assumed that planned distribution of target year will be able to be achieved by increasing quantity of pumps or extension of water supply time without fundamental improvement of facilities to raise energy coefficient. In this case, electricity consumption per m^3 can be assumed not to be changed.

Table 10 Electricity Consumption and Equivalent CO_2 Emissions (in Year 2020)

Planned distribution (m^3/day)	Planned distribution (m^3/y)	Electricity consumption per m^3 (kWh/m^3)	Electricity consumption (kWh/y)	Electricity charge (*1) (JOD/y)	CO2(*2) (ton/y)
10,497	3,831,405	0.69	2,643,669	174,482	1,639

With Project

2 P/S out of 8 existing P/S will continue to be operating after completion of the Project. Electricity consumption of 2 existing P/S can be calculated as shown in Table 11, assuming that it accounts for 20% of the whole electricity consumption of 'Without Project'.

Table 11 Electricity Consumption and Equivalent CO2 Emissions of 2 Existing Pumps that Continue to be Operating (in Year 2020)

Elect. Consumption (kWh/y)	Elect. charge (*1) (JD/y)	CO_2 (*2) (ton/y)
528,734	34,897	328

Electricity consumption of new P/S is shown as below, with equivalent operating time estimated at 20.5 hours.

Table 12 Electricity Consumption and Equivalent CO2 Emissions of New Ma'adi P/S (in Year 2020)

Pumping station	Pump specification				L (*) (kW)	Equivalent operating time (hour)	Elect. consumption		Elect. charge	CO_2(*)
	Q (m^3/h)	Q (m^3/min)	H (m)	kW			(kWh/day)	(kWh/y)	(JD/y)	(ton/y)
Ma'adi P/S (2duty+1stand-by)	141	2.35	170	110	100	20.5	2,054	749,614	49,475	465
	141	2.35	170	110	100	20.5	2,054	749,614	49,475	465
Total	-	-	-	-	-	-	4,108	1,499,228	98,950	930

Note) L (kW) = 0.163 x Q (m^3/min) x H (m) / η、 η = (pump efficiency) x (motor efficiency) = 0.65

Electricity consumption and equivalent CO_2 emissions are summarized in Table 12 according to Table 10, electricity consumption of existing distribution P/S, and Table 13, that of new transmission P/S.

Table 13 Electricity Consumption and Equivalent CO2 Emissions (in Year 2020)

Item	Elect. Consumption (kWh/y)	Elect. charge (*1) (JD/y)	CO_2 (*2) (ton/y)
Existing P/S	528,734	34,897	328
New P/S	1,499,228	98,950	930
Total	2,027,962	133,847	1,258

2. Summary of Reduction of Electricity Consumption and Equivalent CO2 Emissions

Table 14 Reduction of Electricity Consumption and Equivalent CO_2 Emissions

District	Item	Current (in Year 2012)			Target (in Year 2020)		
		Electricity consumption (kWh/y)	Electricity charge (JD/y)	CO_2 (ton/y)	Electricity consumption (kWh/y)	Electricity charge (JD/y)	CO_2 (ton/y)
Ain Al Basha	Without Project	3,349,008	221,035	2,076	4,571,078	301,691	2,834
	With Project	1,751,935	115,628	1,086	2,376,961	156,879	1,474
	Reduction	1,597,073	105,407	990	2,194,117	144,812	1,360
Deir Alla	Without Project	2,244,240	148,120	1,391	2,643,669	174,482	1,639
	With Project	1,721,456	113,616	1,086	2,027,962	133,847	1,258
	Reduction	522,784	34,505	305	615,707	40,635	381

Electricity consumption per m^3 is shown in the following table.

Table 15 Electricity Consumption per m^3

District	Item	unit	Current (in Year 2012)	Target (in Year 2020)
Ain Al Basha	Water distribution	m^3/day	20,000	27,200
	Electricity consumption	kWh/y	3,349,008	2,376,961
		kWh/day	9,175	6,512
	Electricity consumption per m^3	kWh/m^3	0.458	0.239
Deir Alla	Water distribution	m^3/day	8,900	9,100
	Electricity consumption	kWh/y	2,244,240	2,027,962
		kWh/day	6,149	5,556
	Electricity consumption per m^3	kWh/m^3	0.688	0.611

6.8 Social Condition Survey

(1) Sampling

The number of samples is 165 for Ain Al Basha and 135 for Deir Alla, depending on the population of localities.

(2) Social condition

1) Population

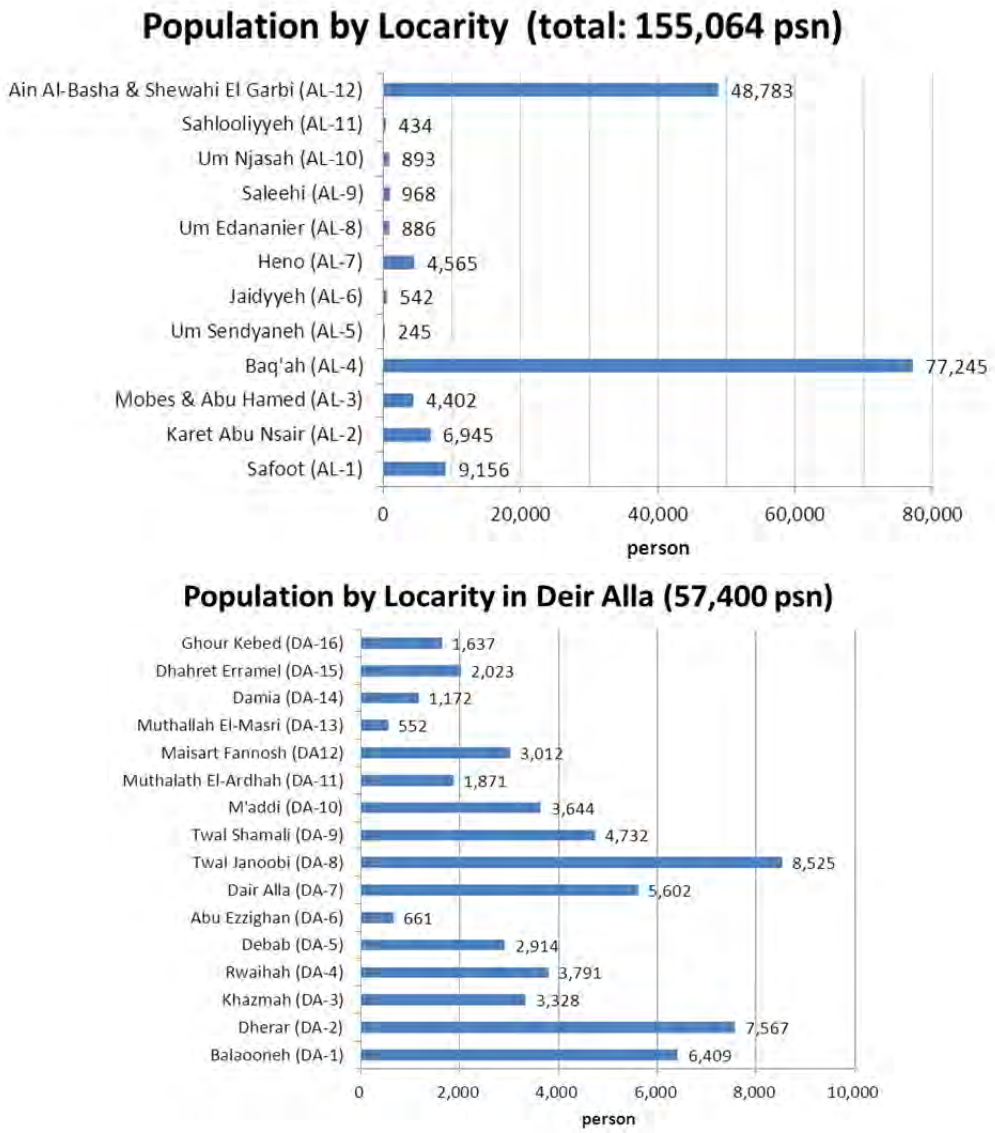


Figure 1:

2) Occupation

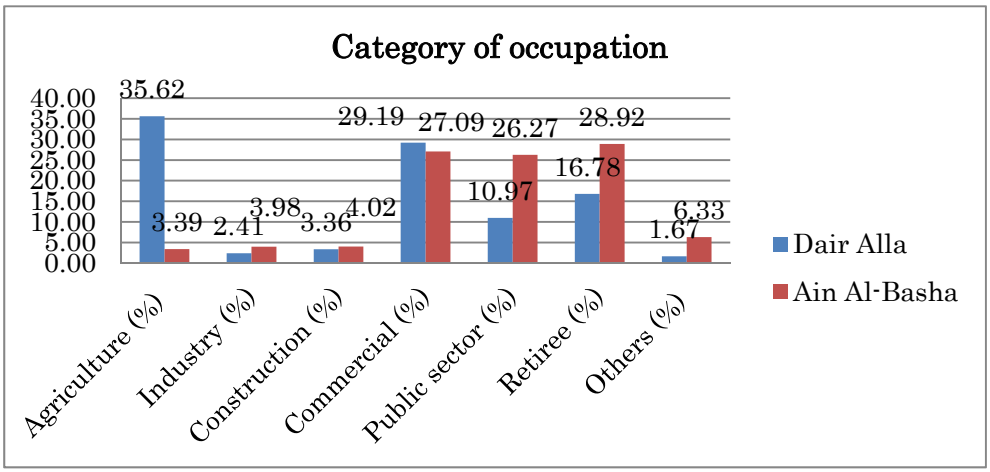

Category of occupation
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
35.62
3.39
2.41
3.98
3.36
4.02
29.19
27.09
10.97
26.27
16.78
28.92
1.67
6.33
Agriculture (%)
Industry (%)
Construction (%)
Commercial (%)
Public sector (%)
Retiree (%)
Others (%)
Dair Alla
Ain Al-Basha

Figure 2:

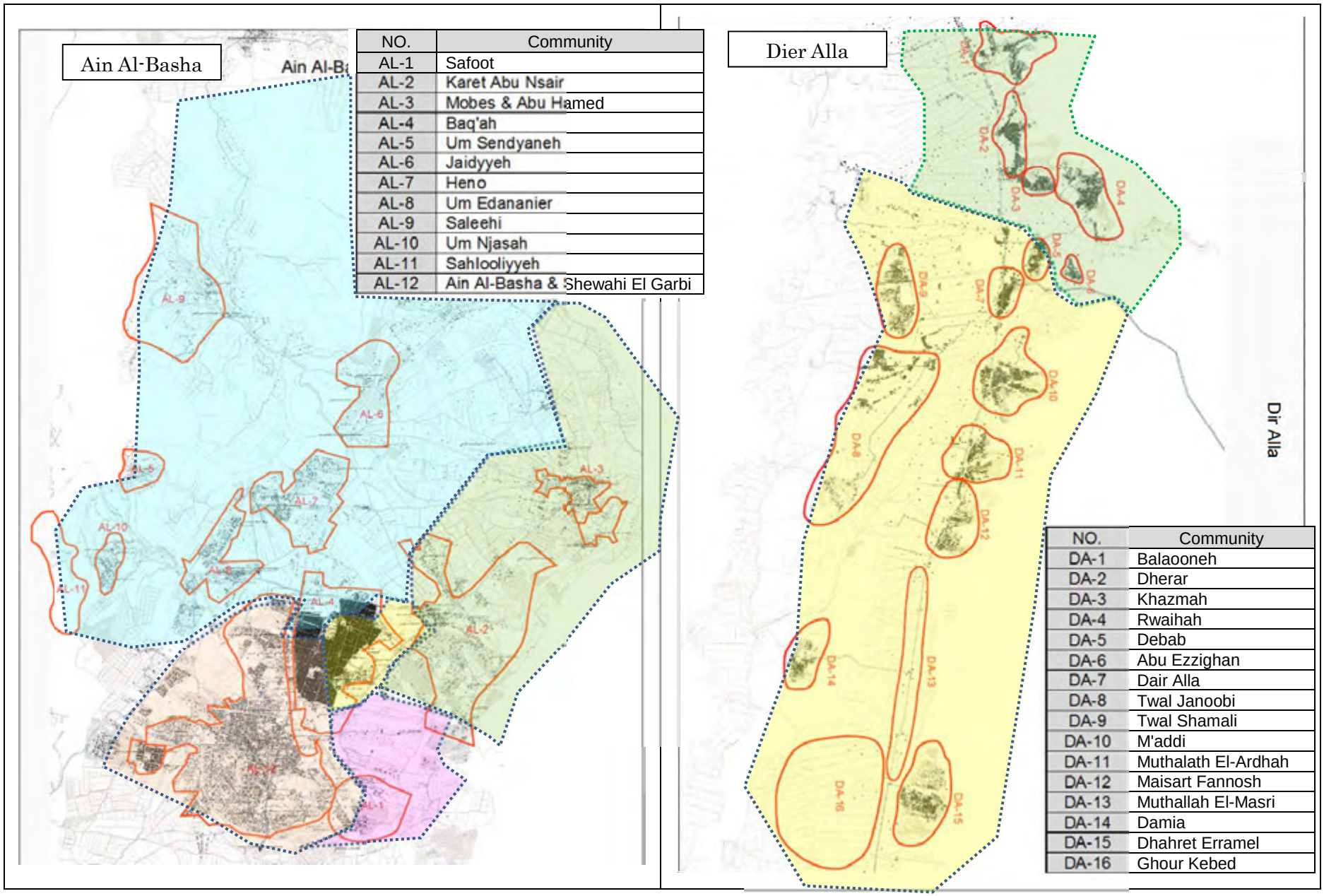

Ain Al-Basha
Ain Al-Ba
NO. Community
AL-1 Safoot
AL-2 Karet Abu Nsair
AL-3 Mobes & Abu Hamed
AL-4 Baq'ah
AL-5 Um Sendyaneh
AL-6 Jaidyyeh
AL-7 Heno
AL-8 Um Edananier
AL-9 Saleehi
AL-10 Um Njasah
AL-11 Sahlooliyyeh
AL-12 Ain Al-Basha & Shewahi El Garbi
Dier Alla
Dir Alla
NO. Community
DA-1 Balaooneh
DA-2 Dherar
DA-3 Khazmah
DA-4 Rwaihah
DA-5 Debab
DA-6 Abu Ezzighan
DA-7 Dair Alla
DA-8 Twal Janoobi
DA-9 Twal Shamali
DA-10 M'addi
DA-11 Muthalath El-Ardhah
DA-12 Maisart Fannosh
DA-13 Muthallah El-Masri
DA-14 Damia
DA-15 Dhahret Erramel
DA-16 Ghour Kebed

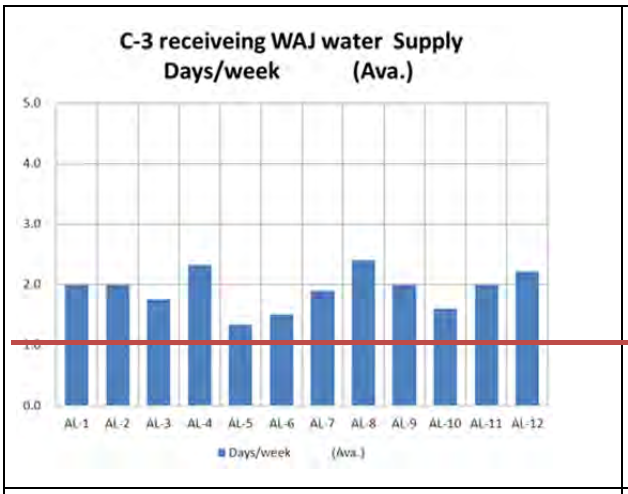
Figure 3:

(3) Rationing Supply

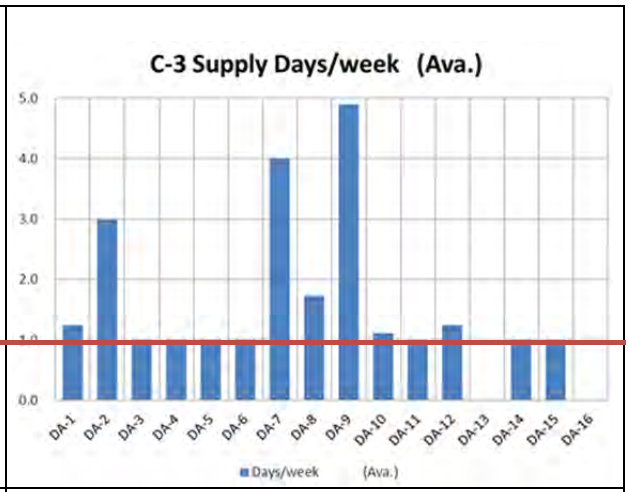
Rationing system adopted in the target area appears to be very complicated depending on the location and elevation of the houses. Its outline can be summarized as shown below according to the socio-economic survey by JICA Survey Team. The survey indicates that Deir Alla's water supply hours not equitable; some areas obtain water for 3-5 days, others only one day.ng water fairly.

Table 1: Average Water Supply Hours

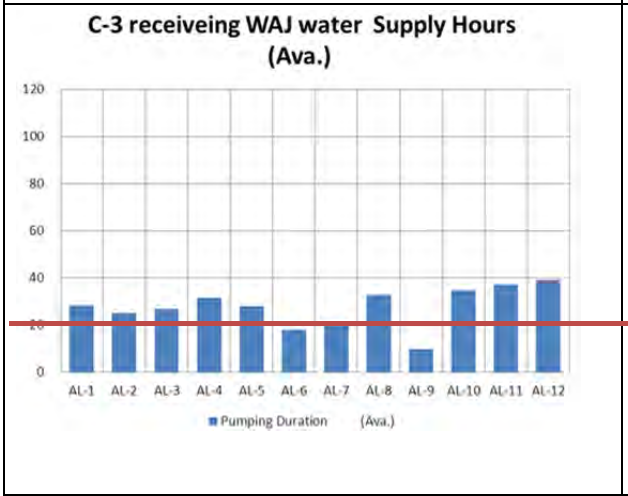
Directorate	Average days per week for water supply (days/week)	Average water supply hours (hours/week)
Ain Al Basha	2.1	31.1
Dier Alla	1.79	30.9



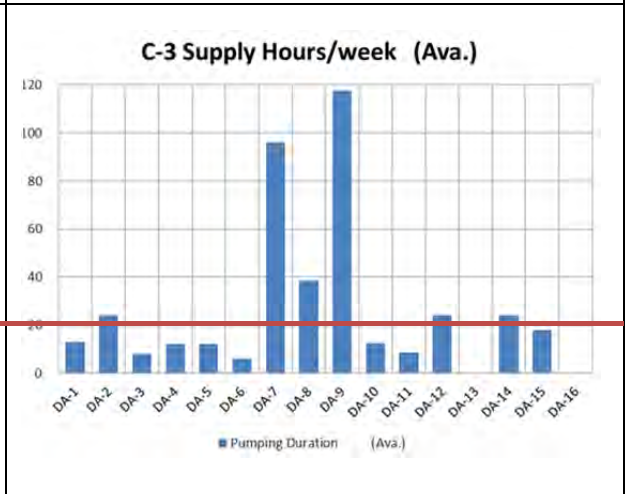
Ain Al Basha



Dier Alla



Ain Al Basha



Dier Alla

Figure 4:

(4) Condition of Water Usage

As an indicator of the public water supply in the areas, Deir Alla had 44% of the samples relies on the water tankers; this could lead to the fact that water supply is not satisfying the demand, bearing in mind that Deir Alla has areas that are not covered with the public water service as discussed before, which will also contribute in the high percentage of private water tankers.

On the other hand, 20% of the samples in Ain Al-Basha rely on the private water tankers, which, again gives an indicator that supply from the public system is not meeting the full households' demand in Ain Al-Basha. This fact is supported with the fact that more than 99% of the samples are connected to the public water network and has no other reason to use private tankers other than shortage in the supply.

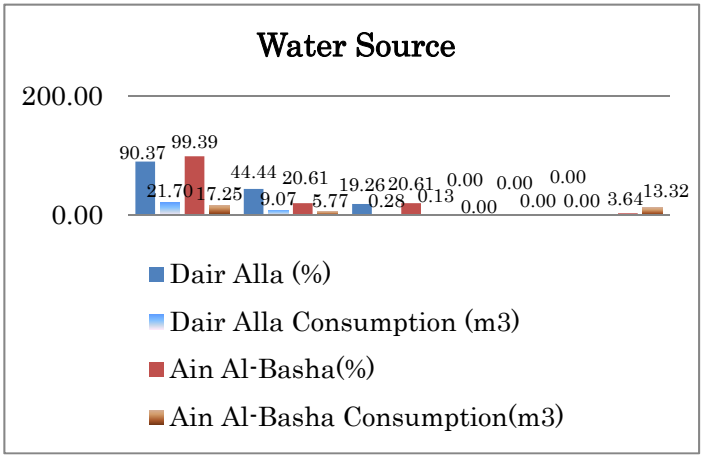


Figure 5:

The results indicated that number of days of supply was 1.79 for Deir Alla and 2.1 for Ain Al-Basha, whereas the supply hours were estimated as 31 hours per week for both. These numbers reflects latest supply during months in February and March.

Table 2:

District	Supply (days/week)	Supply (hrs/week)
Ain Al Basha	1.79	30.89
Dei Alla	2.1	31.1

Almost all households has storage tanks which is needed as the water supply in Jordan is not continuous (intermittent supply) and the consumer has to store the water for the days water is not supplied through the network.

Suction pump is used in 21% of the households in Deir Alla and in 14% of the households in Ain Al-Basha. Water Purifier is used in 67% of the households in Deir Alla and 52% in Ain Al-Basha. This indicated that great percentage of the households does not rely on the quality of water supplied from the public network.

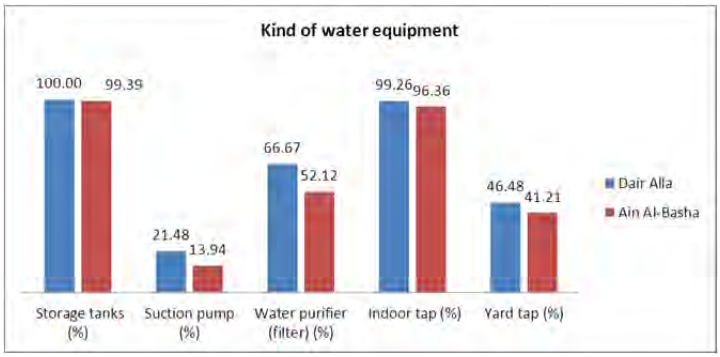


Figure 6:

(5) Awareness of People about Water Supply Services

98% of the households in Deir Alla are not satisfied with water supply services. While this percentage was 67% in Ain Al-Basha versus 33% are satisfied with water services delivered.

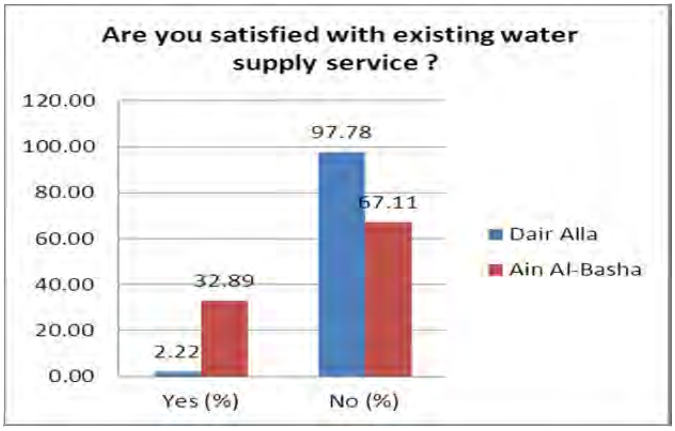


Figure 7:

Satisfaction will increase with increasing the level of service provided by reducing water leakages which will play a key role in enhancing water quality and implementing pressure management in the systems.

As shown in the figure below, 91% of the households in Deir Alla have a problem of water quality while about 49% of the households in Ain Al-Basha complained on the water quality issues. And this clarifies the high percentages of water Purifier used in the majority of homes. The reasons for complains are as follows:

- The residents complaint red colour water, or rusted colour water
  - This is usually caused by flushing after restart of water supply in intermittent water supply system, where pipe is old and rusty because internal surface is expose to air and easy to rust. The main material for this cause is galvanized iron pipe. Also in intermittent supply system, if suction pump is used to withdraw water from pipe, possibly dirty particles may be sucked through leakage holes.
- Other major reason is pollution or rusty in storage tank. WAJ recommend the tank cleaning

Also, 73% of the households in Deir Alla have a problem in amount of water supplied by the public network which was not enough to meet their demand and forces them to buy water from private water tankers. While in Ain Al-Basha 23% of households have a problem in water supply amount.

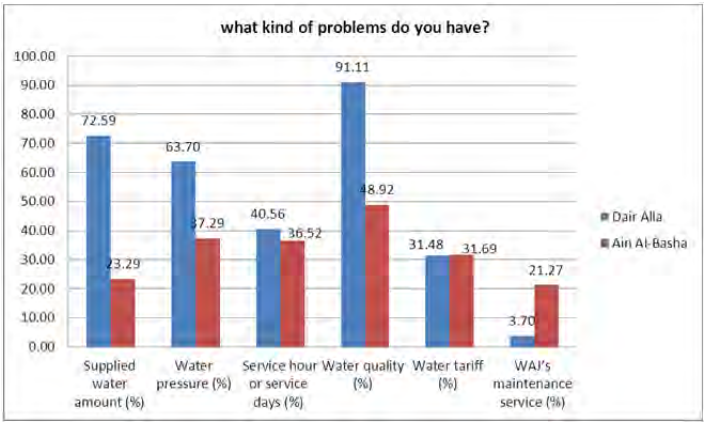


Figure 8:

64% of households in Deir Alla complained about low water pressures. Where 41% complained about supply duration and 31% complained about high water tariff.

In Ain Al-Basha district 37% complained on low water pressures. Where 37% complained about supply duration and 32% complained about high water tariff.

As discussed in previous item the major problems that facing the households in Deir Alla are water quality and supplied water quantities. While in Ain Al-Basha the major problems that face the households are water quality and water pressures. The table below summarizes the problems in each district according to the priority.

Table 3:

District	First Problem	Second Problem
Ain Al Basha	Water Quality	Water Pressure
Deir Alla	Water Quality	Water Amount

Willing to pay to water service depending on their conditions is shown as below. The residents are willing to pay more money for improved water supply conditions, especially in Dier Alla, where they willing to pay as much as 16 JD/month.

Table 4:

District	Current Service	Satisfied Service
Ain Al Basha	5.67 JDs/month	8.84 JDs/month
Deir Alla	6.83 JDs/month	16.18 JDs/month

The 43% of the households in Deir Alla will consume the same amount they currently consume, where 6% will consume 1.25 times of their current consumption, 34% will consume 1.50 times of their current consumption and 17% will consume twice amount of the current consumption.

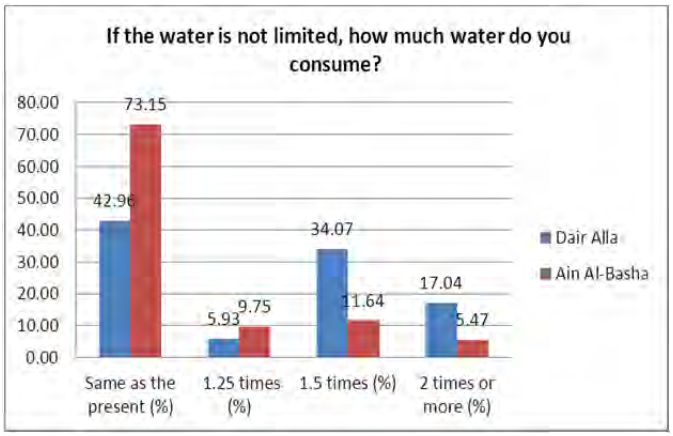


Figure 9:

In Ain Al-Basha district 73% of households will consume the same amounts they currently consume, 10% will consume 1.25 times of their current consumption, 12% will consume 1.50 times of their current consumption and 5% will consume twice amount of their current consumption.

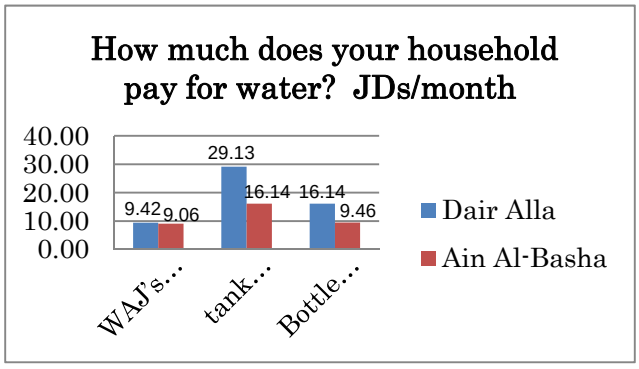


Figure 10:

The average value that paid for WAJ house connection in Deir Alla district is 9.42JDs/month, 29.13JDs/month for tank lorry and 16.14JDs/month for bottled water. While in Ain Al-Basha the average value that paid for WAJ house connection is 9.06JDs/month,16.14JDs/month for tank lorry and 9.46JDs/month for bottled water.

It can be noticed that the householders in Deir Alla pays for tank lorry triple amount than WAJ house connection, because the amount of water that is supplied by WAJ is not sufficient.

The average amount of income in Deir Alla was 425JDs/ month/family, while in Ain Al-Basha was 465JDs/month/family.

It can be noticed that the most expenses are on meals, Education and fuels expenditures respectively. Also, it can be noticed that the lowest expenses is on water.

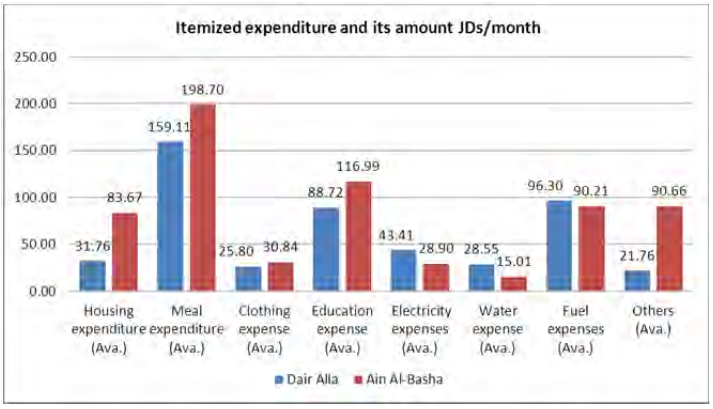


Figure 11:

(6) Condition of Toilet and Sanitary

The following figures show that majority of people have toilets in their homes, which means that hygienic conditions are maintained within the households and this will lead to a better health conditions within the families. The average cost that paid for public sewer in Ain Al-Basha is 13.5 JDs/year/household, and 0 JDs/year/household for Deir Alla since it is not served by public sewer network. The average cost that paid for private vacuum car in Deir Alla is 76 JDs/year, while in Ain Al-Basha is 50 JDs/year

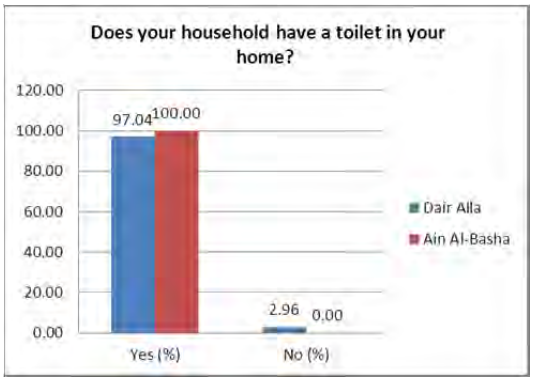


Figure 12:

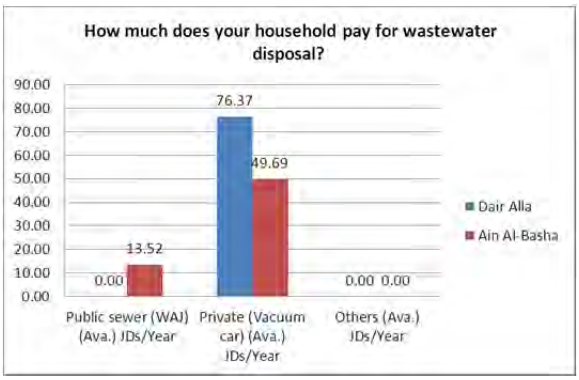


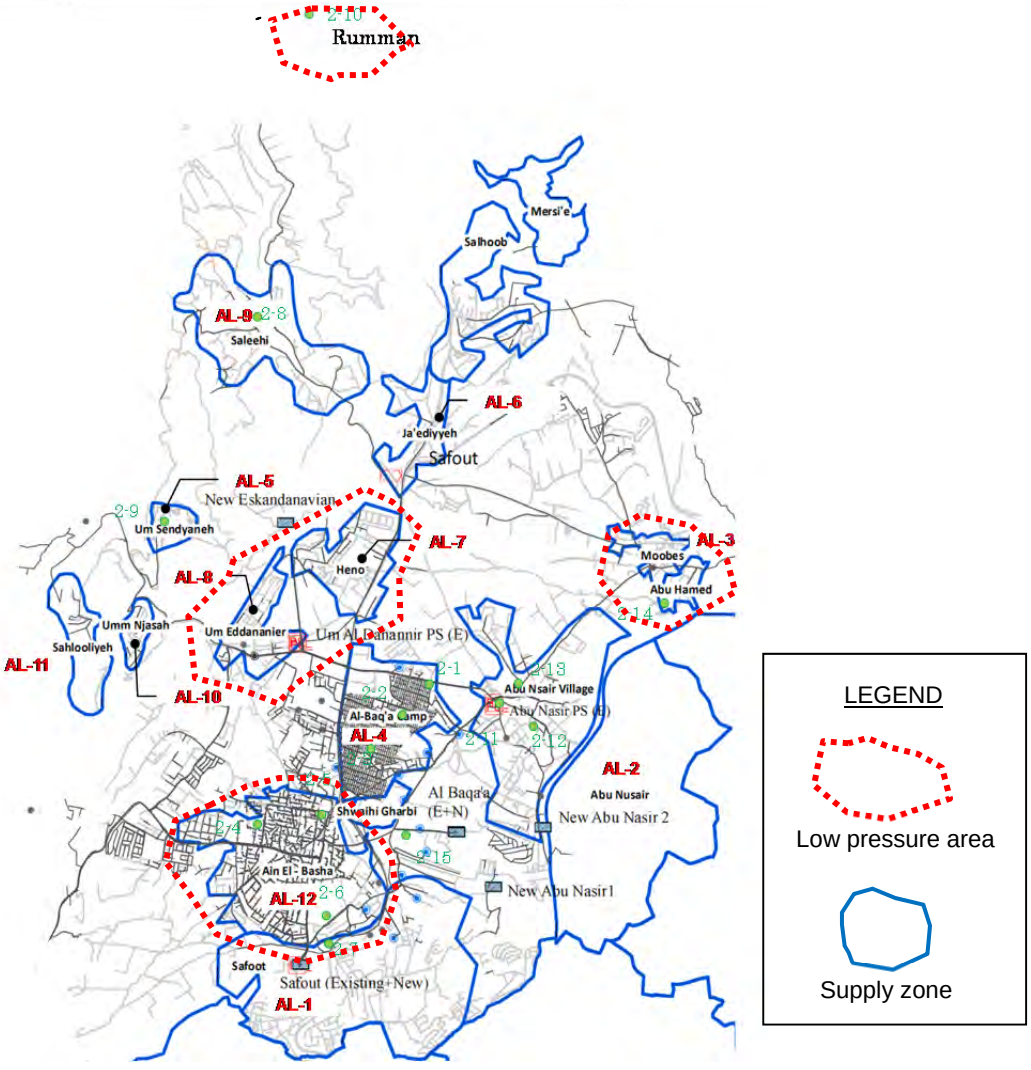
Figure 13:

6.9 Water Pressure Survey Result

(1) Ain Al Basha

Table 1: Low Pressure Area (Ain Al Basha)

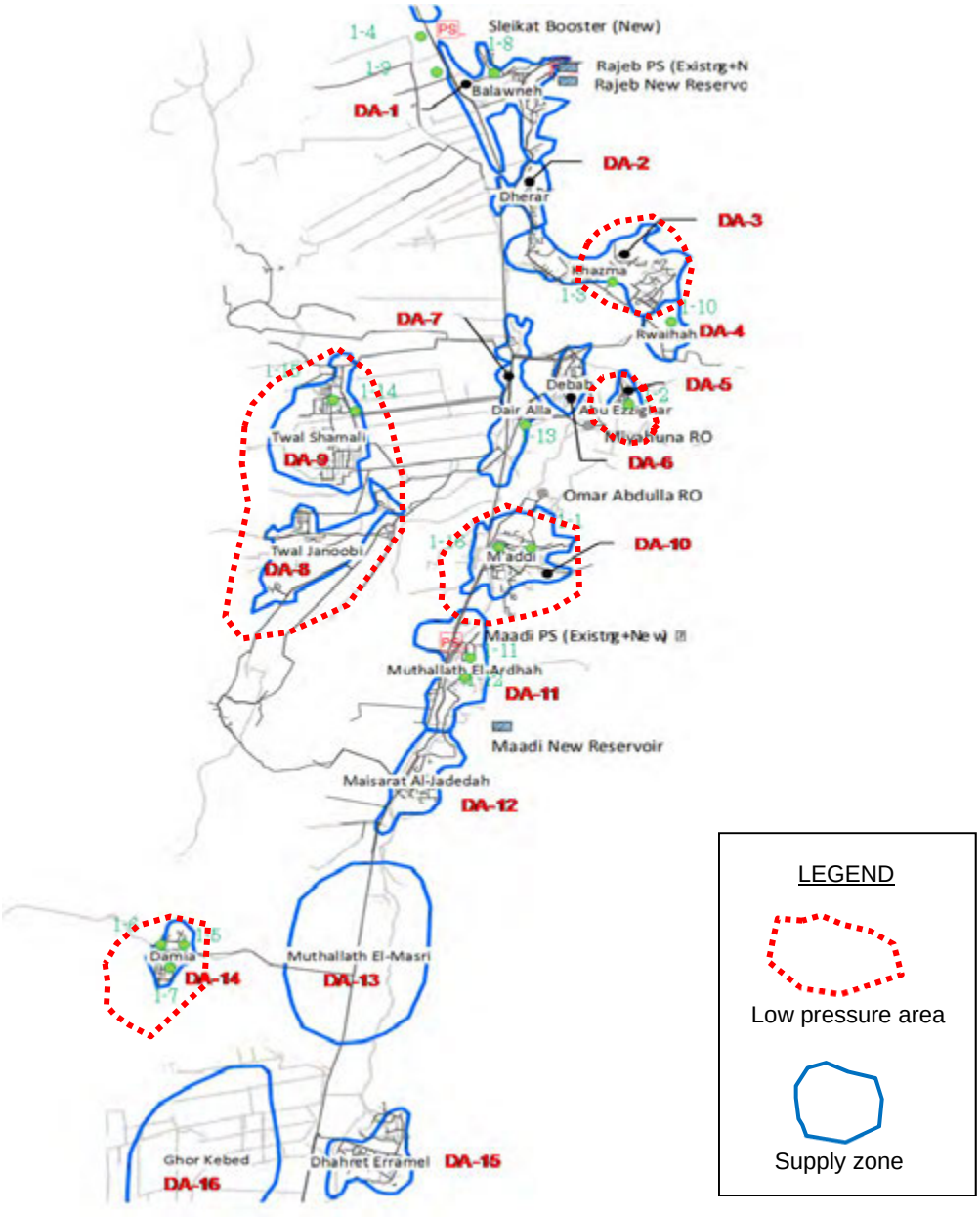
Location	NO	Elevation	Pressure (bar)	Status
Baqqa Camp	2-1	EL+712m	3.5	
	2-2	EL+719m	2.0 – 5.5	
	2-3	EL+707m	2.0	
Ain Al Basha	2-4	EL+700m	1.0	Low pressure
	2-5	EL+730m	0.1	
Safout	2-6	EL+758m	5.2	
	2-7	EL+795m	6.6	
Saleehi	2-8	EL+562m	1.2	
Um Sendyaneh	2-9	EL+613m	8.0	
Rumman	2-10	EL+624m	0.1	Low pressure
Abu Nussair	2-11	EL+777m	3.2	
	2-12	EL+810m	0.1	
	2-13	EL+775m	8.0	
Abu Hamed	2-14	EL+852m	0.1	Low pressure
Al Baqqa	2-15	EL+732m	2.5	



(2) Deir Alla

Table 2: Low Pressure Area (Deir Alla)

Location	No.	Elevation	Pressure (bar)	Status
Maadi	1-1		0.3	Low pressure
	1-16		0.8	
Abu Ezzighan	1-2		1.1	Low pressure
Khazma	1-3		0.7	Low pressure
Sleikat	1-4	EL-155m	1.5	
Damia	1-5		0.2	Low pressure
	1-6		0.1	
	1-7		0.1	
Balawneh	1-8	EL-134m	0.9	
	1-9	EL -159m	2.3	
Rwaihah	1-10	EL -123m	5.0	
Muthallath El-Ardhah	1-11	EL-123m	1.8	
	1-12	EL-123m	0.9	
Deir Alla	1-13	EL-156m	3.0	
Twal Shamali	1-14		0.2	Low pressure
	1-15		0.1	



6.10 Result of Discussion on Pipe Installation Method with at Sites

Open cut method for pipe installation is allowed along the main roads according to the recent presidential order. Therefore, the trenchless method shall be applied when pipeline is installed in the main road. The exception is only when trenchless equipment cannot be accommodated in the limited space at site. The expecting routs of proposed pipeline were surveyed together with staff in MPWH and the survey results are given in the following figures.

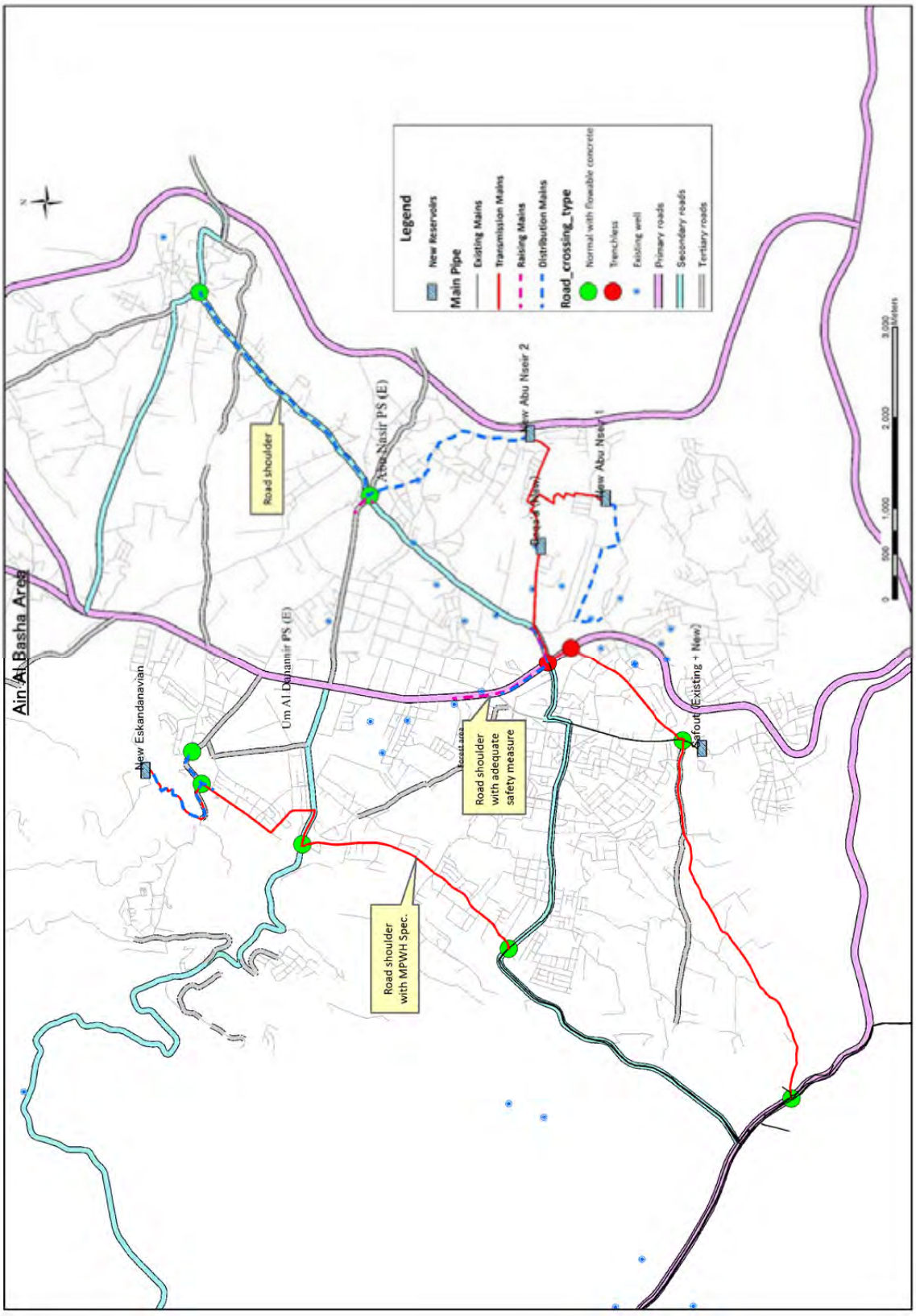


Figure 1: Road occupancy and Road crossing of transmission and distribution pipelines in Ain Al Basha

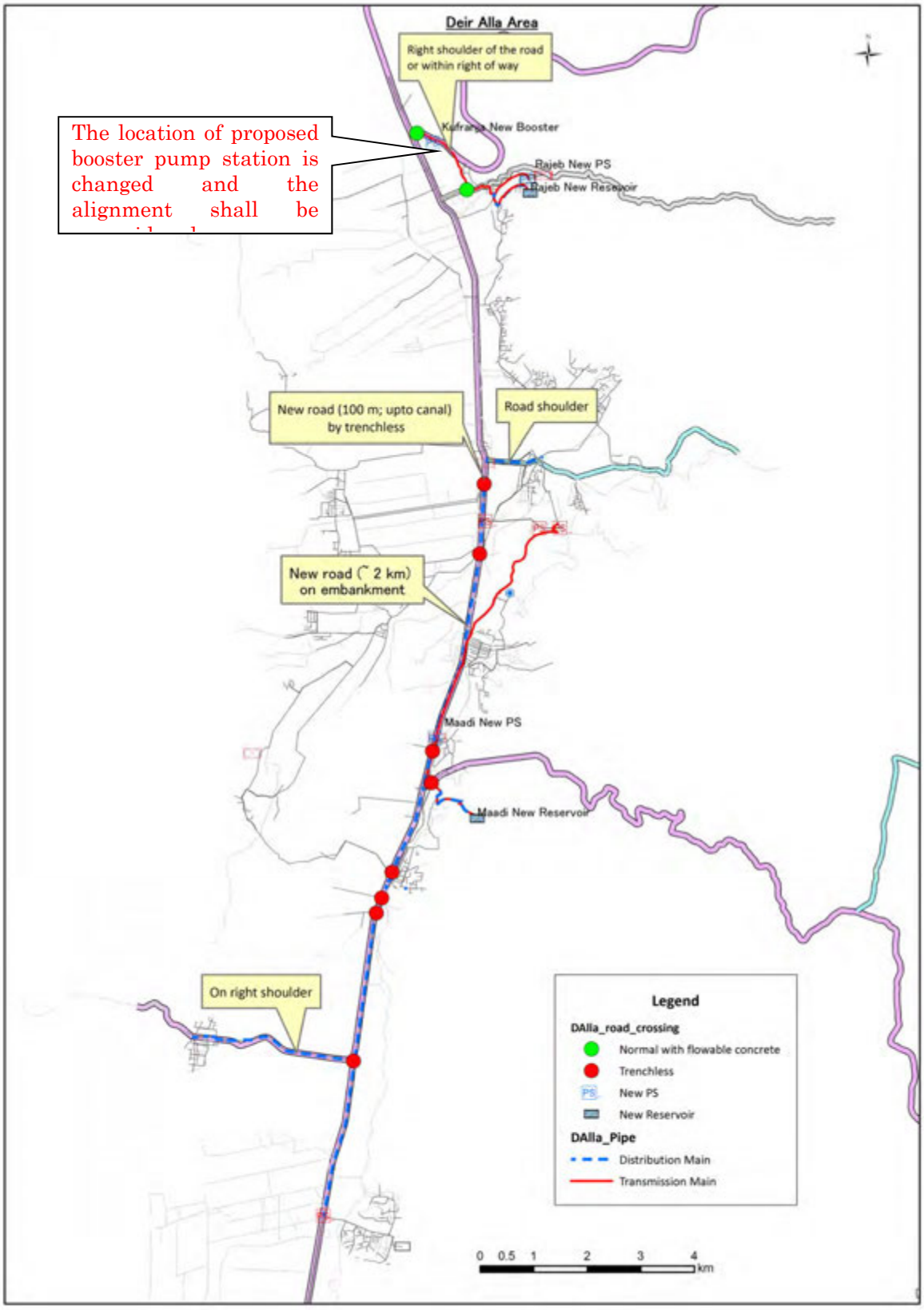


Figure 2: Road occupancy and Road crossing of transmission and distribution pipelines in Deir Alla

6.11 Elevation Profile of DMA and Hydraulic Characteristic of PRV and Dynamic Water Pressure of Proposed Pipeline

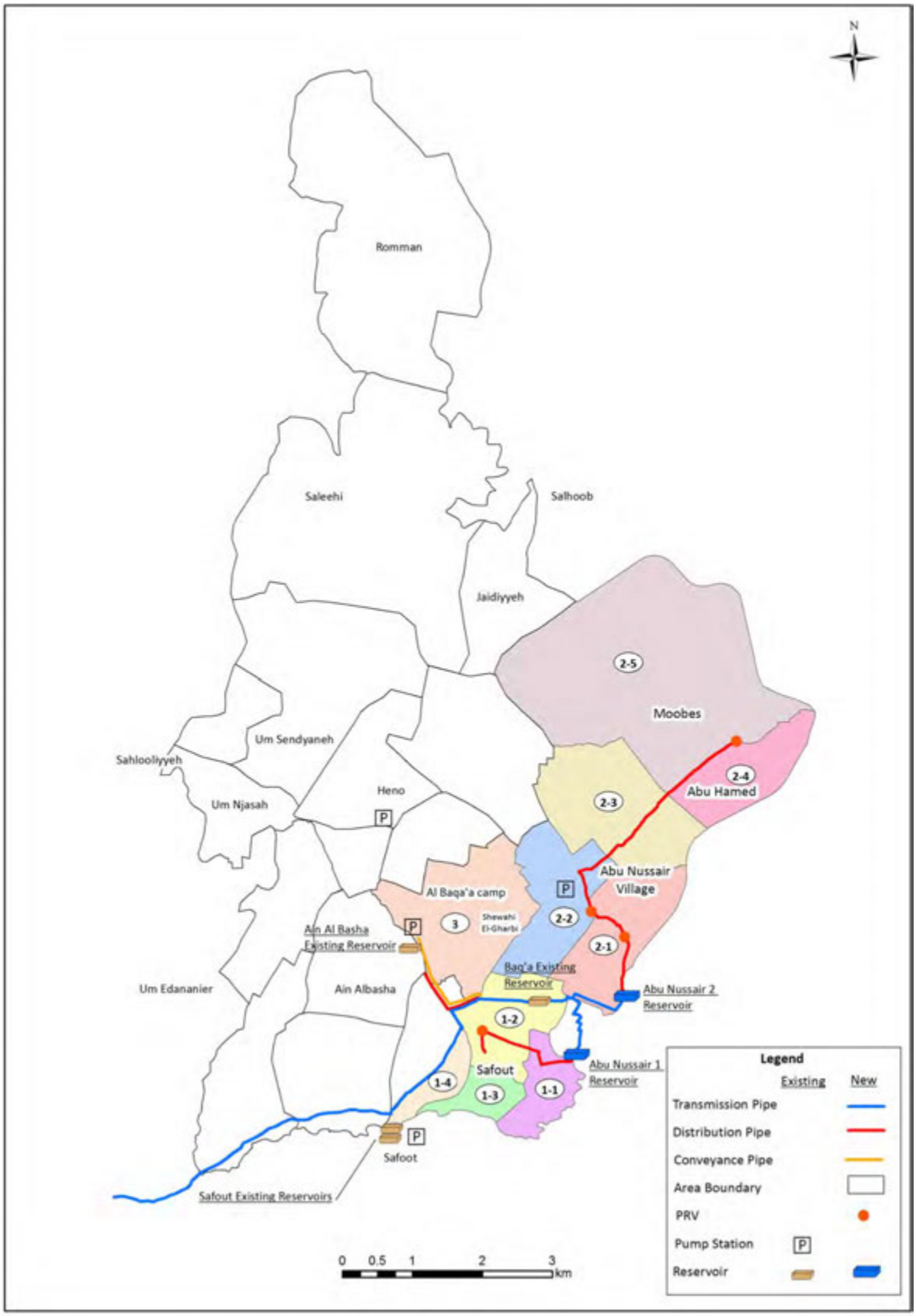
(1) Elevation Profile of DMA and Hydraulic Characteristic of PRV

1) Ain Al Basha

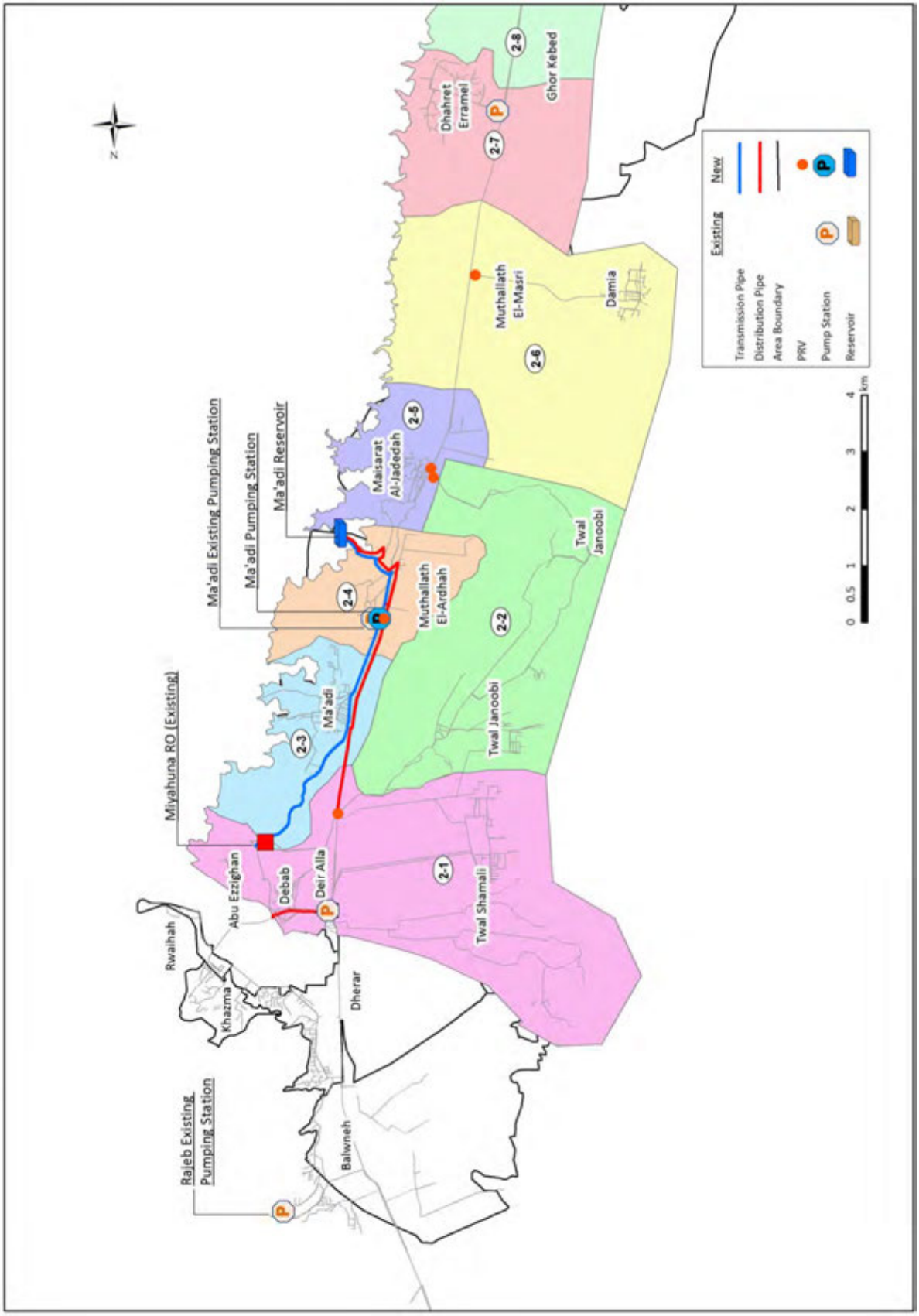
	Sub-zone	Locality Name	Elevation of Residential Area		PRV			Remarks
			High (m)	Low (m)	Elevation of PRV Location (m)	Dynamic Pressure at U/S (m)	Dynamic Pressure at D/S (m)	
Abu Nussair 1	1-1	Safout Part	840	760				Area before PRV
	1-2	Safout Part	760	680	696	165	120	
	1-3	Safout Part	815	730				The above PRV applies
	1-4	Safout Part	730	700				The above PRV applies
Abu Nussair 2	2-1	Abu NussairVillage Part	900	730	843	78	20	
	2-2	Abu NussairVillage Part	770	670	756	162	40	
	2-3	Abu NussairVillage Part	730	630	756	162	40	PRV same as of 2-2
	2-4	Abu Hamed*	830	690				
	2-5	Mobes	730	590	715	192	30	
Al Baqa'a	3	Al Baqa'a camp and Shewahi El-Gharbi	700	640				
Note:	*2-4 Abu Hamed can be divided into two parts as follows:							
		Abu Hamed Part	760	690	756	162	40	Same as of 2-2
		Abu Hamed Part	830	760				No PRV

2) Deir Alla

	Sub-zone	Locality Name	Elevation of Residential Area		PRV			Remarks
			High (m)	Low (m)	Elevation of PRV Location (m)	Dynamic Pressure at U/S (m)	Dynamic Pressure at D/S (m)	
Ma'adi	2-1	Twal Shamali	-240	-330	-213	61	25	
		Deir Alla	-220	-250				No PRV
		Debab	-200	-225				No PRV
		Abu Ezzighan	-180	-230				No PRV
	2-2	Twal Janoobi	-250	-300	-240	125	30	
			-240	-330	-226	81	40	PRVs not in series, from another side
	2-3	Ma'adi	-160	-240	-249	135	110	PRV same as of Muthalath El-Ardhah
	2-4	Muthalath El-Ardhah	-150	-260	-249	135	110	PRV same as of Ma'adi
	2-5	Maisarat Al-Jadedah	-190	-260	-238	116	80	
	2-6	Muthalath El-Masri	-250	-270				No PRV
		Damiya	-270	-290	-240	125	30	
	2-7	Dhahret Erramel	-160	-280				No PRV
	2-8	Ghor Kebed	-240	-290				No PRV


N
Romman
Saleehi
Salhoob
Jaidiyyeh
2-5
Moobes
Um Sendyaneh
Sahlooliyyeh
Heno
Um Njasah
2-4
Abu Hamed
2-3
Abu Nussair
Village
Al Baqa'a camp
3
Shawahi El-Gharbi
2-2
2-1
Ain Al Basha
Existing Reservoir
Baq'a Existing
Reservoir
Abu Nussair 2
Reservoir
Um Edananier
Ain Albasha
1-2
Abu Nussair 1
Reservoir
Safout
1-4
1-3
1-1
Safoot
Safout Existing Reservoirs
0 0.5 1 2 3
km
Legend
Existing
New
Transmission Pipe
Distribution Pipe
Conveyance Pipe
Area Boundary
PRV
Pump Station
Reservoir

Ain Al Basha


N
New
Existing
Transmission Pipe
Distribution Pipe
Area Boundary
PRV
Pump Station
Reservoir
0 0.5 1 2 3 4 km
Miyahuna RO (Existing)
Ma'adi Existing Pumping Station
Ma'adi Pumping Station
Ma'adi Reservoir
Rajeb Existing Pumping Station
Ma'adi
Debab
Deir Alla
Abu Ezzighan
Rwaihah
Khazma
Dherar
Balwneh
Twal Shamali
Twal Janoobi
Muthallath El-Ardhah
Maisarat Al-Jadedah
Muthallath El-Masri
Damia
Dhahret Errameil
Ghor Kebed
2-1
2-2
2-3
2-4
2-5
2-6
2-7
2-8

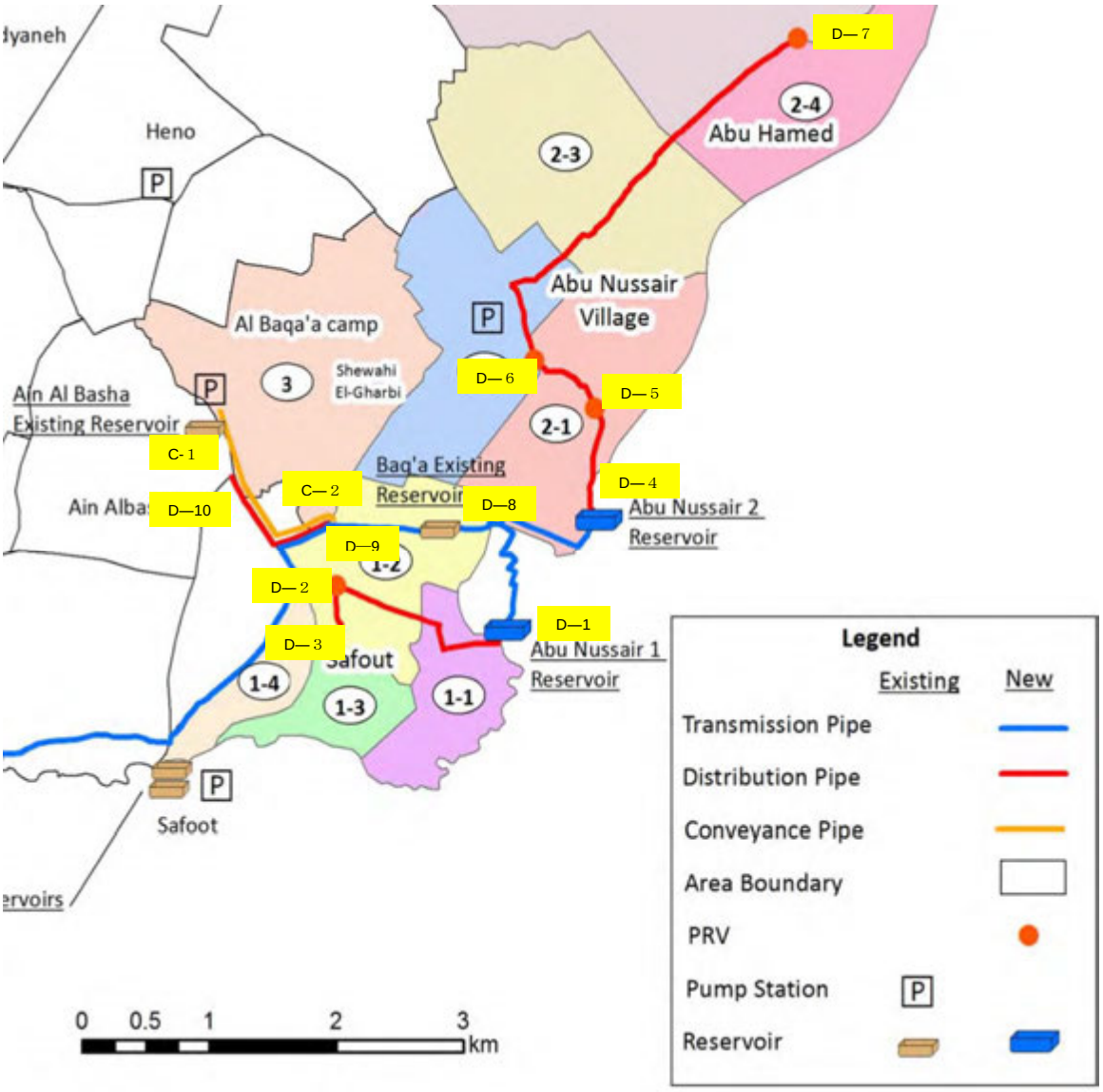
Deir Alla

(2) Dynamic Water Pressure of Proposed Pipeline (Distribution and Conveyance Pipe)

1) Ain Al Basha

(unit: m)

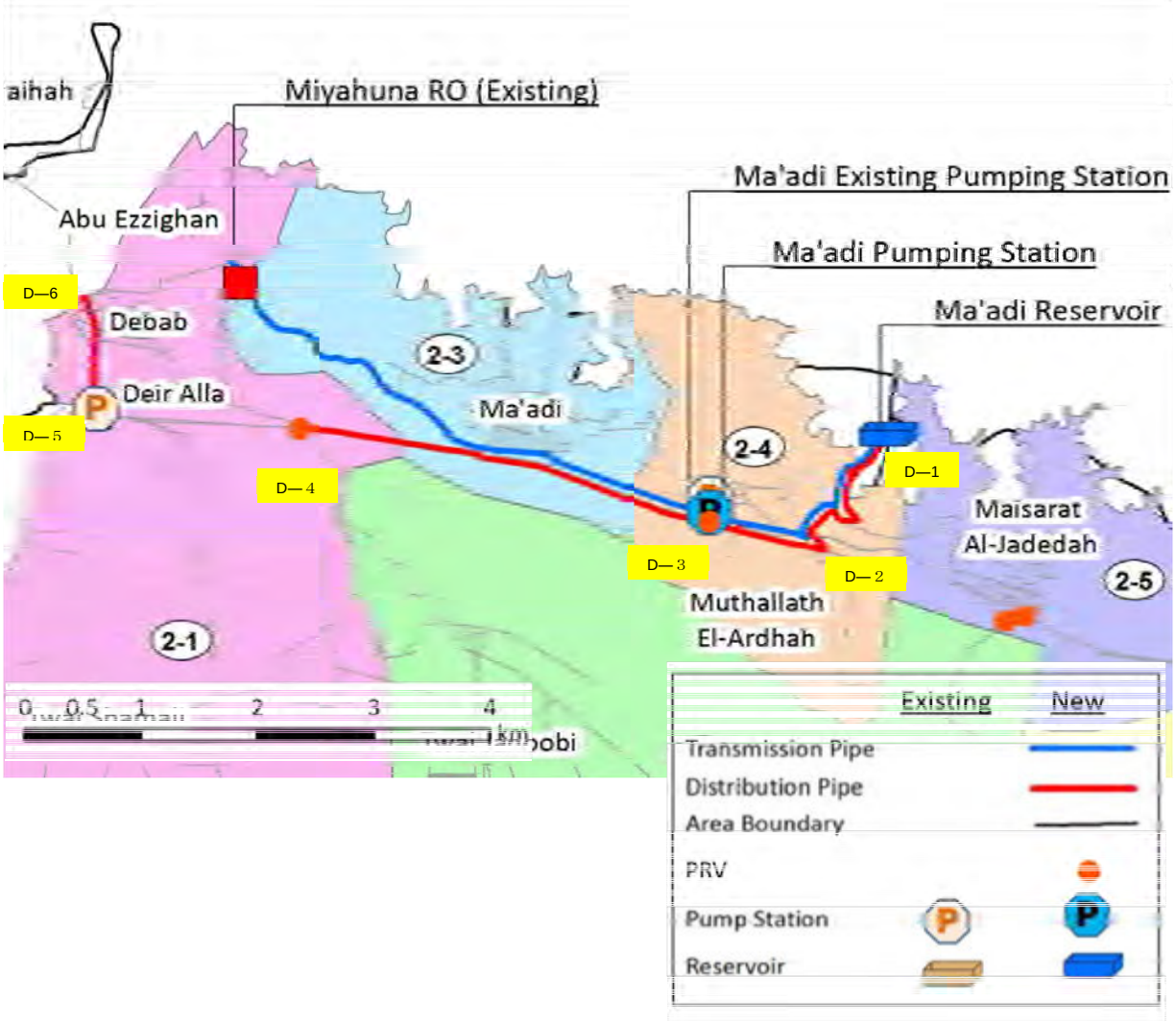
Node No.	Elevation	Total Head	Dynamic Water Pressure	Pressure after PRV	Remarks
D-1	867	-	-	-	Abu Nussair 1 reservoir
D-2	696	858	162	120	
D-3	711	804	93	-	
D-4	926	-	-	-	Abu Nussair 2 reservoir
D-5	842	919	77	20	
D-6	756	917	161	40	
D-7	715	905	190	30	
D-8	743	-	-	-	Al Baqa'a reservoir
D-9	680	738	58	-	
D-10	660	727	67	-	
C-1	641	791	150	-	Ain Al Bash Directorate Office P/S
C-2	680	790	110	-	


Heno
Al Baqa'a camp
Shewahi
El-Gharbi
3
Ain Al Basha
Existing Reservoir
Ain Alba
Baq'a Existing
Reservoir
Abu Nussair
Village
2-3
2-4
Abu Hamed
2-1
Abu Nussair 2
Reservoir
Abu Nussair 1
Reservoir
1-2
1-4
1-3
1-1
Safoot
D— 7
D— 6
D— 5
D— 4
D—8
C— 2
C- 1
D—10
D—9
D— 2
D— 3
D—1
0 0.5 1 2 3
km
Legend
Existing
New
Transmission Pipe
Distribution Pipe
Conveyance Pipe
Area Boundary
PRV
Pump Station
Reservoir

2) Deir Alla

(unit: m)

Node No.	Elevation	Total Head	Dynamic Water Pressure	Pressure after PRV	Remarks
D-1	-91	-	-	-	Ma'adi reservoir
D-2	-241	-105	136	-	
D-3	-250	-116	134	110	
D-4	-227	-145	81	40	
D-5	-224	-78	146	-	
D-6	-205	-92	113	-	



6.12 Result of Geotechnical Survey

Report No.: 79/S/05/2013

Date: 02/06/2013

Geotechnical Investigation for the Proposed Site at Ain Al Basha District

IMPROVEMENT AND EXPANSION OF THE WATER DISTIBUTION NETWORK IN BALQA

AIN AL BASHA DISTRICT

Submitted to

JICA STUDY TEAM / TEC INTERNATIONAL CO., LTD.(TECI)

Amman – Jordan

1- INTRODUCTION

The following report summarizes the results of the in situ investigation and lab tests conducted at the request of our client for his projected site for the purpose of determining the geotechnical parameters and soil conditions needed for guiding the designer of a safe and economic design.

The investigation consisted of the following sequence stage:

- Obtaining and studying the available maps and information concerning the site and the proposed project.
- Reconnaissance stage which include site visit, survey the geotechnical & geological features (rock out crops existing , present facilities used in the site).
- Bore holes drilling as fixed by our client .
- Making test pits that fixed by our client .
- Collecting undisturbed and disturbed samples from different bore holes and at different depths.
- Conducting the required tests on representative samples
- Analyses and evaluation of field & lab tests results

Conclusions & recommendations for the design

2- PROJECT CHARACTERISTICS AND DESCRIPTION

The Project is Improvement and expansion of the water distribution network in Balqa /Ain Al Basha District .As a general the project is composed of water pipe lines and water tanks.

3- GEOLOGY OF THE SITE

3-1- Lithology

As we have mentioned before boreholes and test pits were executed in the site at the locations fixed on the attached site plan .lithology and detailed lithological description of the obtained samples were shown on the attached boreholes s and test pits log sheets , within appendix no.1 .

We wish to emphasize that the results obtained from the boreholes are only representing the boreholes . These results are only representing the lithology at the depths indicated on the attached log sheets.

3-2Ground Water and Cavities

Neither ground water nor cavities were encountered under the drilled bore holes and test pits .

4- FIELD EXPLORATION

4-1 Drilling Boreholes :

Three boreholes were drilled at the site, at the locations shown on the site map enclosed within appendix .They were numbered as BH1 thru BH3 inclusive. The depths and elevations of the drilling were fixed on the attached log sheets within appendix no.1 and as follows in table 1.

Table 1: Boreholes Depths and Elevations

Borehole No.	Borehole Depth (m)
BH1	15
BH2	15
BH3	15

*Number, location and depths of the drilled boreholes were fixed by our client and consultant.

The drilling were carried out with Atlas Copco Rotary drilling rig. The advance of the drilling operation was carried out through rotary air flush drilling method.

4-2Making Test Pits:

Fifteen test pits were drilled at the site, at the locations shown on the site map enclosed within appendix .They were numbered as TP1 thru TP15 inclusive. The depths for each test pit is 1.5m and the lithology of the digged test pits were fixed on the attached log sheets within appendix no.1

*Number, location and depths of the digged Test Pits were fixed by our client and consultant.

4-3 Sampling

Depending on type of material encountered during drilling operation undisturbed & disturbed samples were obtained .

All obtained samples are visual inspected and classified in the site by our geologist and then they were marked , placed in proper way in water –proof plastic bags and placed in wooden boxes to transport them to our lab for conducting the requested tests.

5- FIELD TESTS:

Depending on the type of encountered material standard penetration test (SPT) and according to ASTM:D 1586 were conducted at different boreholes and different depths .Results of these tests are shown on table No.2

Table 2: Standard Penetration Test

Boreholes No.	Depth (m)	Test Type	Penetration (cm)		Number of Blows(N)		Material
BH1	1.0	SPT	15		6		Silty Clay
			15	**30cm**	7	**13**	
			15		6		
	2.0	SPT	15		6		
			15	**30cm**	6	**14**	
			15		8		
	3.0	SPT	15		8		
			15	**30cm**	9	**19**	
			15		10		
	4.0	SPT	15		8		
			15	**30cm**	8	**16**	
			15		8		

Boreholes No.	Depth (m)	Test Type	Penetration (cm)			Number of Blows(N)			Material
BH1	5.0	SPT	15			10			Silty Clay
			15	**30cm**		9	**19**		
			15			10			
	6.0	SPT	15			9			
			15	**30cm**		12	**22**		
			15			10			
	7.0	SPT	15			8			
			15	**30cm**		7	**15**		
			15			8			
	8.0	SPT	15			10			
			15	**30cm**		11	23		
			15			12			
	9.0	SPT	15			9			
			15	**30cm**		10	**21**		
			15			11			
BH2	1.0	SPT	15			6			Silty Clay
			15	**30cm**		7	**15**		
			15			8			
	2.0	SPT	15			8			
			15	**30cm**		10	**20**		
			15			10			
	3.0	SPT	15			9			
			15	**30cm**		11	21		
			15			10			

6-LABORATORY TESTS

Depending on the type of the encountered materials during digged test pits , following lab tests were conducted on the representative samples: (see table 3)

Table 3: Summary of Lab Tests Carried on Obtained Samples

Test No.	Test Type		Method of Testing
1.	Moisture Content Determination		ASTM: C566-97
2.	Seive Analysis of Aggregates		ASTM:C 136-93
3.	Dry and Bulk Densities		ASTM: D854
4.	Atterberg Limits		ASTM:D4318-10
5.	Determination of Specific Gravity		ASTM: C127 & C128
6.	Chemical Tests	Sulfate Content	BS: 1377-75
		Chloride Content	
7.	Unconfined compressive strength of Rock Cores		ASTM: D2938-86

The lab test Results attached in Appendix II.

Summary of the lab test Results shown in the following table , (table no.4)

Table(4) : Summary of Lab Test Results

Test Pit No.	Material	Depth (m)	M.C	Bulk & Dry Density		Atterberg Limits			Seive analysis					Specific Gravity	ASHTOO CLASS.
				γ_b	γ_d	LL	PL	PI	Cobbles	gravels	Sand	Silt	Clay		
T.P.1	Artificial fill material	**0.0-0.3**	--	--	--	--	--	--	--	--	--	--	--	--	--
	fill material	**0.3-1.0**	--	--	--	--	--	--	--	--	--	--	--	--	--
	Silty clay	1.0-1.5	6.3	1.72	1.62	47	23	24	0	5	12	28	55	2.16	A7
T.P.2	fill material	0.0-0.7	--	--	--	--	--	--	--	--	--	--	--	--	--
	limestone	0.7-0.9	2.1	2.32	2.27	--	--	--	--	--	--	--	--	2.57	--
T.P.3	Silty clay	0.0-0.2	5.8	1.76	1.66	39	20	19	0	9	15	24	52	2.17	A6
	Sand	0.2-1.5	2.3	1.87	1.83	Non PI			0	0	90	5	5	2.13	A3
T.P.4	Silty clay	0.0-0.8	7.3	1.80	1.68	43	23	20	0	12	14	23	51	2.18	A7
	limestone	0.8-1.0	1.1	2.27	2.25	--	--	--	--	--	--	--	--	2.33	--
T.P.5	Silty clay	0.0-0.3	5.4	1.72	1.63	39	21	17	0	10	17	25	48	2.15	A6
	Marly Limestone	0.3-0.4	1.7	2.33	2.29	--	--	--	--	--	--	--	--	2.54	--
T.P.6	Sandy Clayey Silt	0.0-0.7	3.8	1.68	1.62	30	18	12	4	6	16	43	31	2.26	A6
	Sand	0.7-1.5	2.5	1.64	1.6	Non PI			0	5	86	3	6	2.2	A3
T.P.7	Silty clay	0.0-0.7	6.3	1.74	1.64	35	16	19	0	16	8	20	56	2.19	A6
	limestone	0.7-1.5	1.2	2.34	2.31	--	--	--	--	--	--	--	--	2.51	--
T.P.8	fill material	0.0-0.3	--	--	--	--	--	--	--	--	--	--	--	--	--
	Silty clay	0.3-1.5	5.0	1.73	1.65	39	18	21	0	8	14	28	50	2.23	A6
T.P.9	fill material	0.0-0.6	--	--	--	--	--	--	--	--	--	--	--	--	--
	fill material	0.6-1.30	--	--	--	--	--	--	--	--	--	--	--	--	--
	Silty clay	1.3-1.5	4.8	1.77	1.69	41	18	23	0	5	10	25	60	2.21	A7
T.P.10	fill material	0.0-0.3	--	--	--	--	--	--	--	--	--	--	--	--	--
	Silty clay	0.3-0.7	5.4	1.75	1.66	44	18	26	0	6	9	21	64	2.11	A7
	Marly Limestone	0.7-1.5	**1.5**	2.34	**2.3**	--	--	--	--	--	--	--	--		--

Test Pit No.	Material	Depth (m)	M.C	Bulk & Dry Density		Atterberg Limits			Seive analysis					Specific Gravity	ASHTOO CLASS.
				γ_b	γ_d	LL	PL	PI	Cobbles	gravels	Sand	Silt	Clay		
T.P.11	fill material	0.0-0.3	--	--	--	--	--	--	--	--	--	--	--	--	--
	Silty clay	0.3-1.1	4.8	1.76	1.68	47	22	25	0	4	13	25	58	2.13	A7
	Clayey Marl	1.1-1.5	4.1	1.95	1.87	--	--	--	--	--	--	--	--	2.35	--
T.P.12	fill material	0.0-0.2	--	--	--	--	--	--	--	--	--	--	--	--	--
	Silty clay	0.2-0.5	4.7	1.77	1.69	43	23	20	0	16	11	22	51	2.11	A7
	Chalky Limestone	0.5-0.7	**2.2**	1.97	**1.9**	--	--	--	--	--	--	--	--	--	--
T.P.13	fill material	0.0-0.15	--	--	--	--	--	--	--	--	--	--	--	--	--
	Silty clay	0.15-0.5	6.5	1.76	1.65	33	18	15	0	14	9	28	49	2.17	A6
	fill material	0.5-1.5	--	--	--	--	--	--	--	--	--	--	--	--	--
T.P.14	fill material	0.0-1.5	--	--	--	--	--	--	--	--	--	--	--	--	--
T.P.15	fill material	0.0-0.5	--	--	--	--	--	--	--	--	--	--	--	--	--
	fill material	0.5-0.9	--	--	--	--	--	--	--	--	--	--	--	--	--
	fill material	0.9-1.3	--	--	--	--	--	--	--	--	--	--	--	--	--
	Silty clay	1.3-1.5	4.7	1.75	1.67	40	21	19	0	9	11	23	57	2.14	A6
BH1	Silty clay	0.0-1.0	3.4	1.71	1.65	38.0	18.0	20.0	0.0	7.0	13.0	27.0	53.0	2.16	A6

7- SIESMIC ACTIVITY

As far as seismic activities are concerned the investigated site lies within zone"2B"as noticed in the Jordanian Seismic Activities map.(see figure1).The following seismic parameters can be used in designing the proposed project:

Table 5 : Seismic Factors for the Proposed Site

Seismic Zone	2B	
Seismic Zone Factor (Z)	0.20	
Seismic Soil Type	Silty Clay	Marl Interbedded with Marly Limestone
Seismic Soil Section Name	S_D	Sc
Seismic Factor Related to Acceleration (Ca)	0.28	0.24
Seismic Factor Related to speed (Cv)	0.40	0.32

If the external walls of the proposed building are bearing walls the effect of the earthquake is practically nil taking into account all considerations mentioned in the JORDANIAN BUILDING CODE table (2-6).

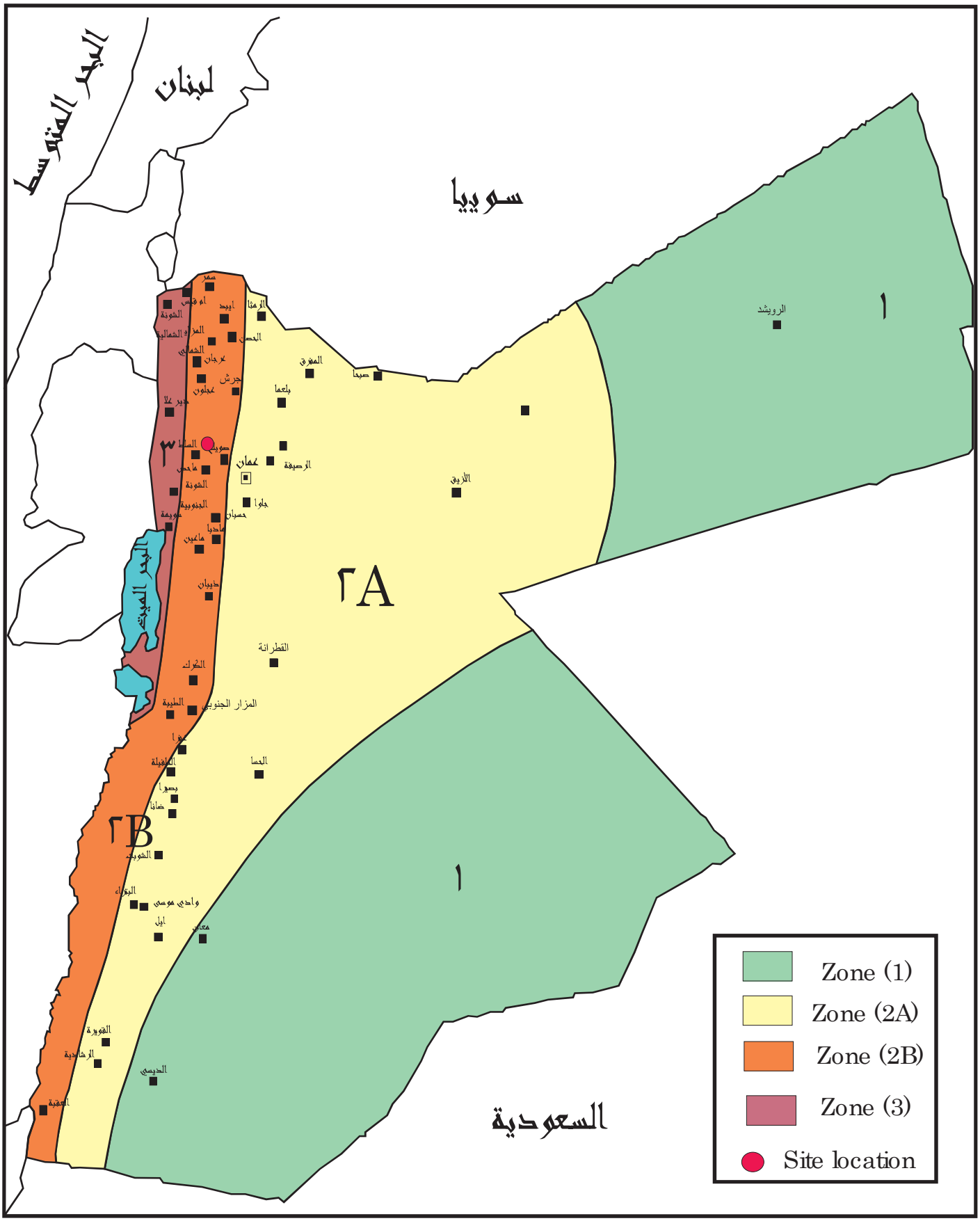
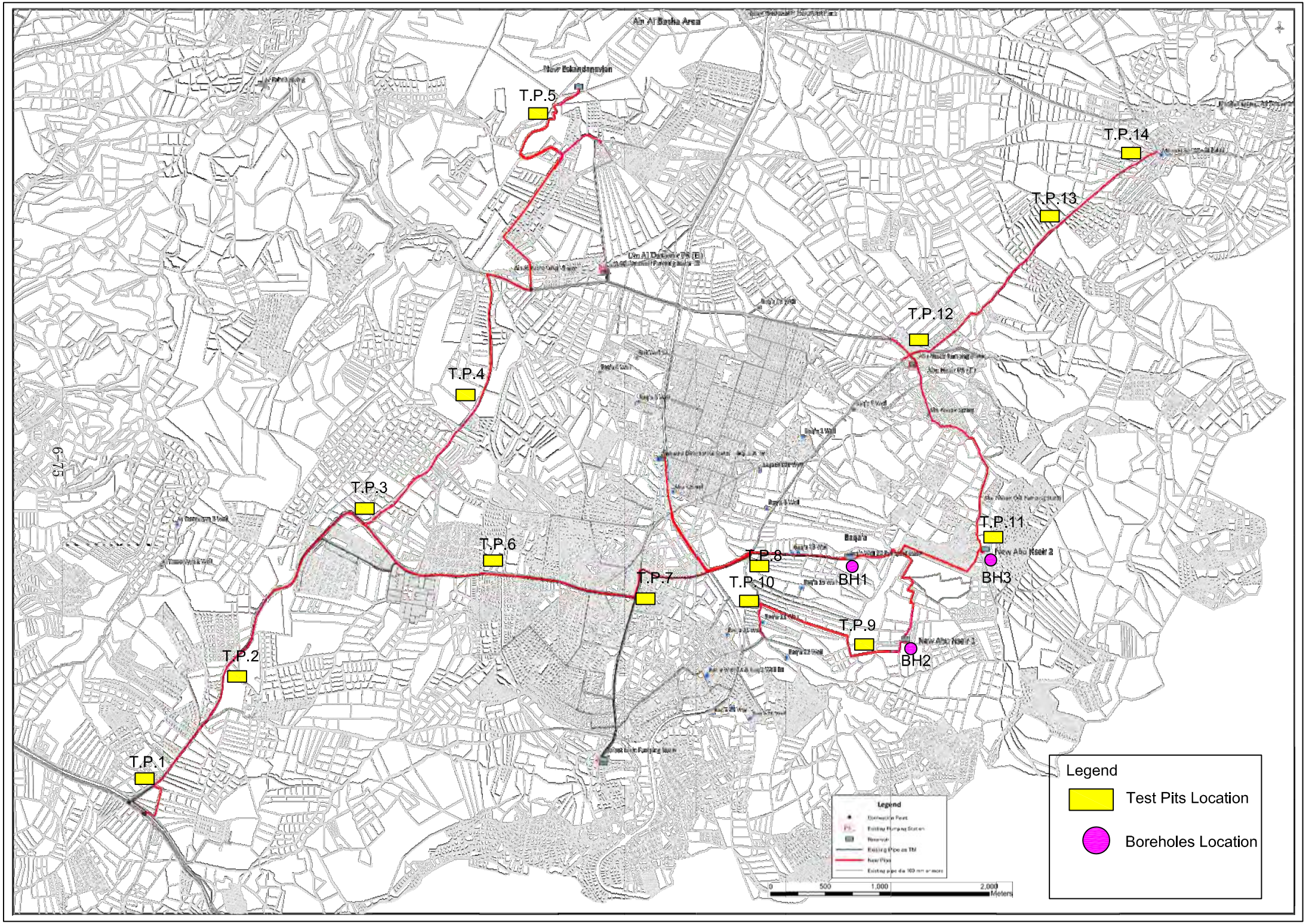


Figure No. (1) : Jordan Seismic Map


T.P.1
T.P.2
T.P.3
T.P.4
T.P.5
T.P.6
T.P.7
T.P.8
T.P.9
T.P.10
T.P.11
T.P.12
T.P.13
T.P.14
BH1
BH2
BH3
Legend
Test Pits Location
Boreholes Location
0
500
1,000
2,000
Meters

Report No.: 90/S/06/2013

Date: 18/06/2013

Geotechnical Investigation for the Proposed Site at Safoot District

IMPROVEMENT AND EXPANSION OF THE WATER DISTIBUTION NETWORK IN BALQA / SAFOOT DISTRICT

Submitted to

JICA STUDY TEAM / TEC INTERNATIONAL CO., LTD.(TECI)

Amman – Jordan

1- INTRODUCTION

The following report summarizes the results of the in situ investigation and lab tests conducted at the request of our client for his projected site for the purpose of determining the geotechnical parameters and soil conditions needed for guiding the designer of a safe and economic design.

The investigation consisted of the following sequence stage:

- Obtaining and studying the available maps and information concerning the site and the proposed project.
- Reconnaissance stage which include site visit, survey the geotechnical & geological features (rock out crops existing , present facilities used in the site).
- Bore holes drilling as fixed by our client .
- Making test pits that fixed by our client .
- Collecting undisturbed and disturbed samples from different bore holes and at different depths.
- Conducting the required tests on representative samples
- Analyses and evaluation of field & lab tests results

Conclusions & recommendations for the design

2- PROJECT CHARACTERISTICS AND DESCRIPTION

The Project is Improvement and expansion of the water distribution network in Balqa /Safoot District .As a general the project is composed of water pipe lines and water tanks.

3- GEOLOGY OF THE SITE

3-1- Lithology

As we have mentioned before boreholes and test pits were executed in the site at the locations fixed on the attached site plan .lithology and detailed lithological description of the obtained samples were shown on the attached boreholes s and test pits log sheets , within appendix no.1 .

We wish to emphasize that the results obtained from the boreholes are only representing the boreholes . These results are only representing the lithology at the depths indicated on the attached log sheets.

3-2Ground Water and Cavities

Neither ground water nor cavities were encountered under the drilled bore holes and test pits .

4- FIELD EXPLORATION

4-1 Drilling Boreholes :

One borehole was drilled at the site, at the location shown on the site map enclosed within appendix .It was numbered as BH1. The depth of the drilling was fixed on the attached log sheets within appendix no.1 and as follows in table 1.

Table 1: Boreholes Depths and Elevations

Borehole No.	Borehole Depth (m)
BH1	15

*Number, location and depths of the drilled borehole was fixed by our client and consultant.

The drilling were carried out with Atlas Copco Rotary drilling rig. The advance of the drilling operation was carried out through rotary air flush drilling method.

4-2Making Test Pits:

Three test pits were drilled at the site, at the locations shown on the site map enclosed within appendix .They were numbered as TP1 thru TP3 inclusive. The depths for each test pit are fixed in the following table (no.2) and the lithology of the digged test pits were fixed on the attached log sheets within appendix no.1

Test Pit No.	Test Pits Depth (m)
TP1	1.5
TP2	0.5
TP3	1.5

*Number, location and depths of the digged Test Pits were fixed by our client and consultant.

4-3 Sampling

Depending on type of material encountered during drilling operation undisturbed & disturbed samples were obtained .

All obtained samples are visual inspected and classified in the site by our geologist and then they were marked , placed in proper way in water –proof plastic bags and placed in wooden boxes to transport them to our lab for conducting the requested tests.

5- FIELD TESTS:

Depending on the type of encountered material standard penetration test (SPT) and according to ASTM:D 1586 were conducted at different boreholes and different depths .Results of these tests are shown on table No.3

Table 3: Standard Penetration Test

Boreholes No.	Depth (m)	Test Type	Penetration (cm)	Number of Blows(N)	Material
BH1	1.0	SPT	15	6	Silty Clay
			15 **30cm** 15	6 **14** 8	
	2.0	SPT	15	5	
			15 **30cm** 15	7 16 9	
	3.0	SPT	15	7	
			15 **30cm** 15	8 **15** 7	

- **For the rock strata "Marly Limestone " The estimated SPT "N " Value will be 100 .**

6-LABORATORY TESTS

Depending on the type of the encountered materials during digged test pits , following lab tests were conducted on the representative samples: (see table 4)

Table 4: Summary of Lab Tests Carried on Obtained Samples

Test No.	Test Type	Method of Testing
1.	Moisture Content Determination	ASTM: C566-97
2.	Seive Analysis of Aggregates	ASTM:C 136-93
3.	Dry and Bulk Densities	ASTM: D854
4.	Atterberg Limits	ASTM:D4318-10
5.	Determination of Specific Gravity	ASTM: C127 & C128
6.	Unconfined compressive strength of Rock Cores	ASTM: D2938-86

The lab test Results attached in Appendix II.

Summary of the lab test Results shown in the following table , (table no.5)

7- SIESMIC ACTIVITY

As far as seismic activities are concerned the investigated site lies within zone"2B"as noticed in the Jordanian Seismic Activities map.(see figure1).The following seismic parameters can be used in designing the proposed project:

Table 5 : Seismic Factors for the Proposed Site

Seismic Zone	2B
Seismic Zone Factor (Z)	0.20
Seismic Soil Type	Marly Limestone
Seismic Soil Section Name	S_B
Seismic Factor Related to Acceleration (Ca)	0.20
Seismic Factor Related to speed (Cv)	0.20

Report No.: 70/S/05/2013

Date: 02/06/2013

Geotechnical Investigation for the Proposed Site at Deir Alla District

IMPROVEMENT AND EXPANSION OF THE WATER DISTIBUTION NETWORK IN BALQA / DEIR ALLA DISTRICT

Submitted to

JICA STUDY TEAM / TEC INTERNATIONAL CO., LTD.(TECI)

Amman – Jordan

1- INTRODUCTION

The following report summarizes the results of the in situ investigation and lab tests conducted at the request of our client for his projected site for the purpose of determining the geotechnical parameters and soil conditions needed for guiding the designer of a safe and economic design.

The investigation consisted of the following sequence stage:

- Obtaining and studying the available maps and information concerning the site and the proposed project.
- Reconnaissance stage which include site visit, survey the geotechnical & geological features (rock out crops existing , present facilities used in the site).
- Bore holes drilling as fixed by our client .
- Making test pits that fixed by our client .
- Collecting undisturbed and disturbed samples from different bore holes and at different depths.
- Conducting the required tests on representative samples
- Analyses and evaluation of field & lab tests results
- Conclusions & recommendations for the design .

2- PROJECT CHARACTERISTICS AND DESCRIPTION

The Project is Improvement and expansion of the water distribution network in Balqa /Deir Alla District .As a general the project is composed of water pipe lines and water tanks.

3- GEOLOGY OF THE SITE

3-1- Lithology

As we have mentioned before boreholes and test pits were executed in the site at the locations fixed on the attached site plan .lithology and detailed lithological description of the obtained samples were shown on the attached boreholes s and test pits log sheets , within appendix no.1 .

We wish to emphasize that the results obtained from the boreholes are only representing the boreholes . These results are only representing the lithology at the depths indicated on the attached log sheets.

3-2Ground Water and Cavities

Neither ground water nor cavities were encountered under the drilled bore holes and test pits .

4- FIELD EXPLORATION

4-1 Drilling Boreholes :

Two boreholes were drilled at the site, at the locations shown on the site map enclosed within appendix .They were numbered as BH1 thru BH2 inclusive. The depths and elevations of the drilling were fixed on the attached log sheets within appendix no.1 and as follows in table 1.

Table 1: Boreholes Depths and Elevations

Borehole No.	Borehole Depth (m)
BH1	15
BH2	15

*Number, location and depths of the drilled boreholes were fixed by our client and consultant.

The drilling were carried out with Atlas Copco Rotary drilling rig. The advance of the drilling operation was carried out through rotary air flush drilling method.

4-2Making Test Pits:

Ten test pits were drilled at the site, at the locations shown on the site map enclosed within appendix .They were numbered as TP1 thru TP10 inclusive. The depths for each test pit is 1.5m and the lithology of the digged test pits were fixed on the attached log sheets within appendix no.1

*Number, location and depths of the digged Test Pits were fixed by our client and consultant.

4-3 Sampling

Depending on type of material encountered during drilling operation undisturbed & disturbed samples were obtained .

All obtained samples are visual inspected and classified in the site by our geologist and then they were marked , placed in proper way in water –proof plastic bags and placed in wooden boxes to transport them to our lab for conducting the requested tests.

5- FIELD TESTS:

Depending on the type of encountered material standard penetration test (SPT) and according to ASTM:D 1586 were conducted at different boreholes and different depths .Results of these tests are shown on table No.2

Table 2: Standard Penetration Test

<table>
<tr><th>Boreholes No.</th><th>Depth (m)</th><th>Test Type</th><th colspan="2">Penetration (cm)</th><th colspan="2">Number of Blows(N)</th><th>Material</th></tr>
<tr><td rowspan="4">BH1</td><td rowspan="4">0.5</td><td rowspan="4">SPT</td><td colspan="2">15</td><td colspan="2">7</td><td rowspan="4">Clayey Silt</td></tr>
<tr><td>15</td><td rowspan="3">30cm</td><td>7</td><td rowspan="3">15</td></tr>
<tr><td>15</td><td>8</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td rowspan="6">BH2</td><td rowspan="4">1.0</td><td rowspan="4">SPT</td><td colspan="2">15</td><td colspan="2">13</td><td rowspan="4">Clayey Sandy Silt</td></tr>
<tr><td>15</td><td rowspan="3">30cm</td><td>15</td><td rowspan="3">34</td></tr>
<tr><td>15</td><td>19</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td rowspan="4">2.0</td><td rowspan="4">CPT</td><td colspan="2">15</td><td colspan="2">12</td><td rowspan="4">Alluvial Material</td></tr>
<tr><td>15</td><td rowspan="3">30cm</td><td>13</td><td rowspan="3">29</td></tr>
<tr><td>15</td><td>16</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
</table>

Boreholes No.	Depth (m)	Test Type	Penetration (cm)			Number of Blows(N)			Material
BH2	3.0	CPT	15			14			Alluvial Material
			15	**30cm**		14	**31**		
			15			17			
	4.0	CPT	15			13			
			15	**30cm**		14	**29**		
			15			15			
	5.0	CPT	15			15			
			15	15		15	**31**		
			15			16			
	6.0	CPT	15			12			
			15	**30cm**		11	**25**		
			15			14			
	7.0	CPT	15			12			
			15	**30cm**		12	**24**		
			15			12			
	8.0	CPT	7cm			50 blows			
			15	**30cm**					
			15						
	9.0	CPT	15			13			
			15	**30cm**		15	**32**		
			15			17			

Boreholes No.	Depth (m)	Test Type	Penetration (cm)		Number of Blows(N)		Material
BH2	10	CPT	15		13		Alluvial Material
			15 15	**30cm**	14 15	**29**	
	11	CPT	15		12		
			15 15	**30cm**	14 14	**28**	
	12	CPT	10cm		50 blows		
			15 15	**30cm**			
	13	CPT	15		12		
			15 15	**30cm**	13 16	**29**	
	14	CPT	15		17		
			15 15	**30cm**	18 18	**36**	

6-LABORATORY TESTS

Depending on the type of the encountered materials during digged test pits , following lab tests were conducted on the representative samples: (see table 3)

Table 3: Summary of Lab Tests Carried on Obtained Samples

Test No.	Test Type		Method of Testing
1.	Moisture Content Determination		ASTM: C566-97
2.	Seive Analysis of Aggregates		ASTM:C 136-93
3.	Dry and Bulk Densities		ASTM: D854
4.	Atterberg Limits		ASTM:D4318-10
5.	Determination of Specific Gravity		ASTM: C127 & C128
6.	Chemical Tests	Sulfate Content	BS: 1377-75
		Chloride Content	
7.	Unconfined compressive strength of Rock Cores		ASTM: D2938-86

The lab test Results attached in Appendix II.

Summary of the lab test Results shown in the following table , (table no.4)

Table(4) : Summary of Lab Test Results

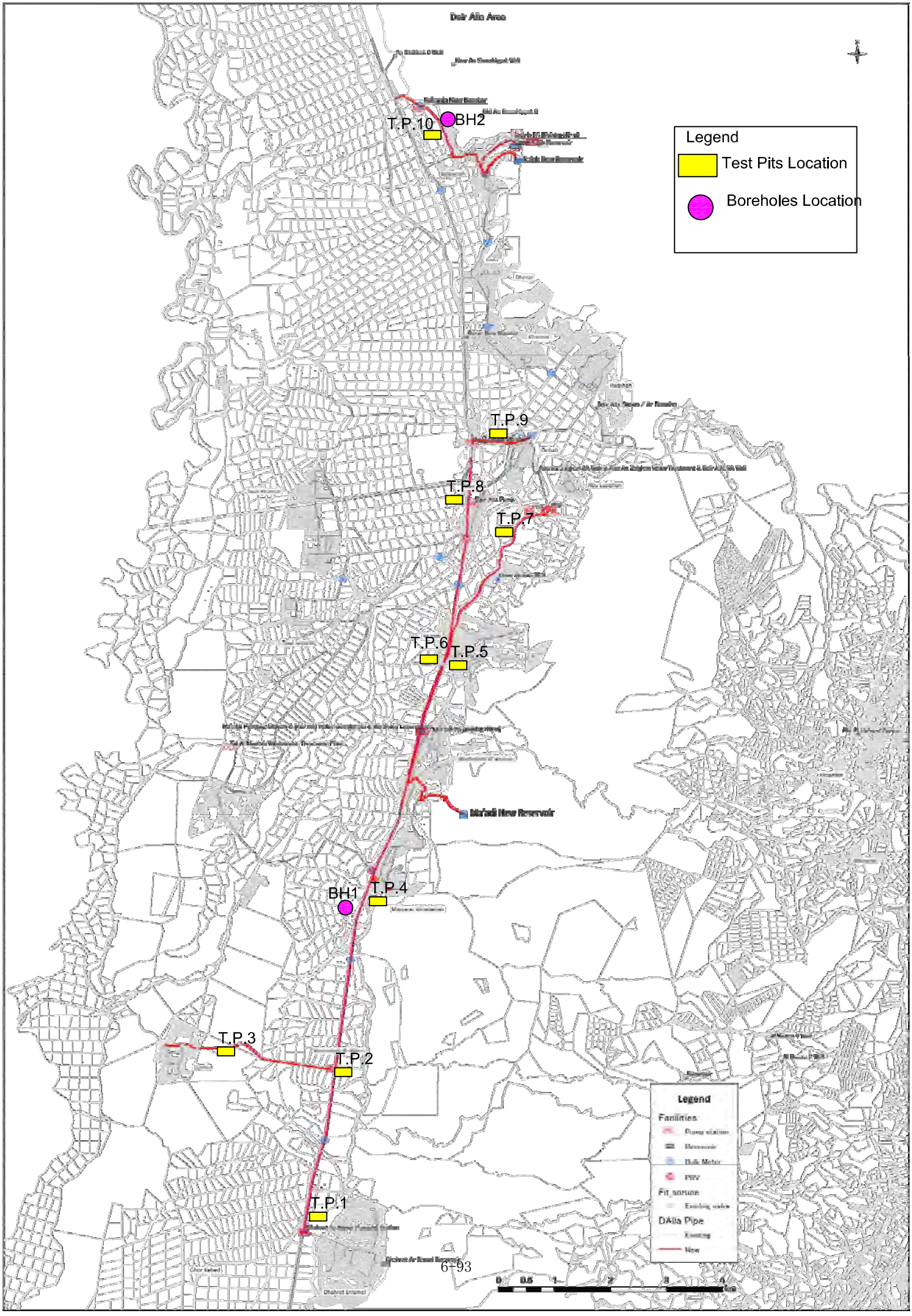
Test Pit No.	Material	Depth (m)	M.C	Bulk & Dry Density		Atterberg Limits			Seive analysis					Specific Gravity	ASHTOO Class.
				γ_b	γ_d	LL	PL	PI	Cobbles	gravels	Sand	Silt	Clay		
T.P.1	Clayey Sandy silt	0.0-1.5	5.8	1.81	1.71	29	18	11	0	3	23	65	9	2.34	A6
T.P.2	Wadi material	0.0-0.4	3.0	0.00		non PI			7	46	29	12	6	2.23	--
	Clayey Sandy silt	0.4-1.5	4.7	1.76	1.68	32	19	13	0	5	27	61	7	2.31	A6
T.P.3	Silty sand	0.0-1.5	5.2	1.83	1.74	19	16	3	0	7	45	37	11	2.27	A3
T.P.4	Asphaltic Pavement	0.0-0.05	Thichness of the layer is 5 cm												
	Silty Sandy Clay	0.05-0.50	6.2	1.79	1.69	39	21	18	0	25	15	29	31	2.29	A6
	Clayey Sandy silt	0.50-1.5	5.1	1.76	1.67	30	17	13	0	10	17	45	28	2.25	A6
T.P.5	Silty Clay	0.0-1.5	7.3	1.75	1.63	45	21	24	0	2	7	28	63	2.21	A7
T.P.6	silty clay	0.0-0.5	7.0	1.79	1.67	48	23	25	0	5	12	31	52	2.23	A7
	marl to clayey marl	0.5-1.5	11.7	1.95	1.75	57	20	27	--	--	--	--	--	2.3	--
T.P.7	Fill Material (silty sandy clay)	0.0-0.8	--	--	--	--	--	--	--	--	--	--	--	--	--
	Fill Material (Marland limestone)	0.8-1.5	--	--	--	--	--	--	--	--	--	--	--	--	--
T.P.8	Silty Clay	0.0-1.5	8.4	1.81	1.67	46	25	21	0	3	9	26	62	2.17	A7
T.P.9	Silty Clay	0.0-1.5	9.0	1.84	1.691	42	23	19	0	4.5	6.5	34	54	2.2	A7
T.P.10	Silty Clay	0.0-1.5	8.6	1.85	1.7	44	20	24	4	10	7	37	42	2.23	A7

7- SIESMIC ACTIVITY

As far as seismic activities are concerned the investigated site lies within zone"3"as noticed in the Jordanian Seismic Activities map.(see figure1).The following seismic parameters can be used in designing the proposed project:

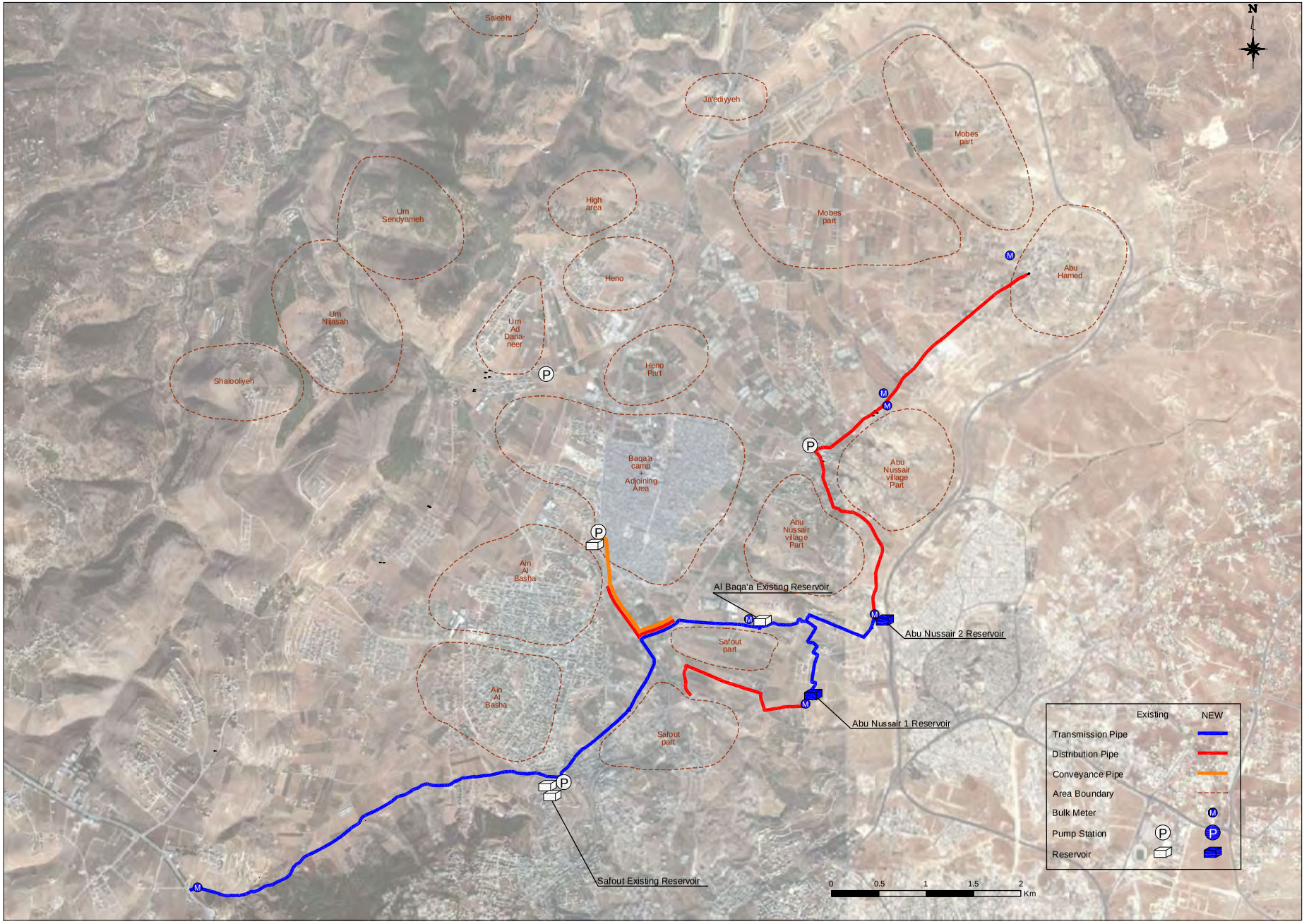
Table 4 : Seismic Factors for the Proposed Site

Seismic Zone	3	
Seismic Zone Factor (Z)	0.30	
Seismic Soil Type	Marly Limestone (as BH1)	Alluvial Material (as BH2)
Seismic Soil Section Name	S_B	S_C
Seismic Factor Related to Acceleration (Ca)	0.30	0.33
Seismic Factor Related to speed (Cv)	0.30	0.45

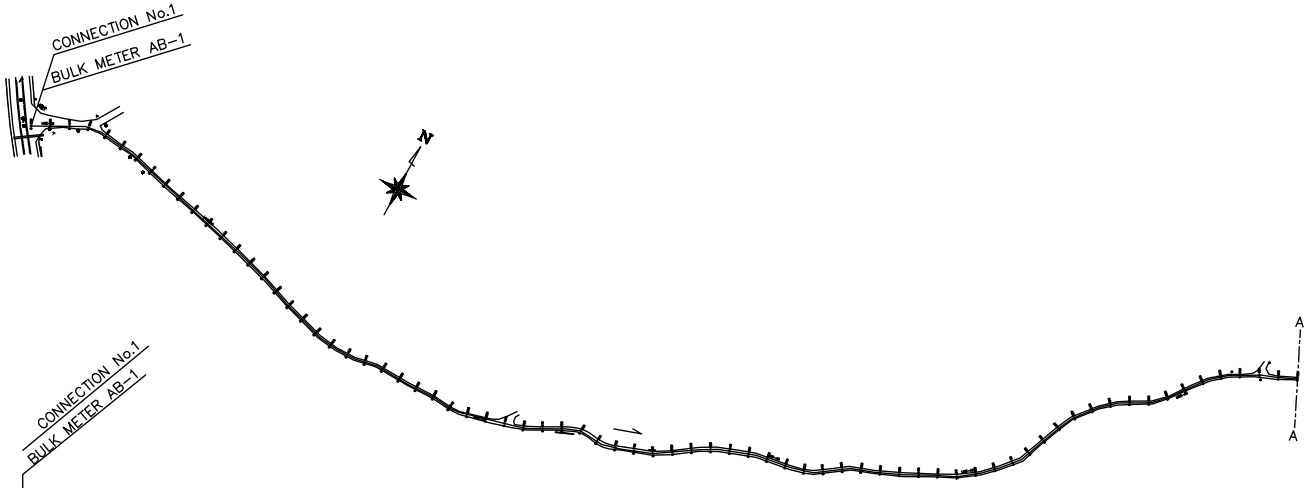

Deir Alla Area
Legend
Test Pits Location
Boreholes Location
T.P.10
BH2
T.P.9
T.P.8
T.P.7
T.P.6
T.P.5
Mahadi New Reservoir
BH1
T.P.4
T.P.3
T.P.2
T.P.1
Legend
Facilities
PRV
Fit_sorting
DAlla Pipe
New
0 0.5 1 2 3 4 Km

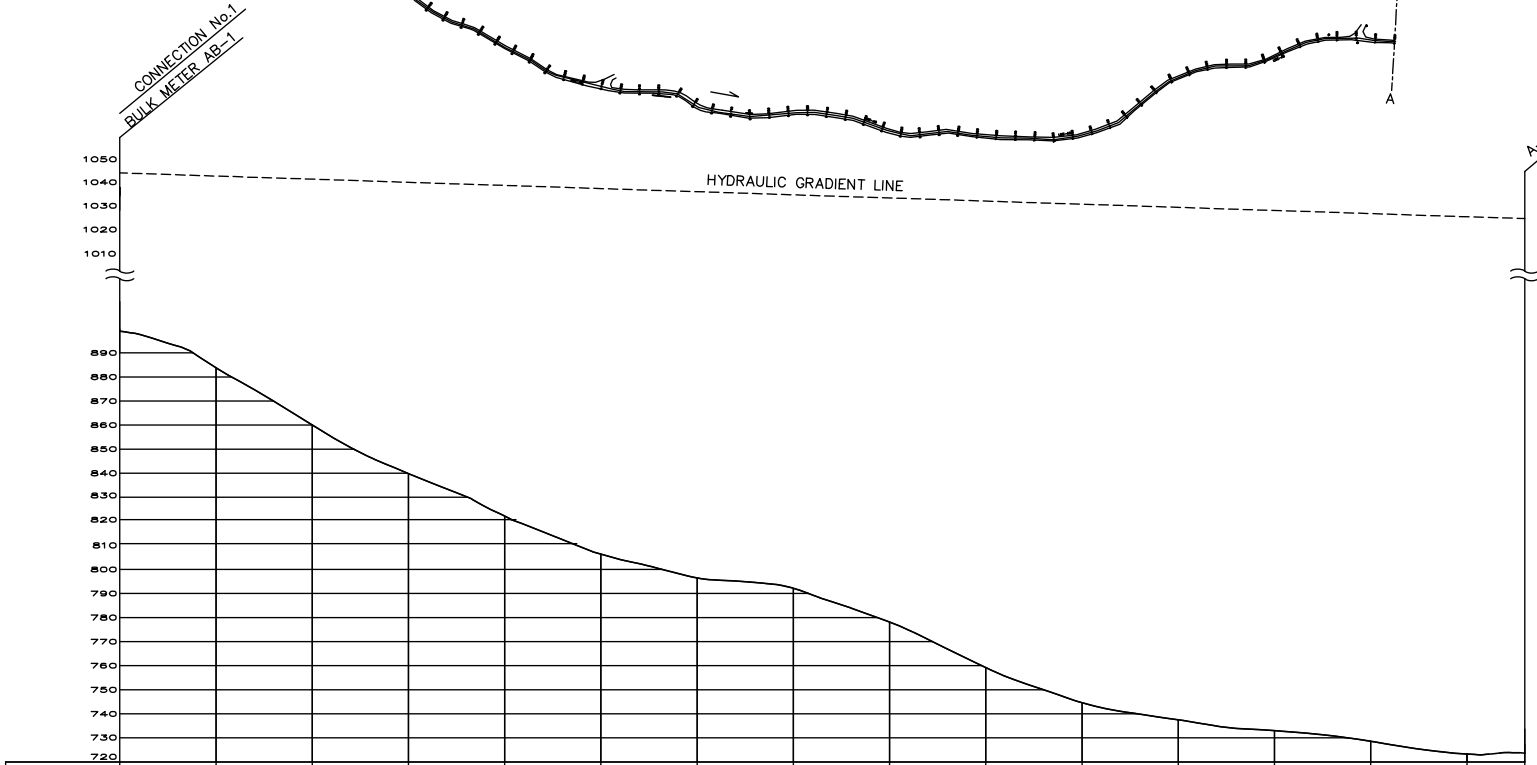
ATTACHMENT

Attachment-1



AL-GN-01	GENERAL SITE PLAN (AIN AL BASHA)
	全体計画施設配置図（アインアルバシャ地区）

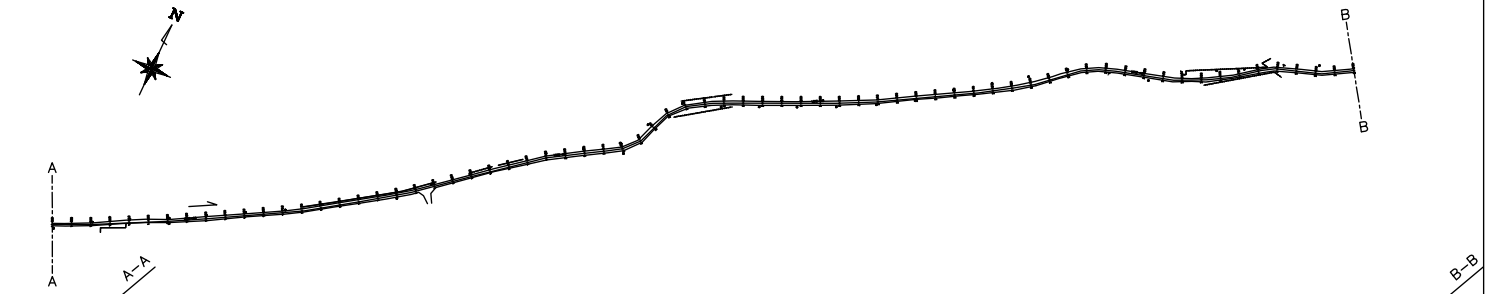


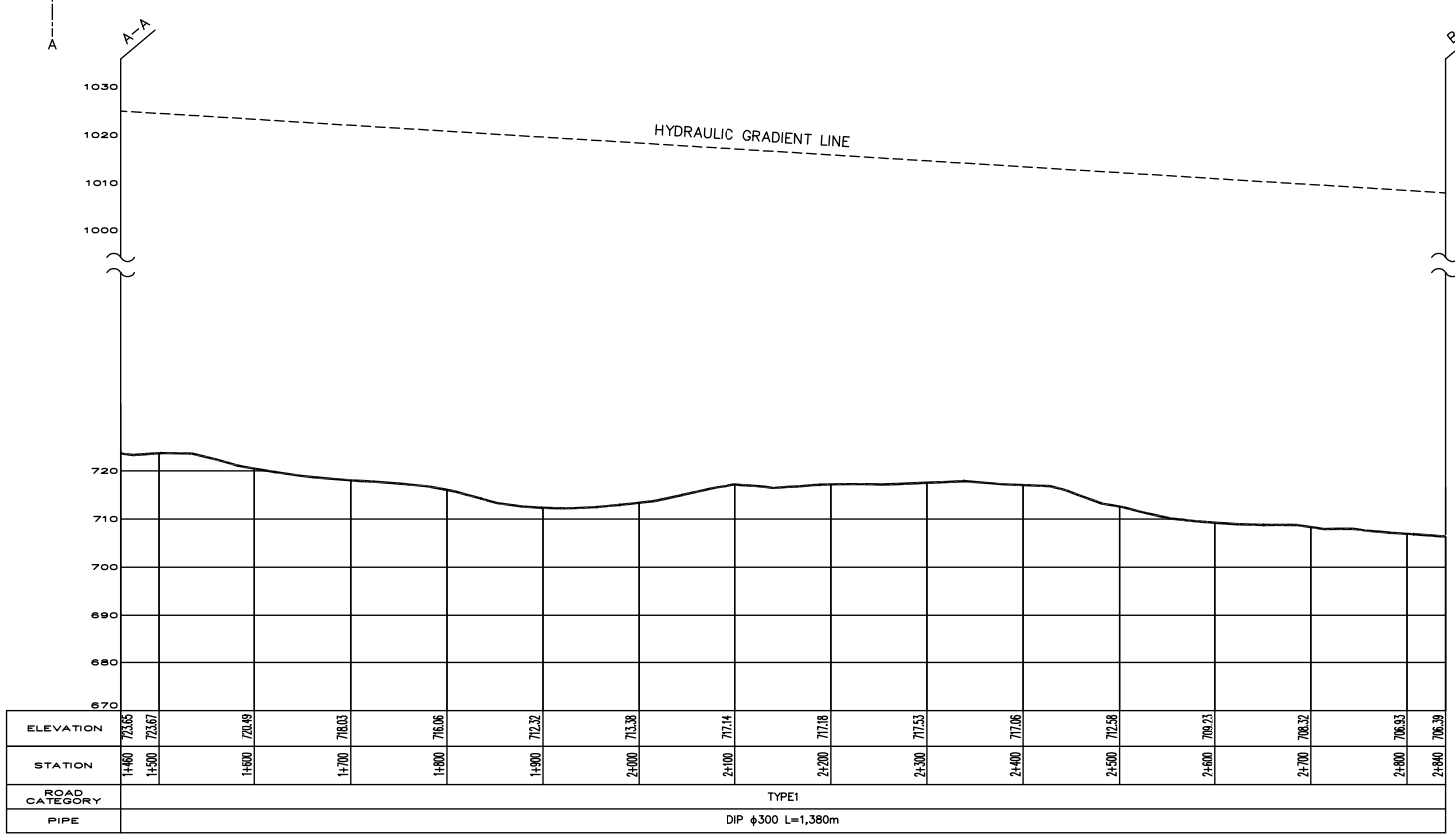


ELEVATION	868.97	863.78	860.00	839.80	822.09	806.36	796.48	792.14	778.10	759.22	744.62	737.50	733.05	728.62	723.25	723.65
STATION	0+000	0+100	0+200	0+300	0+400	0+500	0+600	0+700	0+800	0+900	1+000	1+100	1+200	1+300	1+400	1+460
ROAD CATEGORY	※1	TYPE1														
PIPE	※2	DIP ϕ300 L=1,430m														

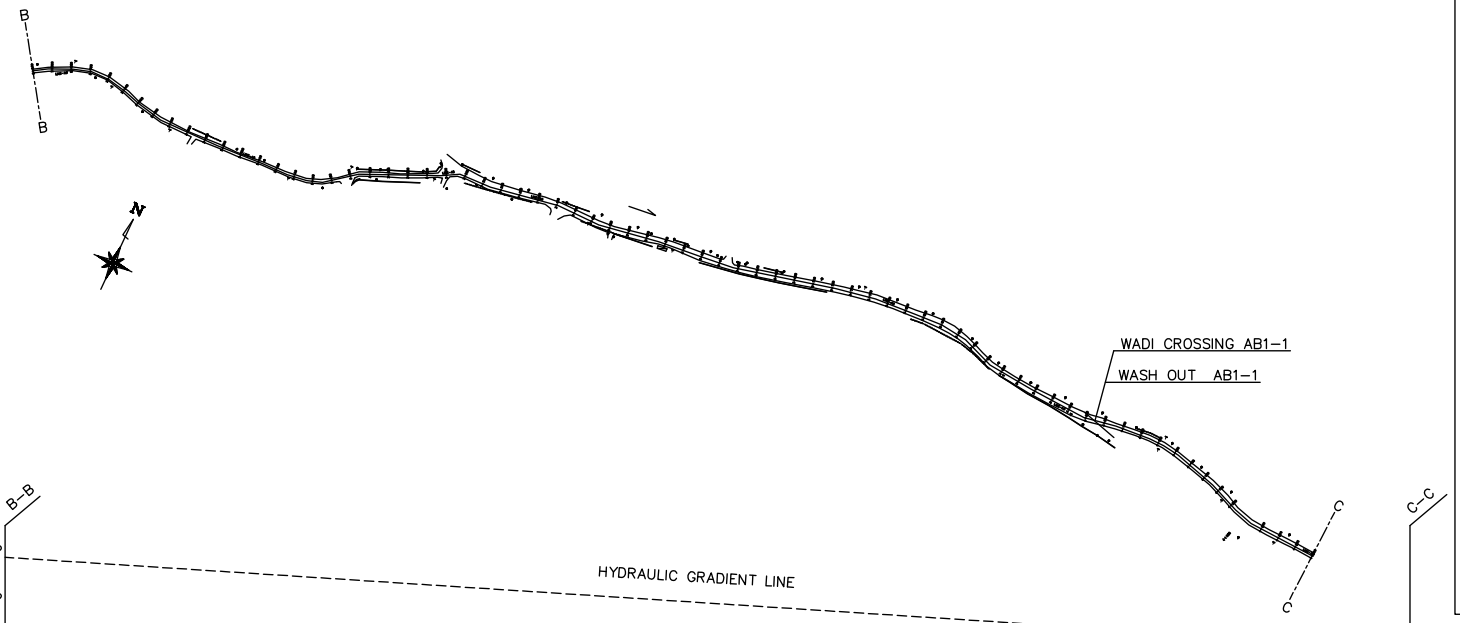
※1 TYPE5
※2 DIP ϕ300 L=30m

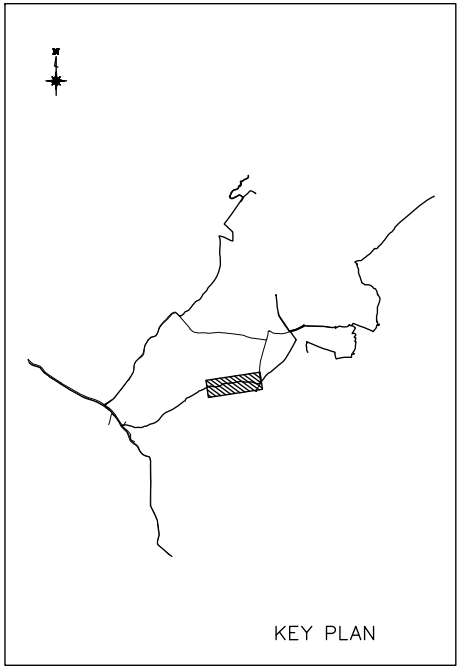
AL-TP-01	PLAN AND PROFILE OF TRANSMISSION LINE FROM CONNECTION No.1 TO AL-BAQA'A EXISTING RESERVOIR (1/5)
送水管　平面図・縦断図（送水管分岐点 No.1 ～アルバカ既存配水池）（1/5）	

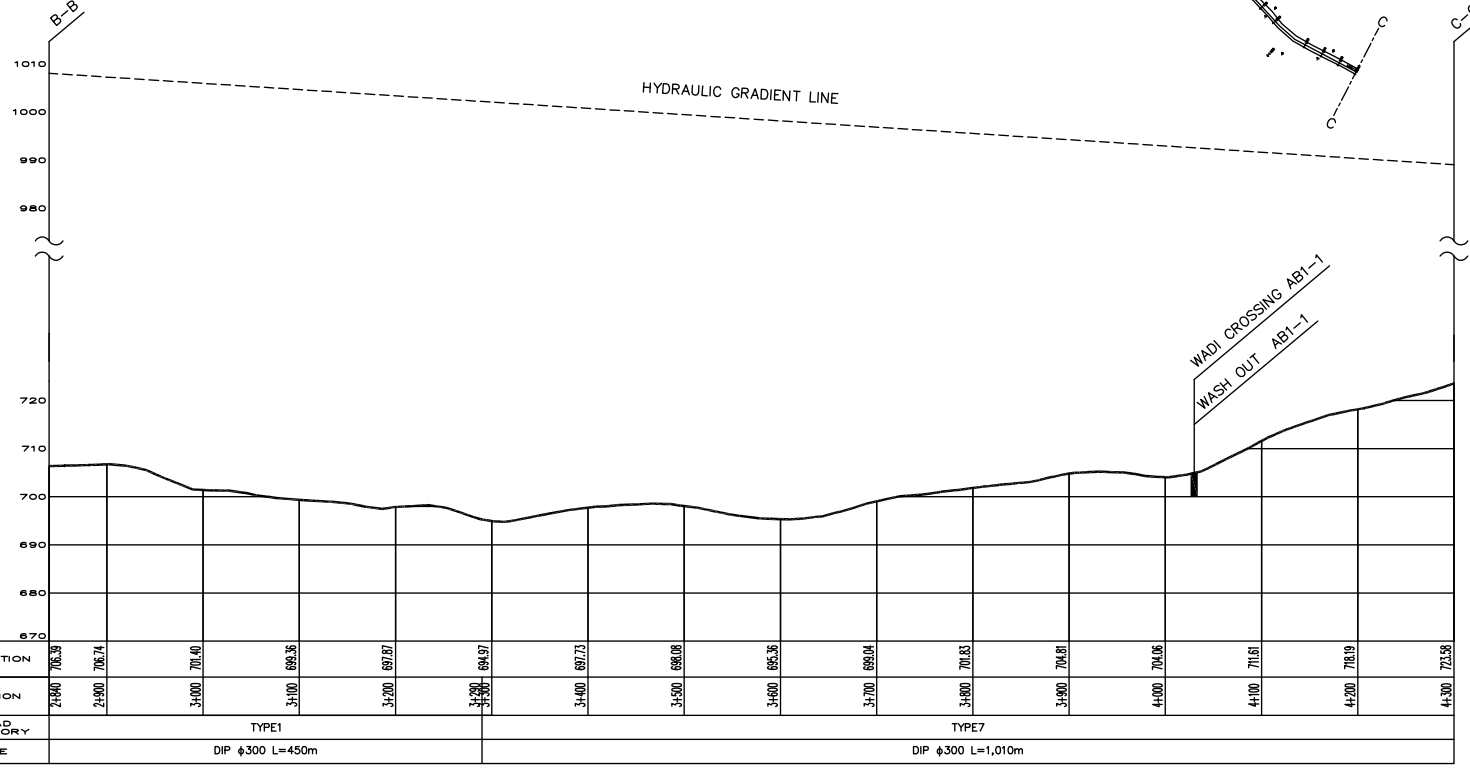




AL-TP-02	PLAN AND PROFILE OF TRANSMISSION LINE FROM CONNECTION No.1 TO AL-BAQA'A EXISTING RESERVOIR (2/5)
送水管　平面図・縦断図（送水管分岐点 No.1 ～アルバカ既存配水池）（2/5）	

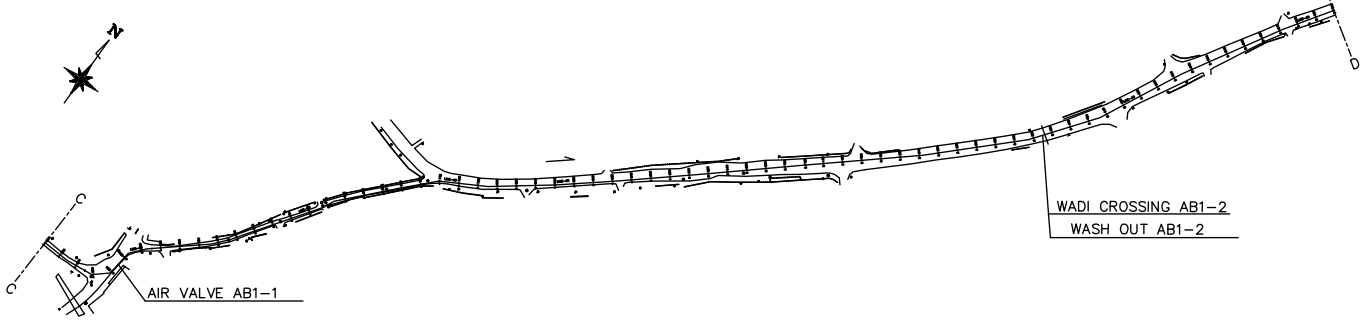


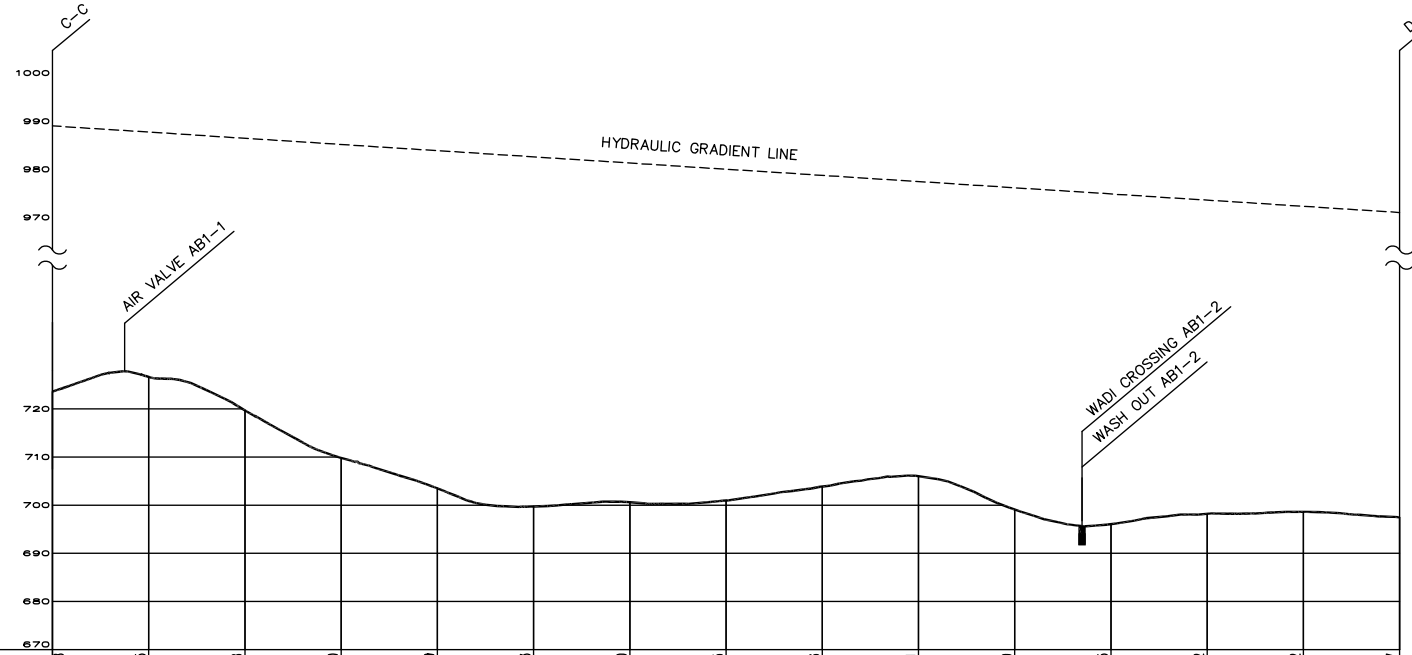




ELEVATION	706.39	706.74	701.40	699.36	697.87	694.97	697.73	698.08	695.36	699.04	701.83	704.81	704.06	711.61	718.19	723.58
STATION	2+940	2+900	3+000	3+100	3+200	3+300	3+400	3+500	3+600	3+700	3+800	3+900	4+000	4+100	4+200	4+300
ROAD CATEGORY	TYPE1						TYPE7									
PIPE	DIP ϕ300 L=450m						DIP ϕ300 L=1,010m									

AL-TP-03	PLAN AND PROFILE OF TRANSMISSION LINE FROM CONNECTION No.1 TO AL-BAQA'A EXISTING RESERVOIR (3/5)
送水管　平面図・縦断図（送水管分岐点 No.1 ～アルバカ既存配水池）（3/5）	

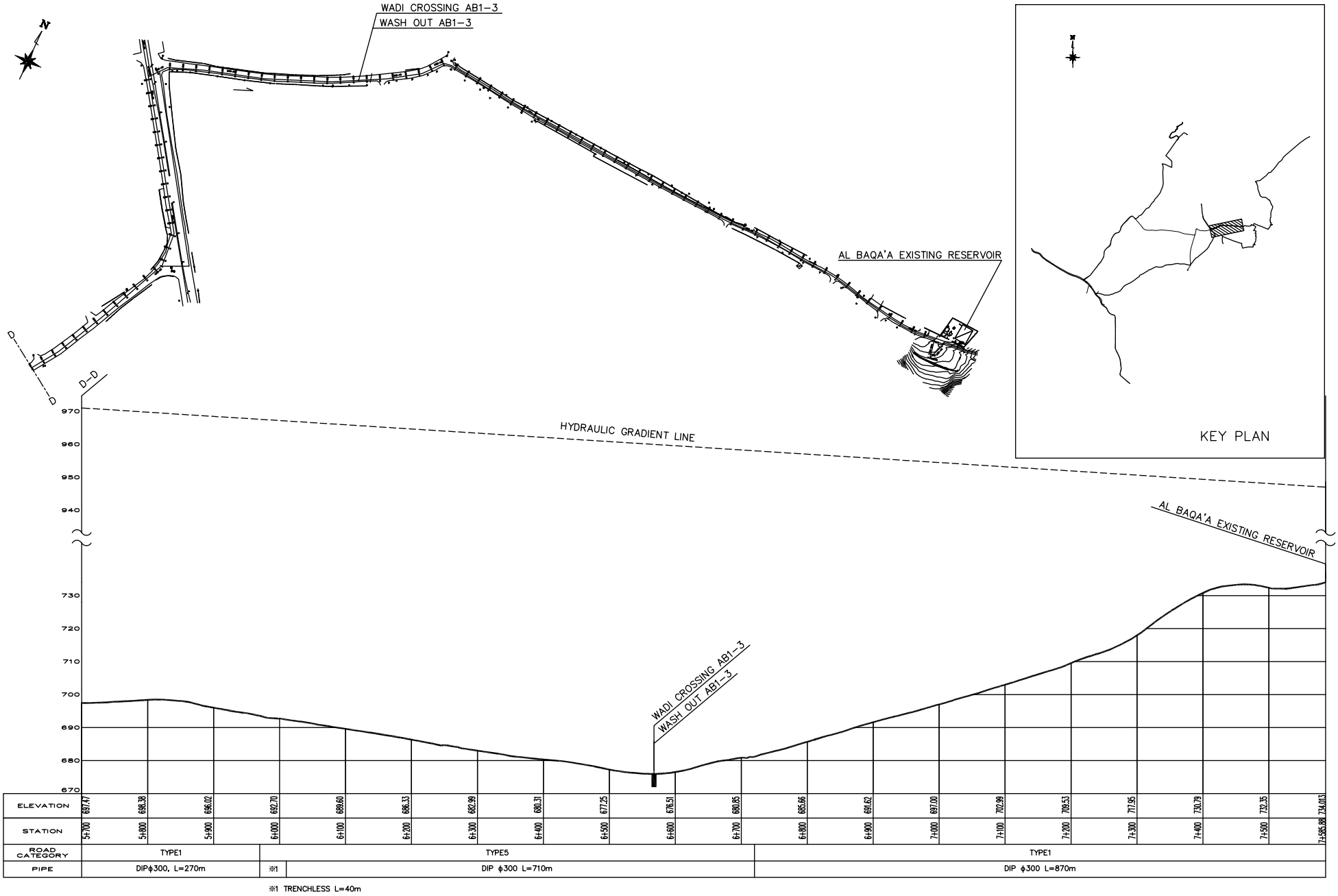




ELEVATION	723.58		726.65	719.68	709.80	703.49	699.73	700.60	700.95	703.86	706.01	699.09	696.05	698.22	698.62	697.47
STATION	4+300	4+340	4+380	4+400	4+500	4+600	4+700	4+800	4+900	5+000	5+100	5+200	5+300	5+400	5+500	5+600	5+700
ROAD CATEGORY	TYPE7				TYPE1												
PIPE	L=48m	※1	L=50m	DIP φ300 L=1,270m													

※1 TRENCHLESS L=32m

AL-TP-04	PLAN AND PROFILE OF TRANSMISSION LINE FROM CONNECTION No.1 TO AL-BAQA'A EXISTING RESERVOIR (4/5)
送水管　平面図・縦断図（送水管分岐点 No.1～アルバカ既存配水池）（4/5）	

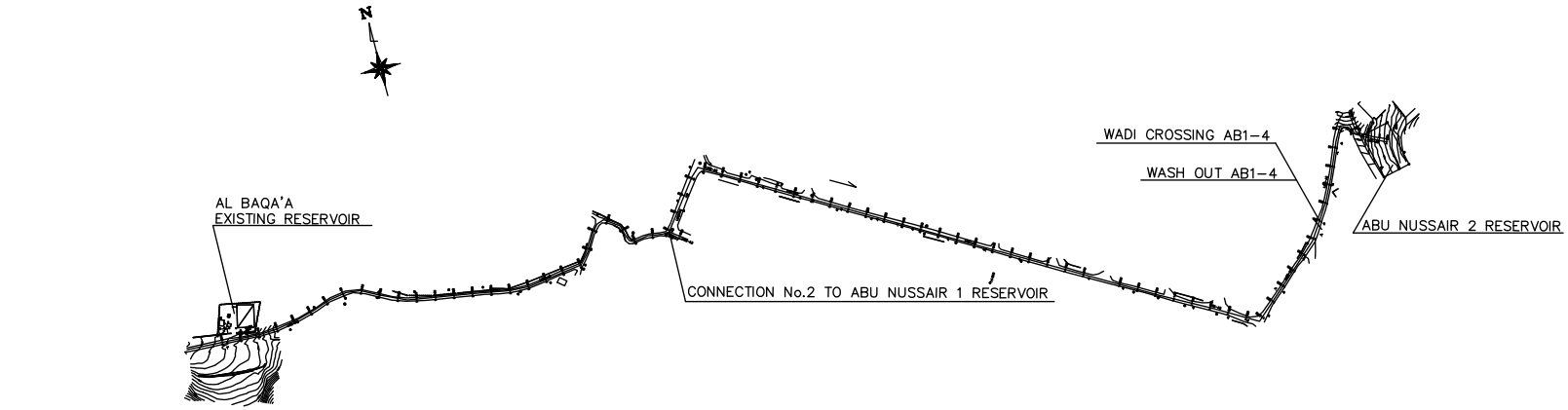


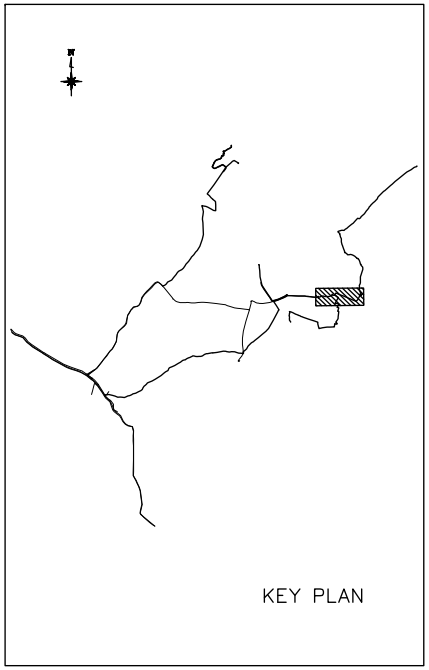
ELEVATION	697.47	698.38	696.02	692.70	689.60	686.33	682.99	680.31	677.25	676.51	680.85	685.66	691.62	697.00	702.99	709.53	717.95	730.79	739.35	734.013	
STATION	5+700	5+800	5+900	6+000	6+100	6+200	6+300	6+400	6+500	6+600	6+700	6+800	6+900	7+000	7+100	7+200	7+300	7+400	7+500	7+595.88	
ROAD CATEGORY	TYPE1			TYPE5												TYPE1					
PIPE	DIPφ300, L=270m			※1	DIP φ300 L=710m											DIP φ300 L=870m					

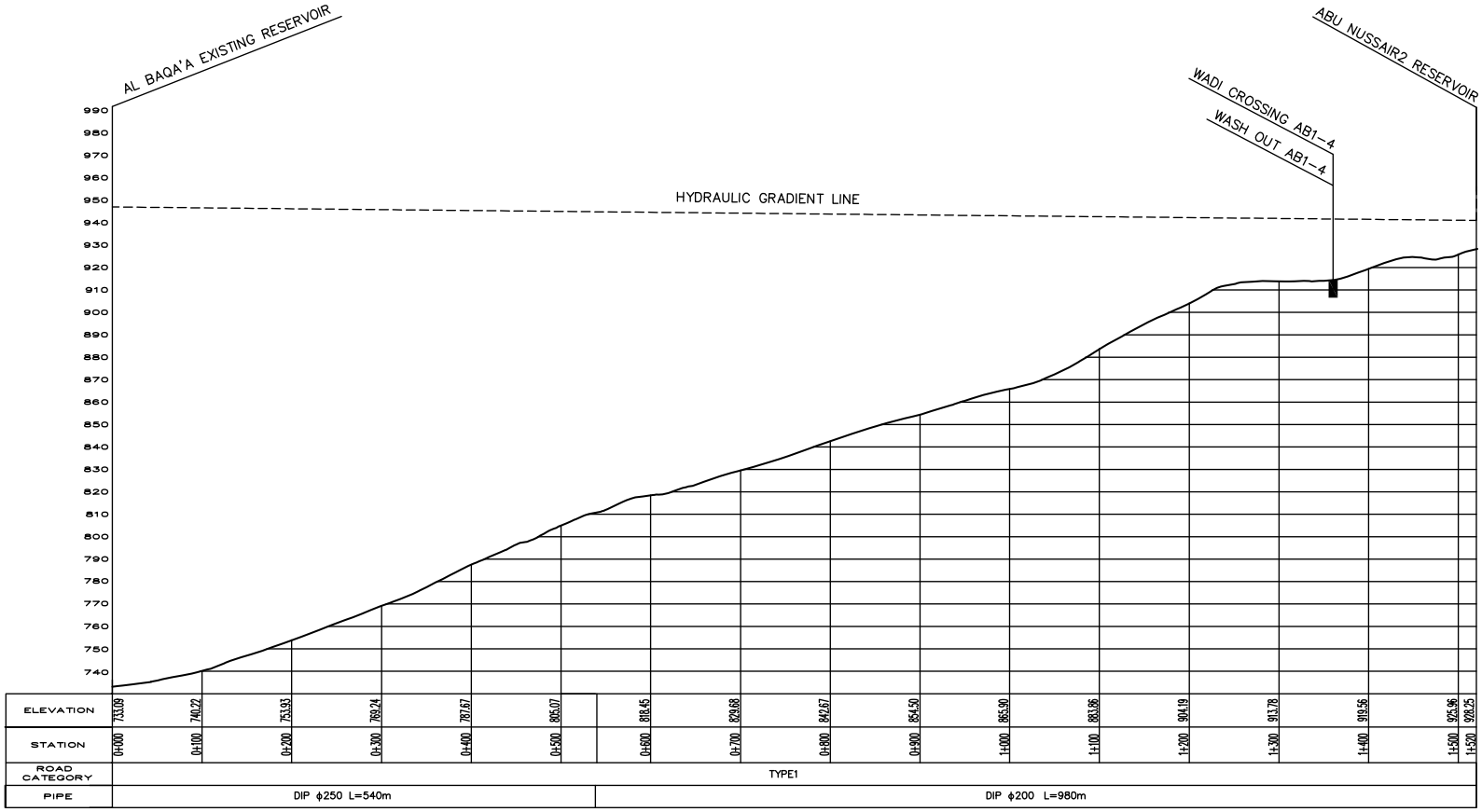
※1 TRENCHLESS L=40m

AL-TP-05	PLAN AND PROFILE OF TRANSMISSION LINE FROM CONNECTION No.1 TO AL-BAQA'A EXISTING RESERVOIR (5/5)

送水管　平面図・縦断図（送水管分岐点 No.1 ～アルバカ既存配水池）（5/5）

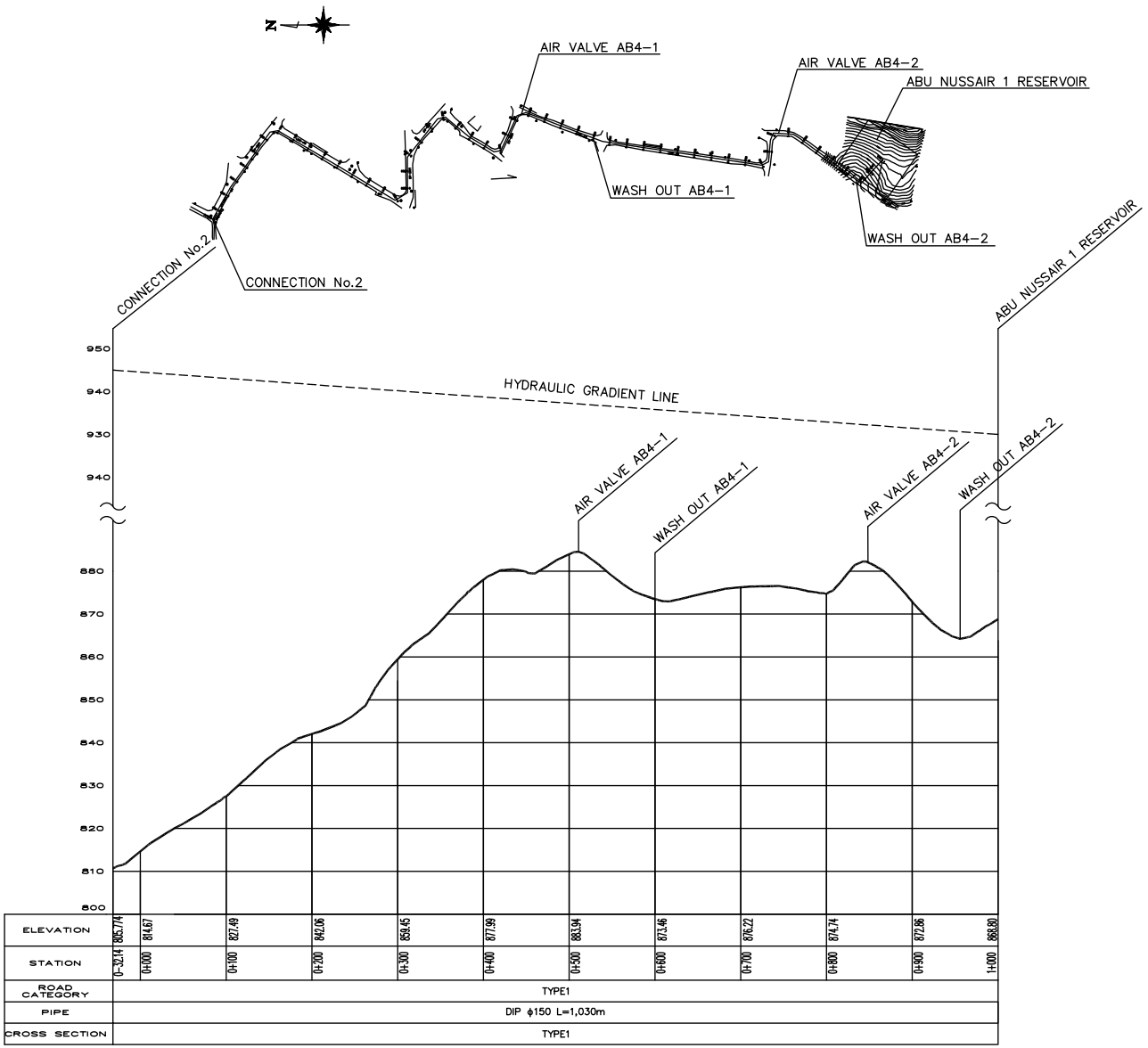


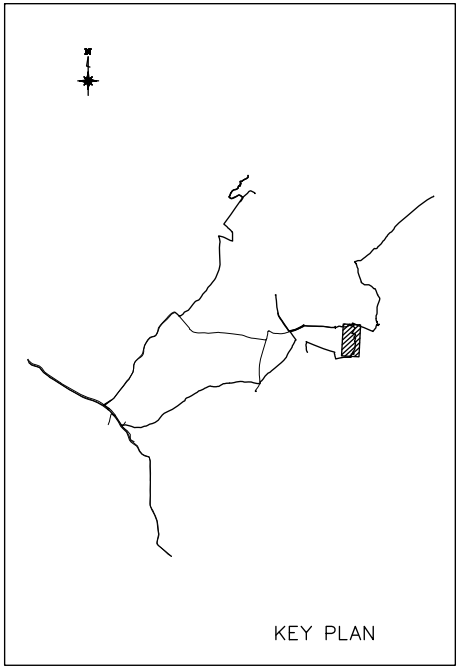




ELEVATION	733.09	740.22	753.93	769.24	787.67	805.07		816.45	829.68	842.97	854.50	865.90	883.86	904.19	913.78	919.56	925.96	928.25						
STATION	0+000	0+100	0+200	0+300	0+400	0+500		0+600	0+700	0+800	0+900	1+000	1+100	1+200	1+300	1+400	1+500	1+520						
ROAD CATEGORY	TYPE1																							
PIPE	DIP ϕ250 L=540m							DIP ϕ200 L=980m																

AL-TP-06	PLAN AND PROFILE OF TRANSMISSION LINE FROM AL-BAQA'A EXISTING RESERVOIR TO ABU NUSSAIR 2 RESERVOIR
送水管　平面図・断面図（アルバカ既存配水池～アブナシール2 配水池）	



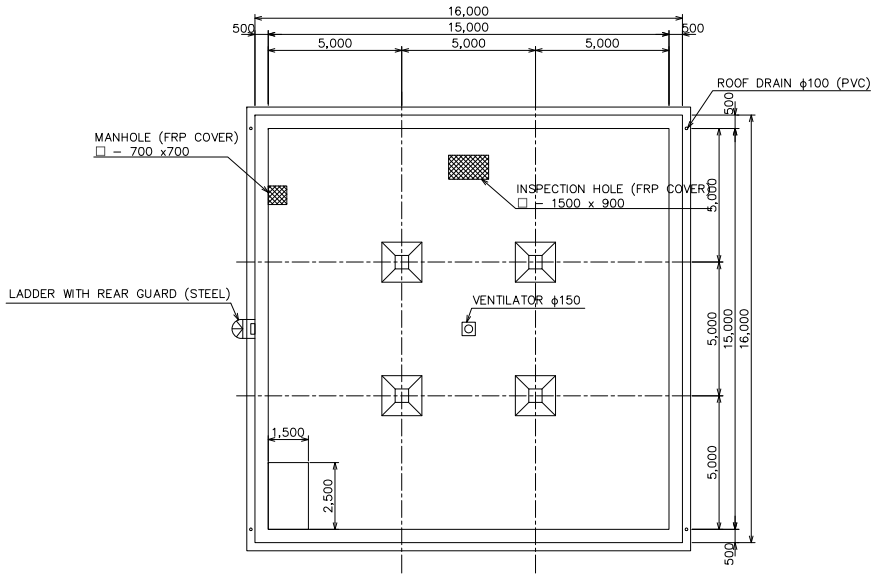


AL-TP-07	PLAN AND PROFILE OF TRANSMISSION LINE FROM CONNECTION No.2 TO ABU NUSSAIR 1 RESERVOIR
送水管　平面図・断面図（送水管分岐点 No.2～アブナシール 1 配水池）	

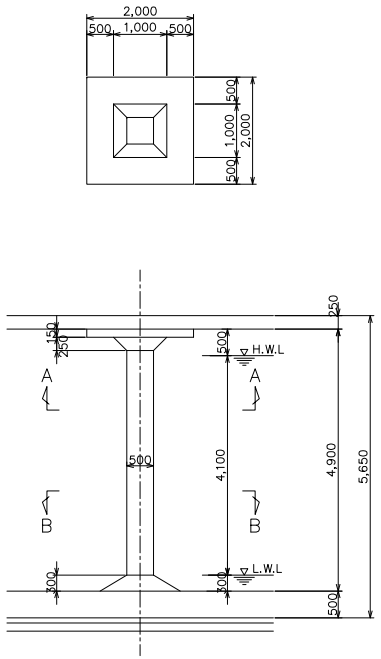
AL-RV-01	LAYOUT OF ABU NUSSAIR 1 RESERVOIR (900m³)
	配水池一般平面図（アブナシール1配水池） 900m³

A-9

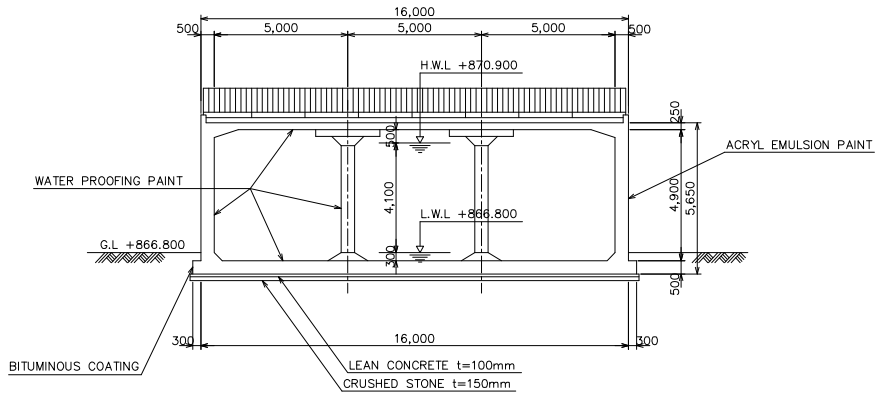
PLAN S=1/200



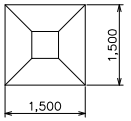
SECTION A–A S=1/100



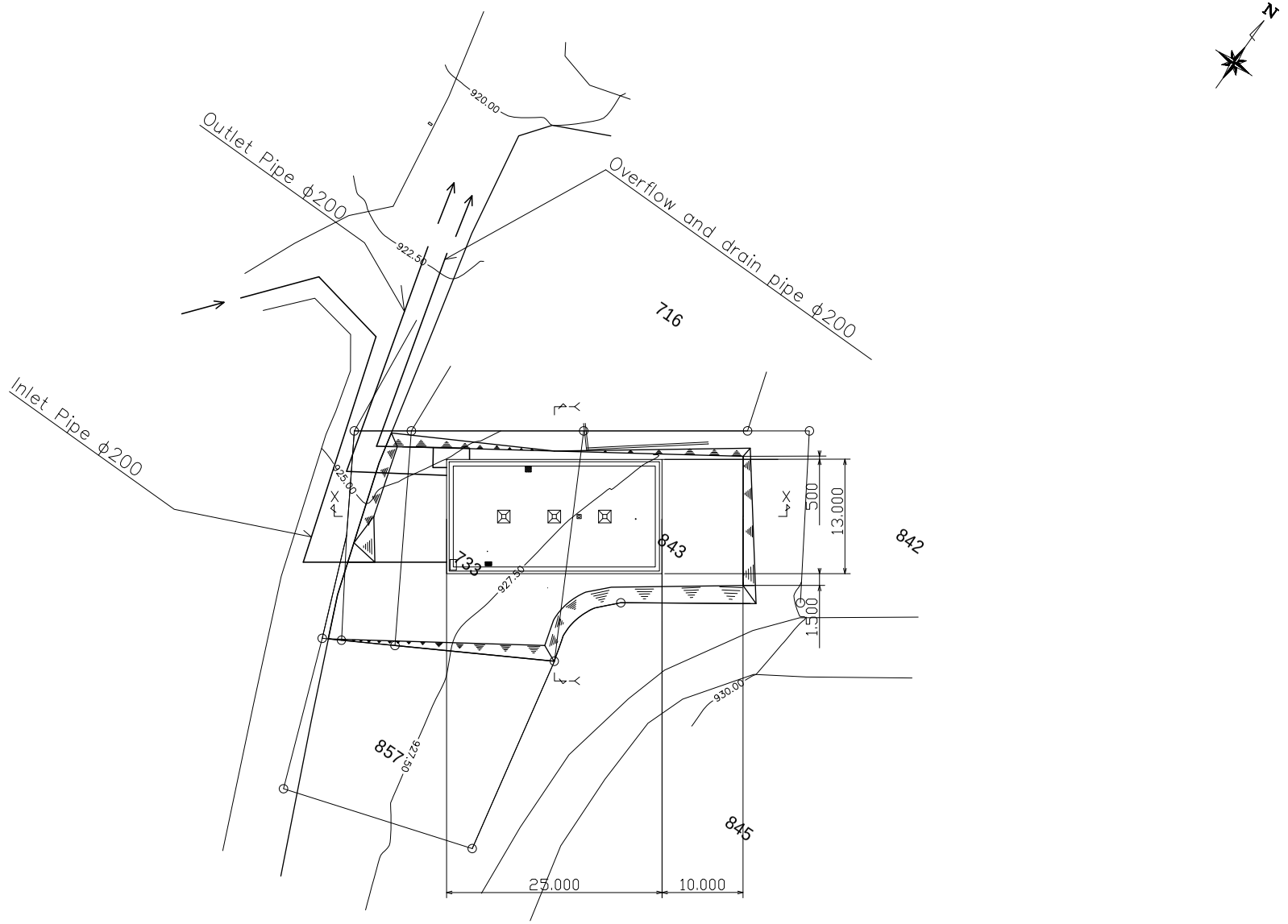
SECTION S=1/200



SECTION B–B S=1/100

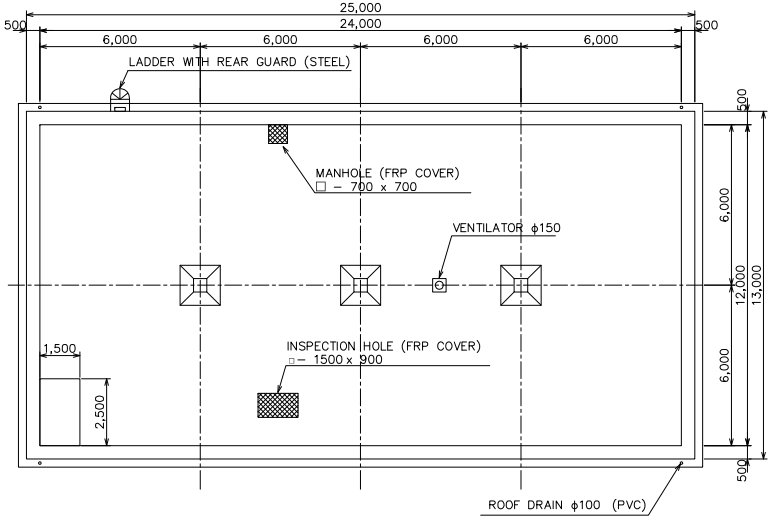


AL-RV-02	STRUCTURAL PLAN AND SECTION VIEW OF ABU NUSSAIR 1 RESERVOIR (900m³)
配水池構造図（アブナシール1配水池） 900m³	

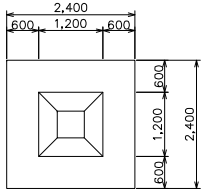


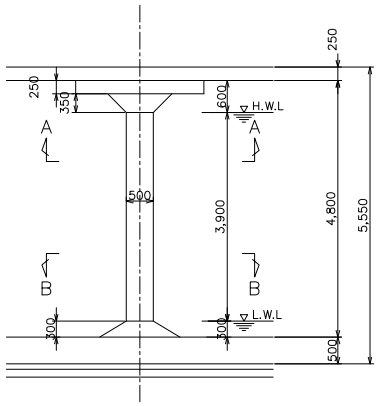
AL-RV-03	LAYOUT PLAN OF ABU NASIR 2 RESERVOIR (1,100m³)
配水池一般平面図（アブナシール2配水池） 1,100m³	

PLAN S=1/200

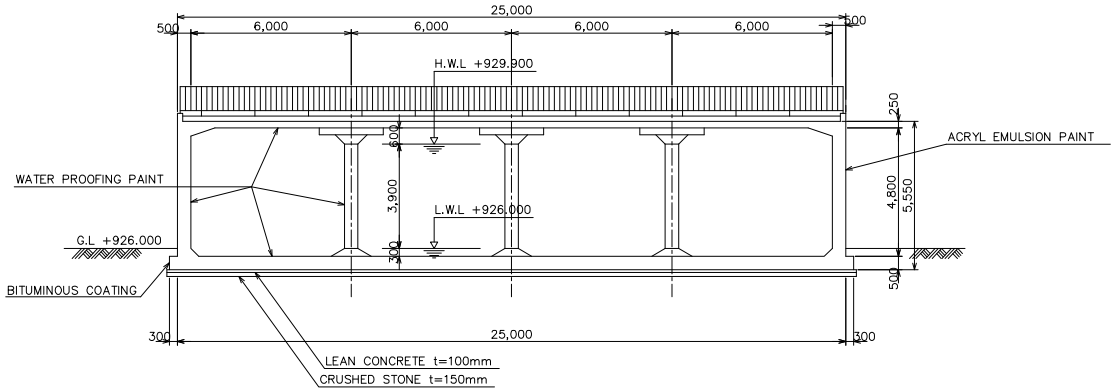


SECTION A–A S=1/100

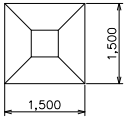




SECTION S=1/200

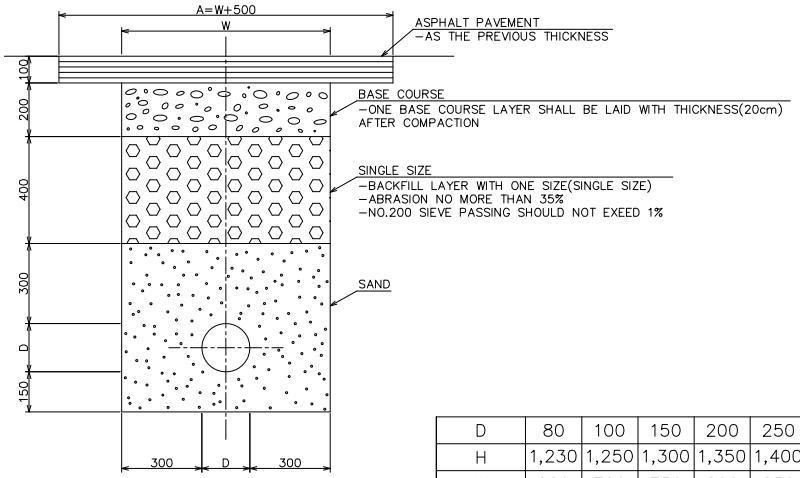


SECTION B–B S=1/100



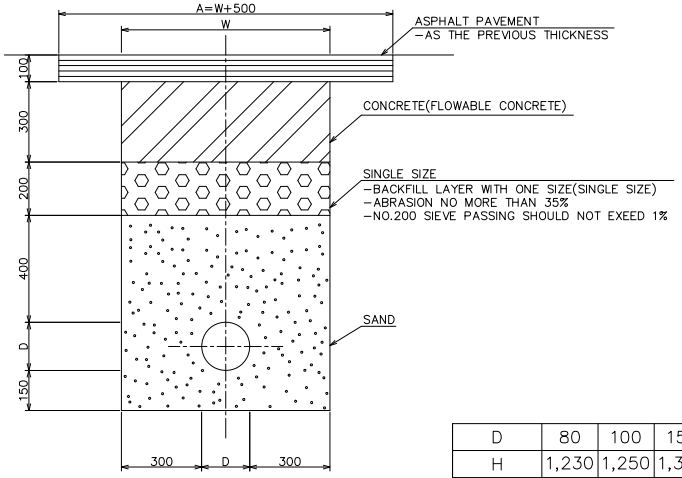
AL-RV-04	STRUCTURAL PLAN AND SECTION VIEW OF ABU NASIR 2 RESERVOIR (1,100m³)
	配水池構造図（アブナシール2配水池） 1,100m³

TYPE: 1 ALONG ASPHALT STREET FOR MAIN ROAD S=1/20



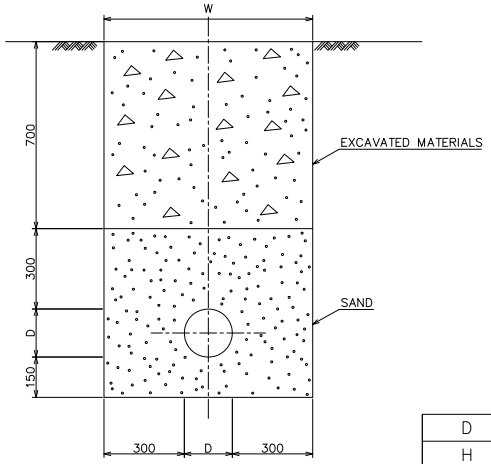
D	80	100	150	200	250	300	400
H	1,230	1,250	1,300	1,350	1,400	1,450	1,550
W	680	700	750	800	850	900	1,000
A	1,180	1,200	1,250	1,300	1,350	1,400	1,500

TYPE: 2 CROSS SECTION FOR ASPHALT STREET FOR MAIN ROAD S=1/20



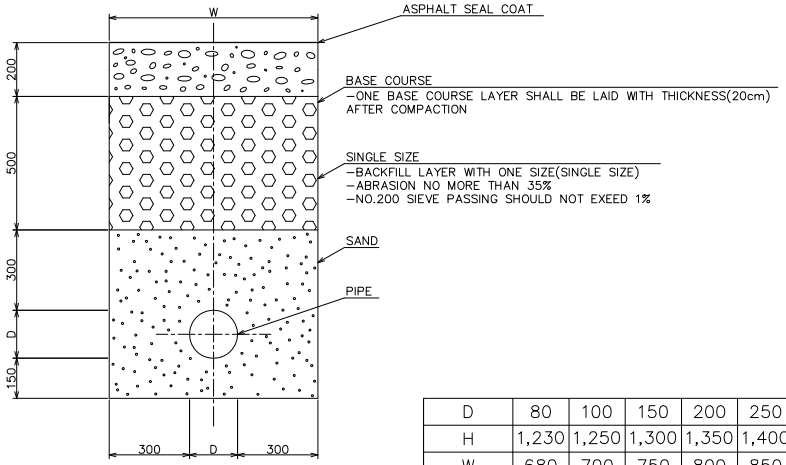
D	80	100	150	200	250	300	400
H	1,230	1,250	1,300	1,350	1,400	1,450	1,550
W	680	700	750	800	850	900	1,000
A	1,180	1,200	1,250	1,300	1,350	1,400	1,500

TYPE: 3 CROSS SECTION OF NON PAVEMENT ROAD S=1/20



D	80	100	150	200	250	300	400
H	1,230	1,250	1,300	1,350	1,400	1,450	1,550
W	680	700	750	800	850	900	1,000
A	–	–	–	–	–	–	–

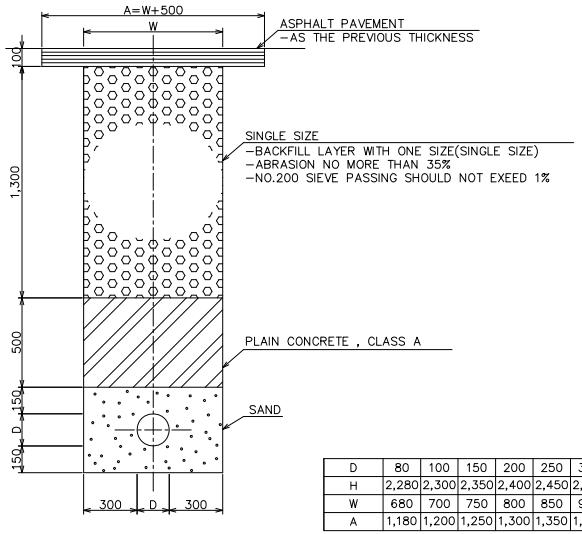
TYPE: 4 TYPICAL SECTION OF AGRICULTURAL ROAD S=1/20



D	80	100	150	200	250	300	400
H	1,230	1,250	1,300	1,350	1,400	1,450	1,550
W	680	700	750	800	850	900	1,000
A	–	–	–	–	–	–	–

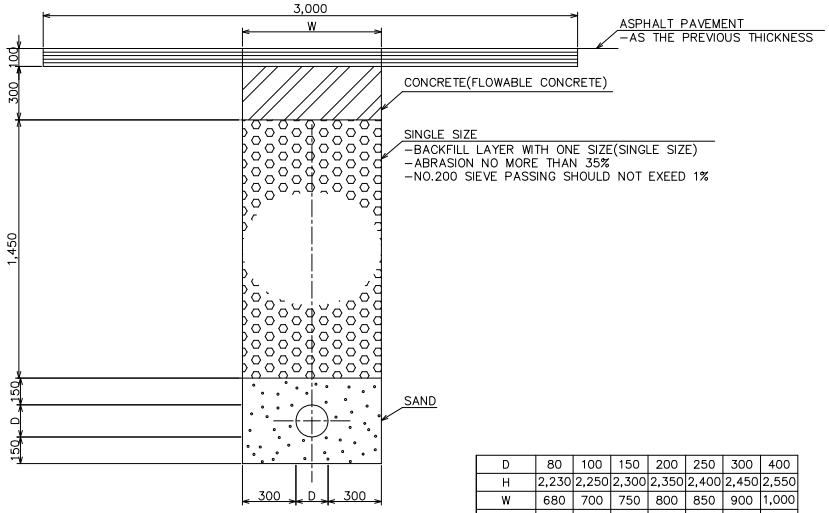
TD-01	TYPICAL TRENCH CROSS SECTION FOR PIPELINE IN THE ROAD UNDER MUNCIPALITY
	送配水管路掘削標準断面図 1

TYPE: 5 LONGITUDINAL FOR MAIN AND SECONDARY ROAD S=1/30



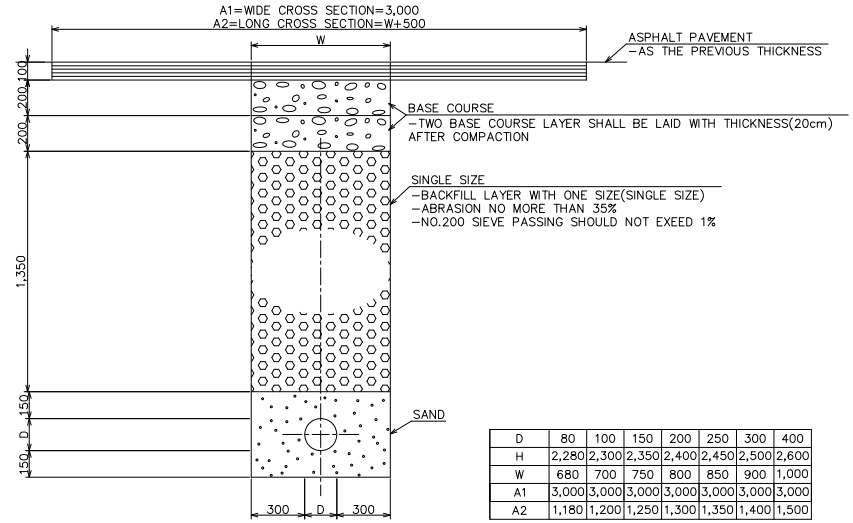
D	80	100	150	200	250	300	400
H	2,280	2,300	2,350	2,400	2,450	2,500	2,600
W	680	700	750	800	850	900	1,000
A	1,180	1,200	1,250	1,300	1,350	1,400	1,500

TYPE: 6 CROSS SECTION FOR SECONDARY ROAD S=1/30



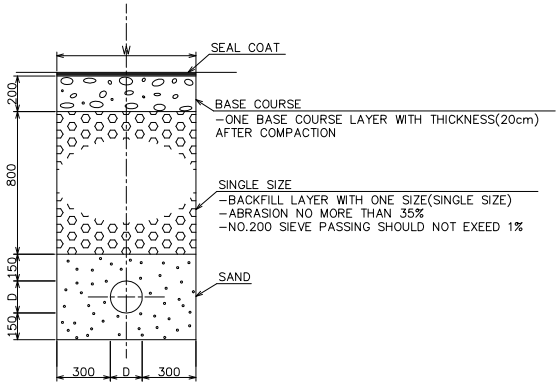
D	80	100	150	200	250	300	400
H	2,230	2,250	2,300	2,350	2,400	2,450	2,550
W	680	700	750	800	850	900	1,000
A	3,000	3,000	3,000	3,000	3,000	3,000	3,000

TYPE: 7 LONG AND CROSS SECTION FOR THE RURAL ROAD S=1/30



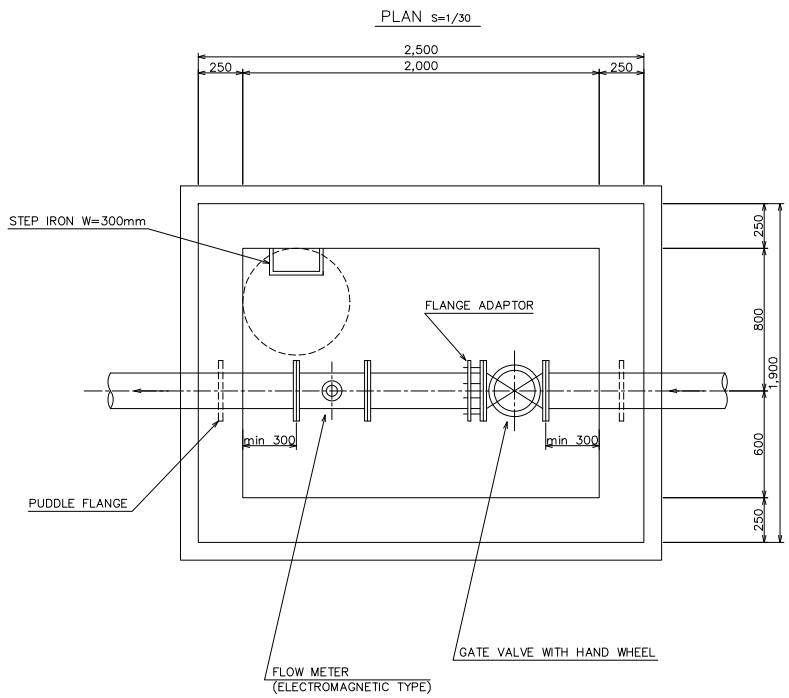
D	80	100	150	200	250	300	400
H	2,280	2,300	2,350	2,400	2,450	2,500	2,600
W	680	700	750	800	850	900	1,000
A1	3,000	3,000	3,000	3,000	3,000	3,000	3,000
A2	1,180	1,200	1,250	1,300	1,350	1,400	1,500

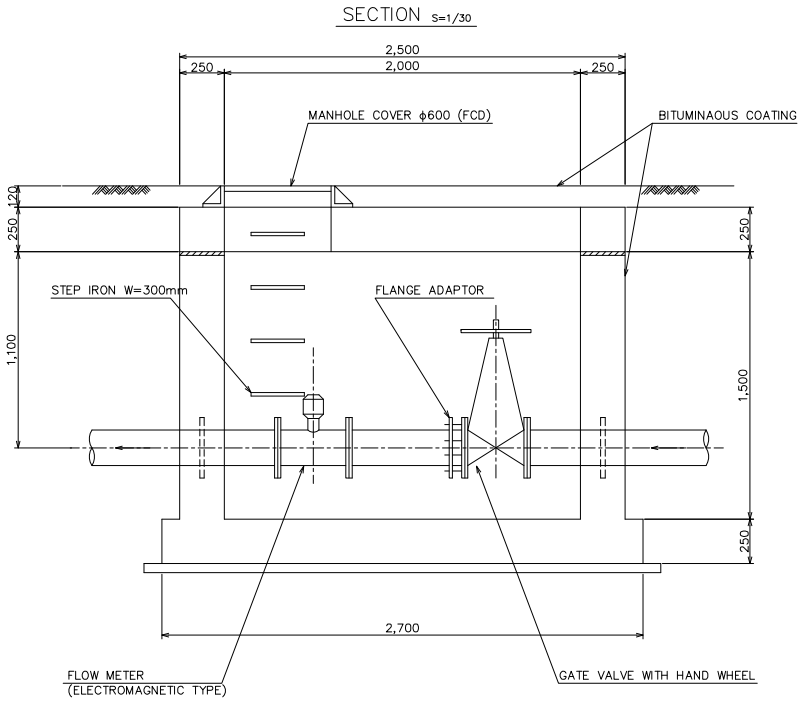
TYPE: 8 LONG & CROSS SECTION FOR THE AGRICULTURAL ROAD(SEAL COAT) S=1/30



D	80	100	150	200	250	300	400
H	2,280	2,300	2,350	2,400	2,450	2,500	2,600
W	680	700	750	800	850	900	1,000
A	–	–	–	–	–	–	–

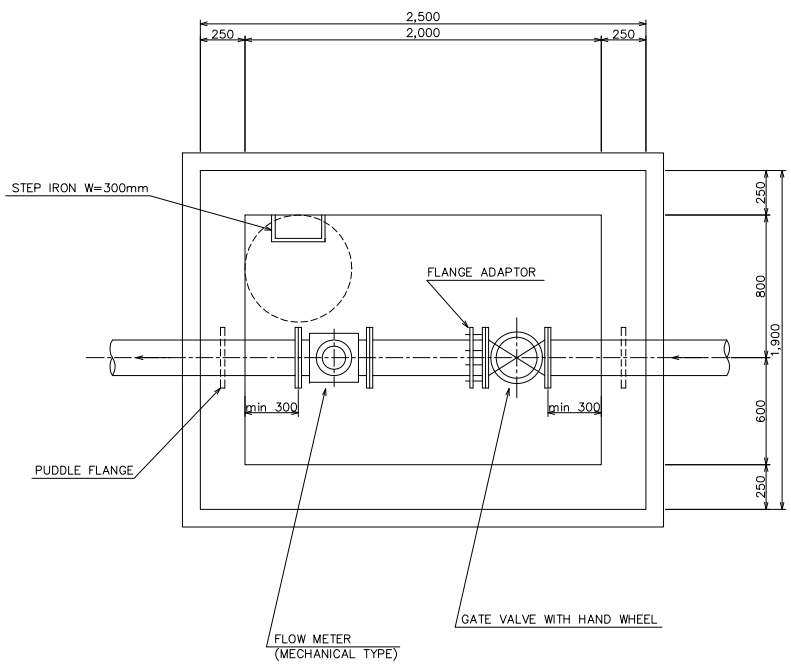
TD-02	TYPICAL TRENCH CROSS SECTION FOR PIPELINE IN THE ROAD UNDER MPWH
	送配水管路掘削標準断面図 2



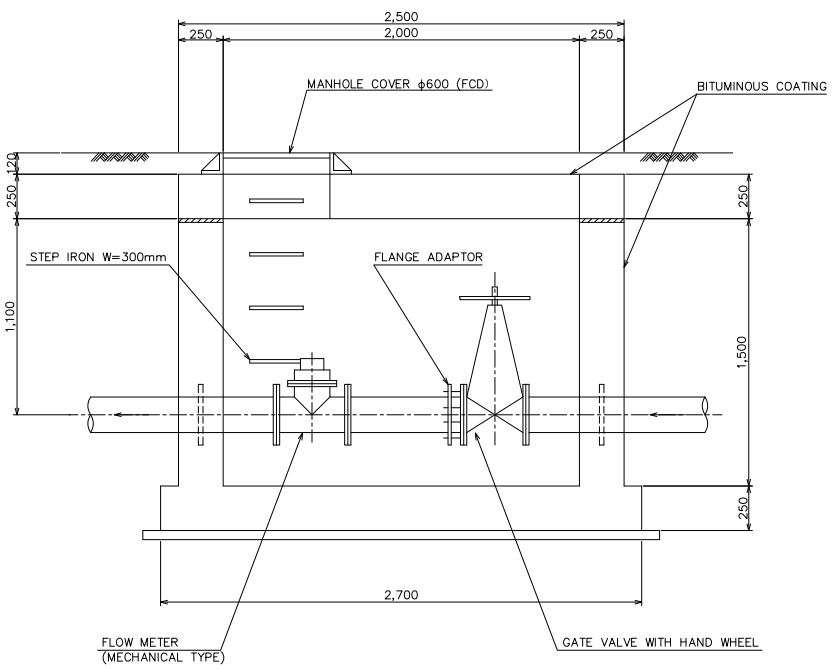


TD-03	DETAILS OF FLOW METER CHAMBER (ELECTROMAGNETIC TYPE)
	標準流量計室(電磁式)

PLAN S=1/30



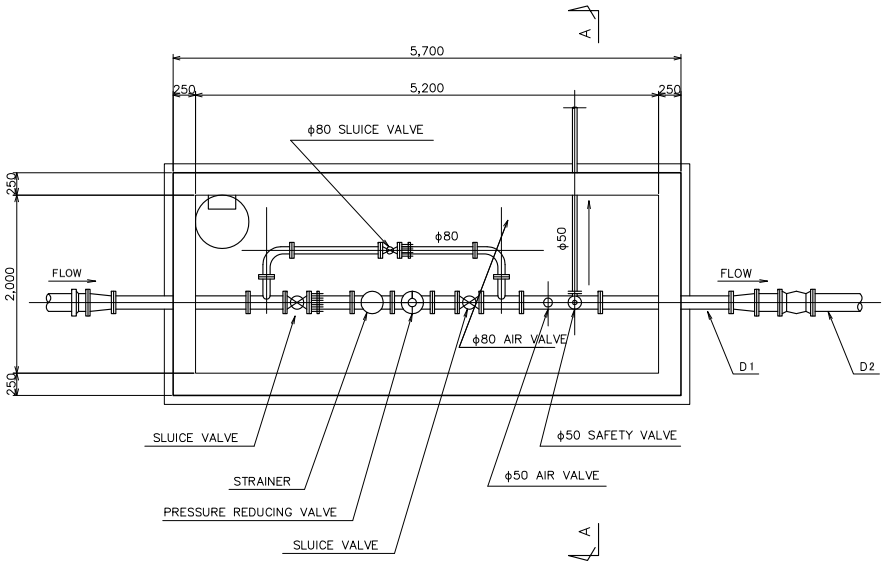
SECTION S=1/30



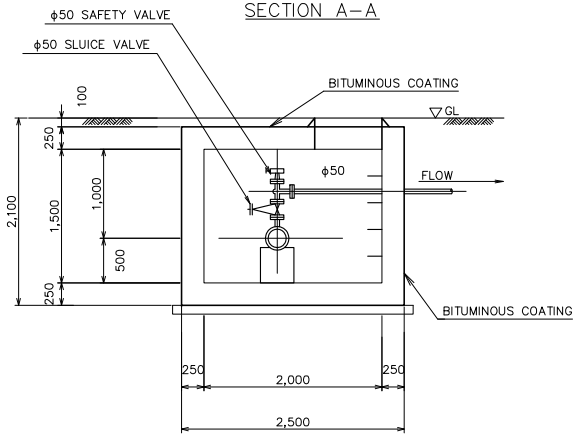
TD-04	DETAILS OF FLOW METER (MECHANICAL TYPE)
	標準流量計室(機械式)

P.R.V CHAMBER

PLAN



SECTION A–A

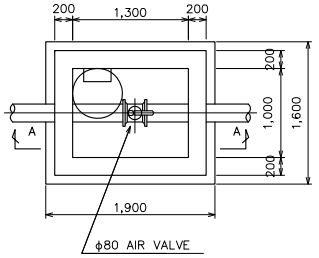


SIZE OF PIPES & PRV

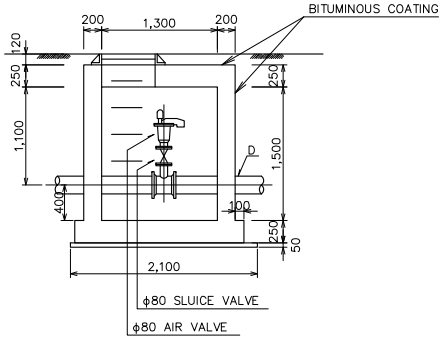
D1	D2
ϕ100	ϕ100
ϕ100	ϕ150
ϕ100	ϕ200
ϕ200	ϕ300

AIR VALVE CHAMBER

PLAN



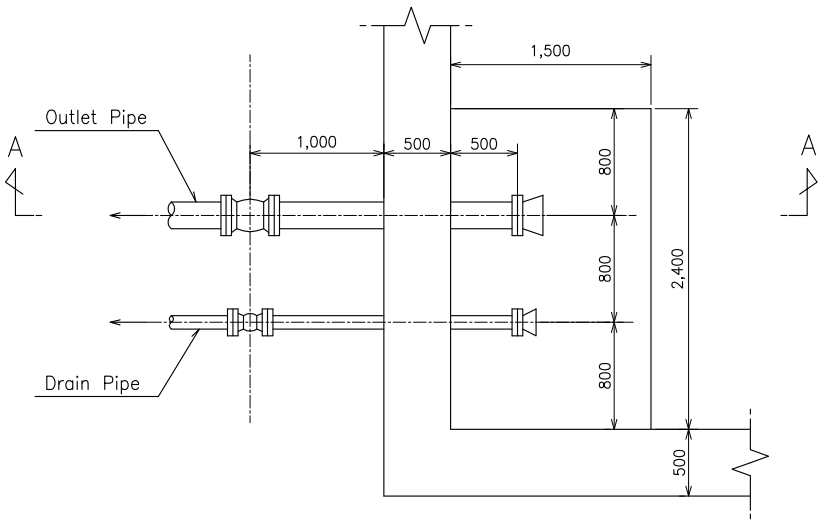
SECTION A–A



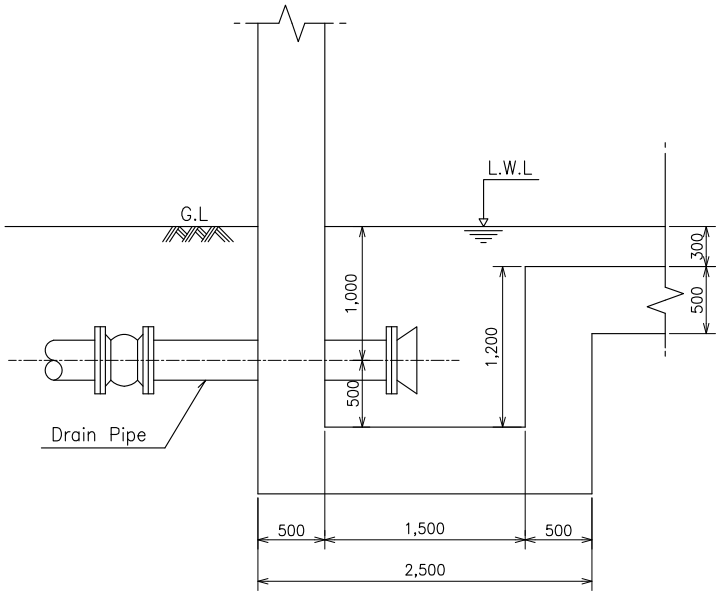
TD-05	TYPICAL DRAWING OF PRESSURE REDUCING VALVE CHAMBER AND AIR VALVE CHAMBER
	減圧弁室及び空気弁室

TYPICAL DRAWING OF PIT FOR OUTLET & DRAIN PIPE

PLAN

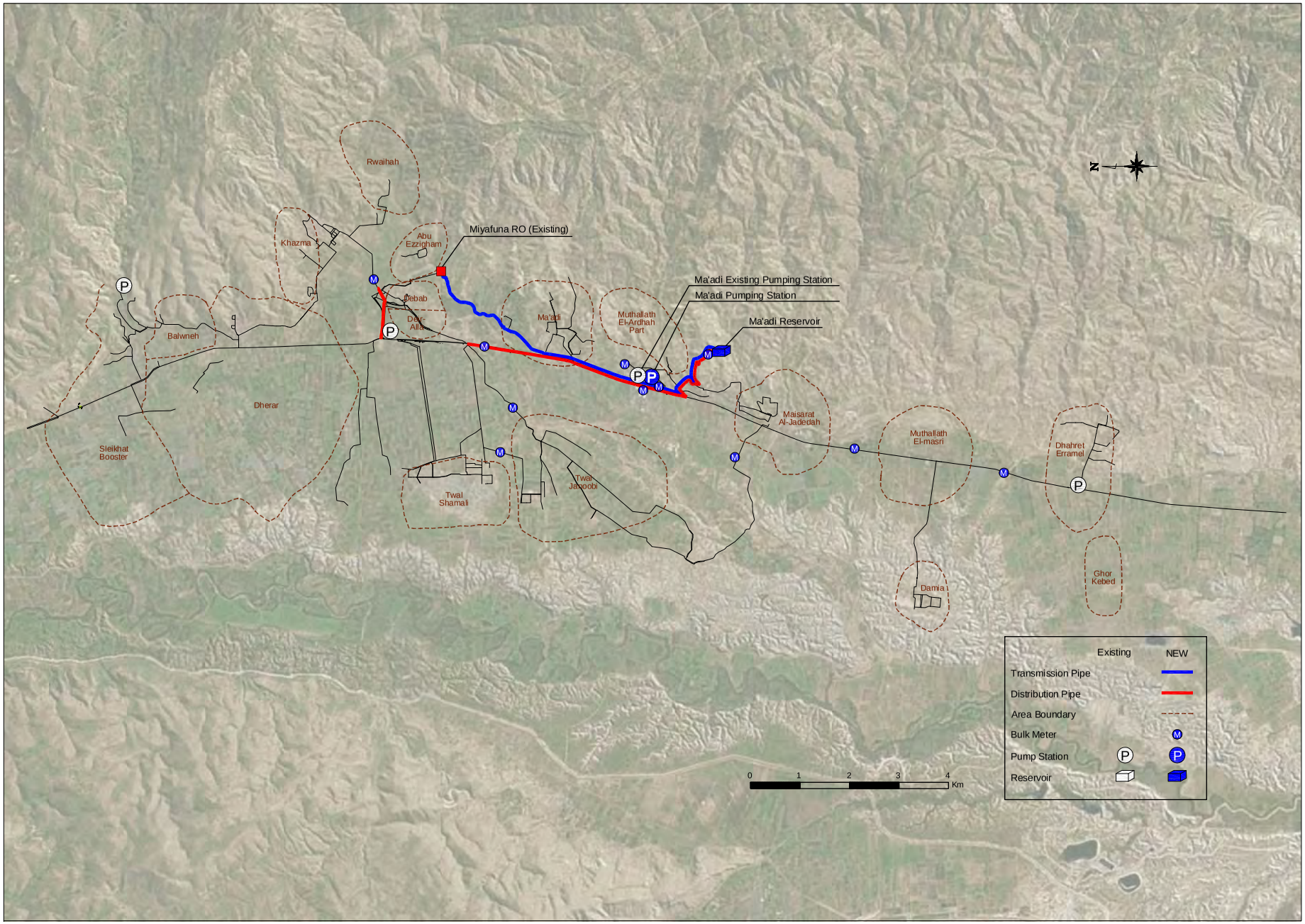


SECTION A–A

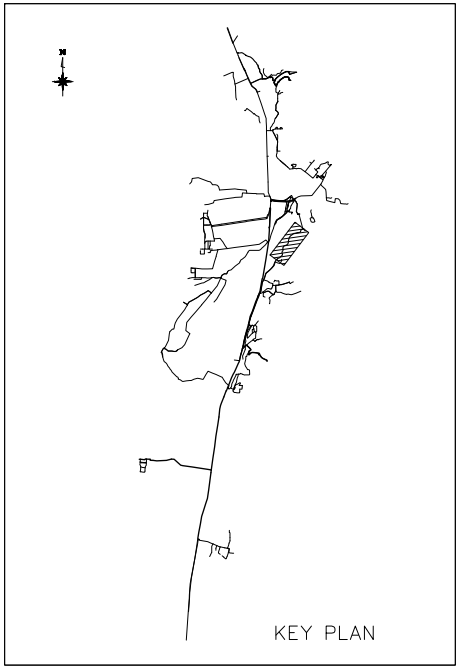


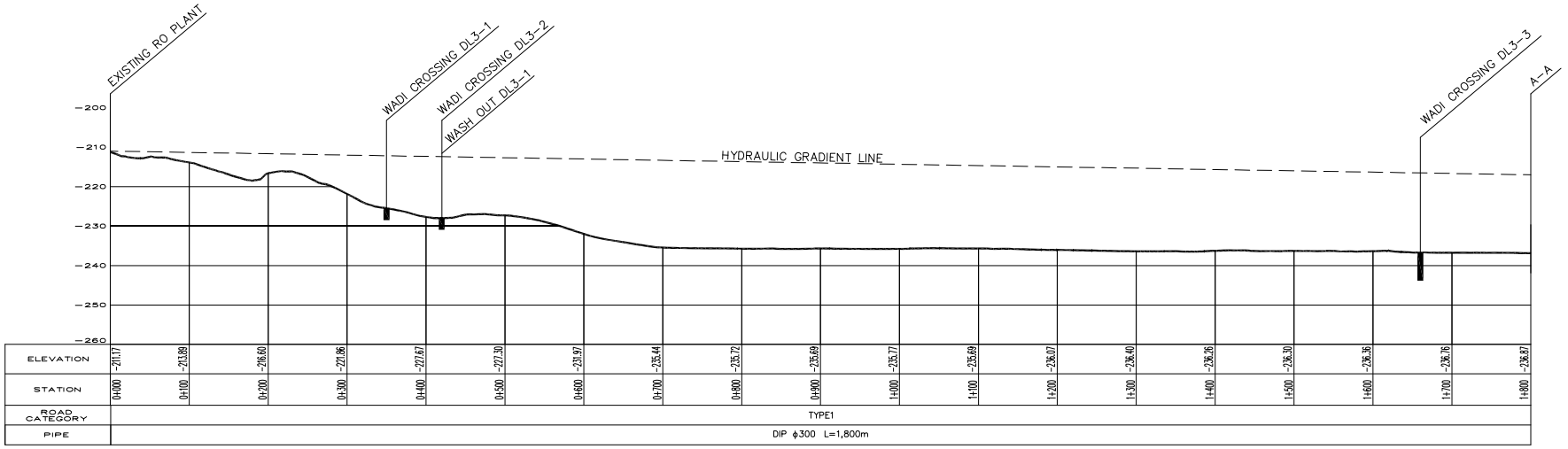
	NAME OF RESERVOIRS		
	MAADI Res.	ABU–NUSSAIR Res. NO.1	ABU–NUSSAIR Res. NO.2
OUTLET PIPE SIZE	ϕ300	ϕ200	ϕ200
DRAIN PIPE SIZE	ϕ100	ϕ100	ϕ100

TD–06	TYPICAL DRAWING OF PIT FOR OUTLET & DRAIN PIPE
	配水池流出ピット詳細図



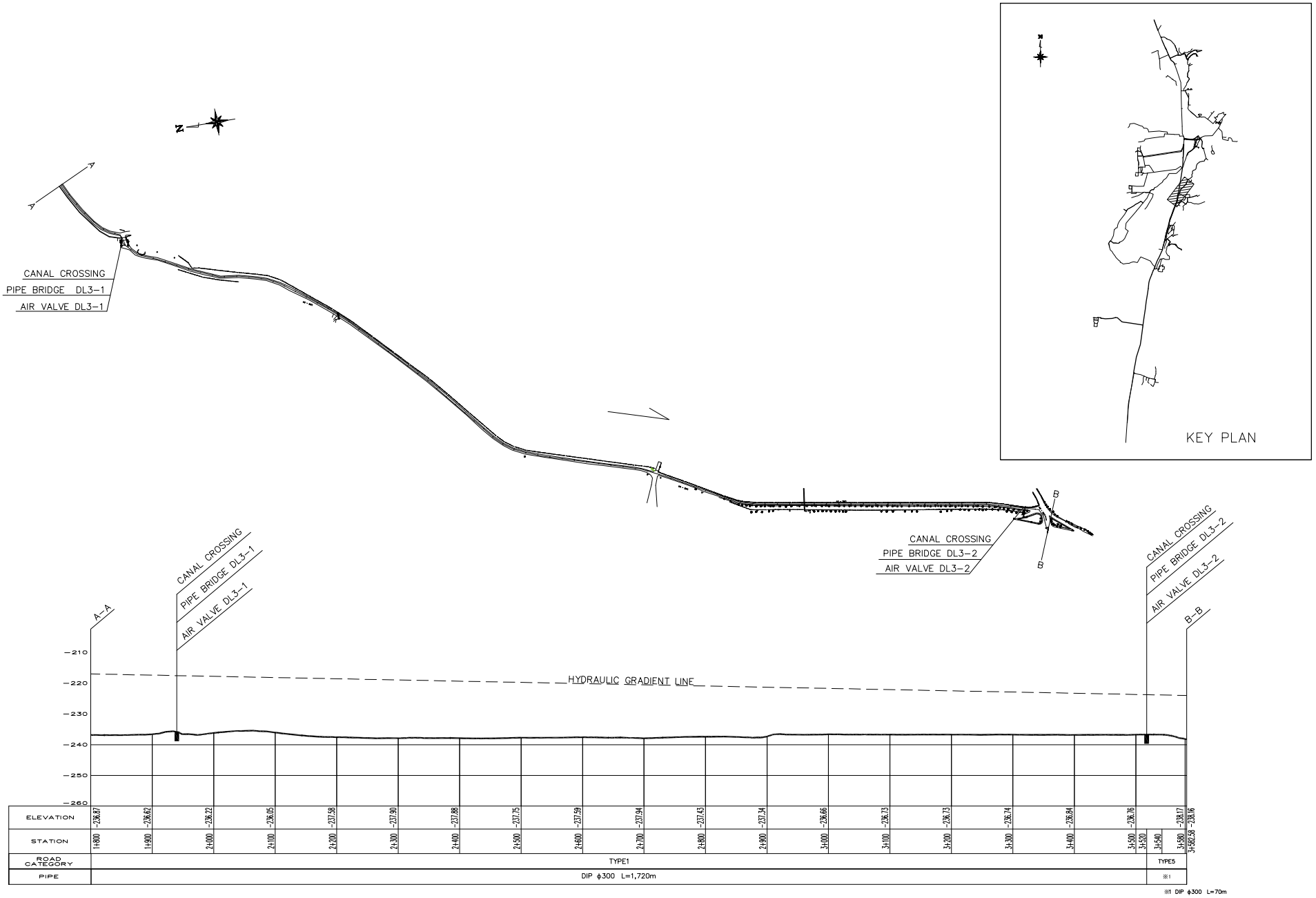
DA-GN-01	GENERAL SITE PLAN (DEIR ALLA)
	全体計画施設配置図（デルアラ地区）



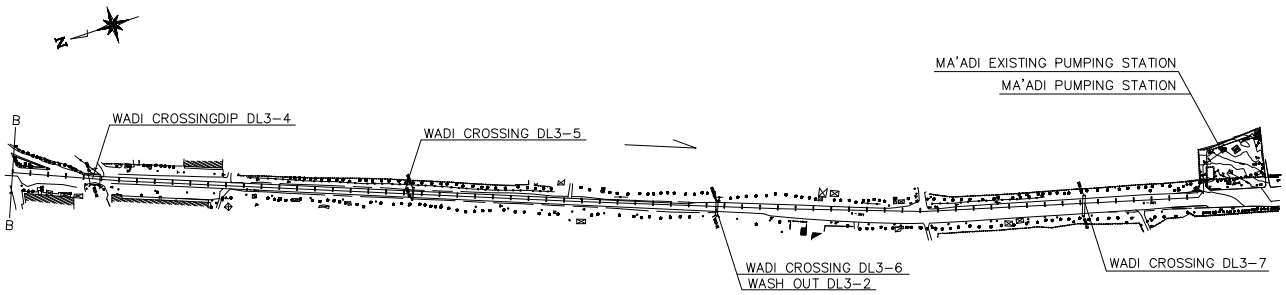


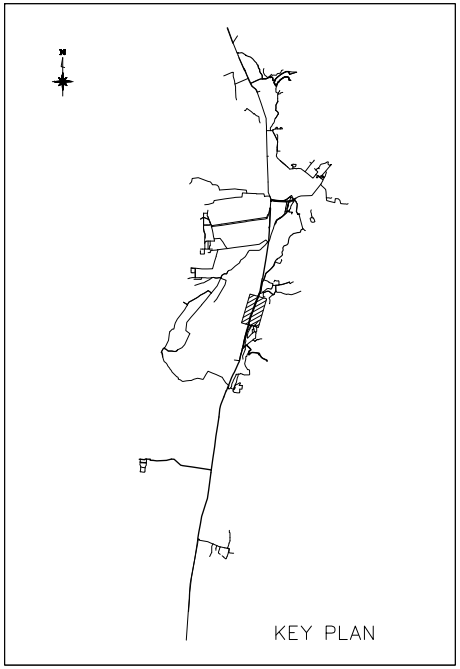
DA-TP-01	PLAN AND PROFILE OF TRANSMISSION LINE FROM EXISTING RO PLANT TO MA'ADI PUMPING STATION (1/3)

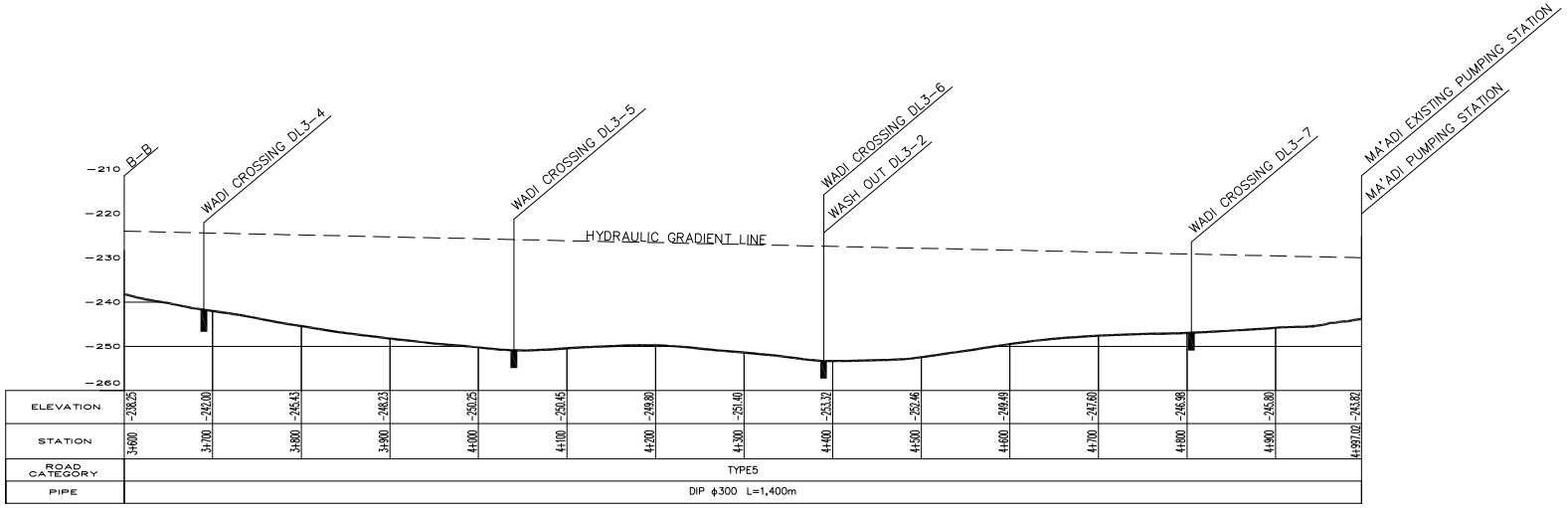
送水管　平面図・断面図（既存RO施設～マアディポンプ場）（1/3）



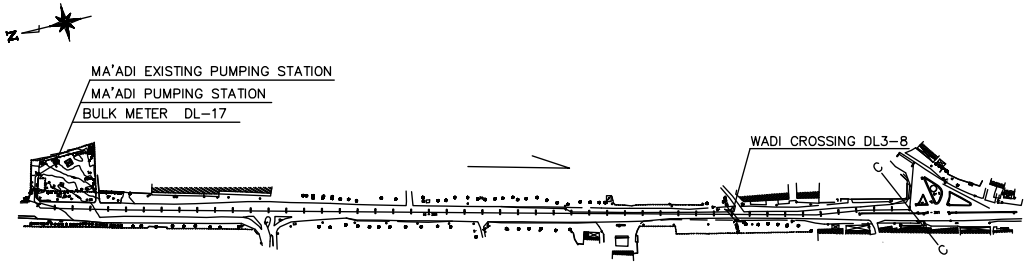
DA-TP-02	PLAN AND PROFILE OF TRANSMISSION LINE FROM EXISTING RO PLANT TO MA'ADI PUMPING STATION (2/3)
送水管　平面図・断面図（既存RO施設～マアディポンプ場）(2/3)	

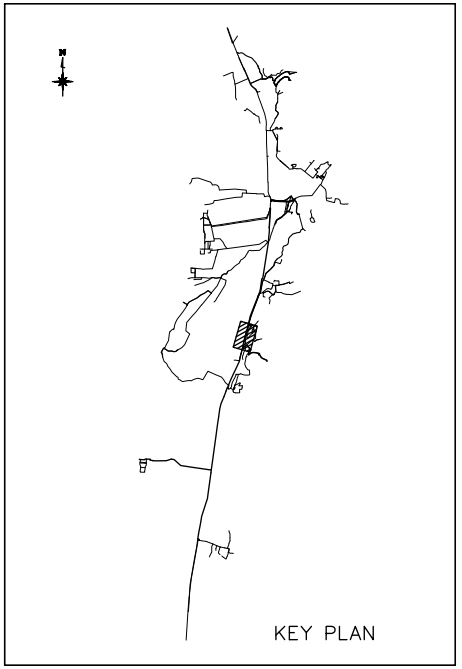


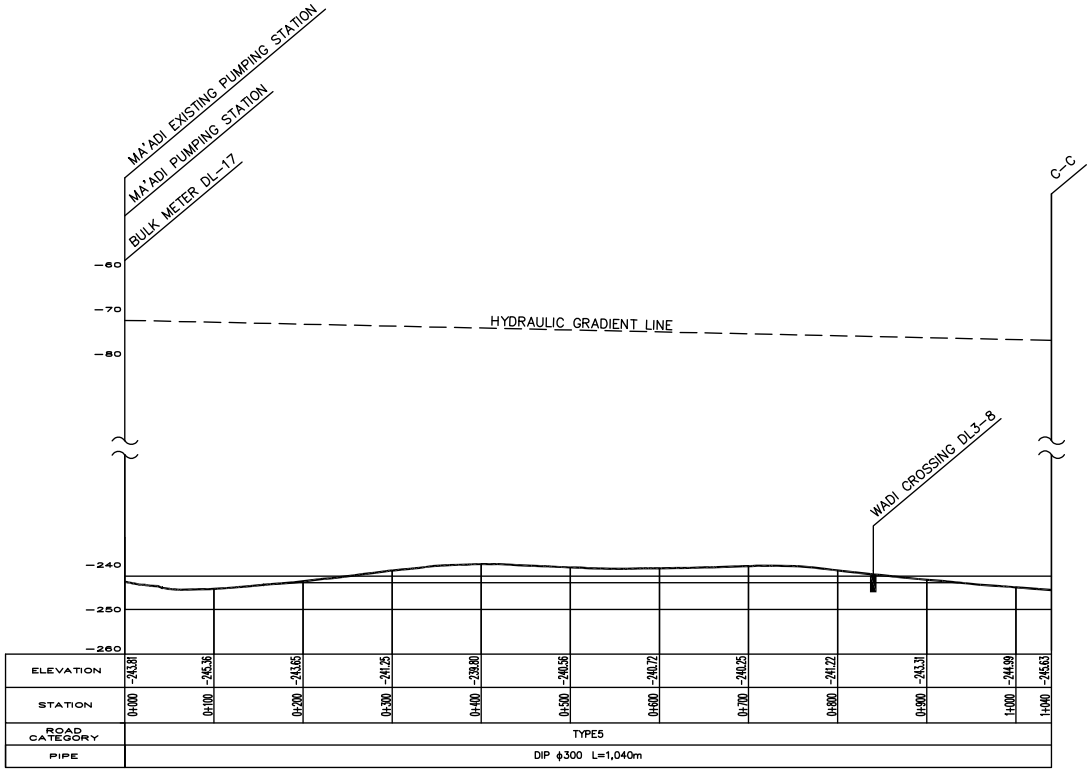




DA-TP-03	PLAN AND PROFILE OF TRANSMISSION LINE FROM EXISTING RO PLANT TO MA'ADI PUMPING STATION (3/3)
送水管　平面図・断面図（既存RO施設～マアディポンプ場）（3/3）	

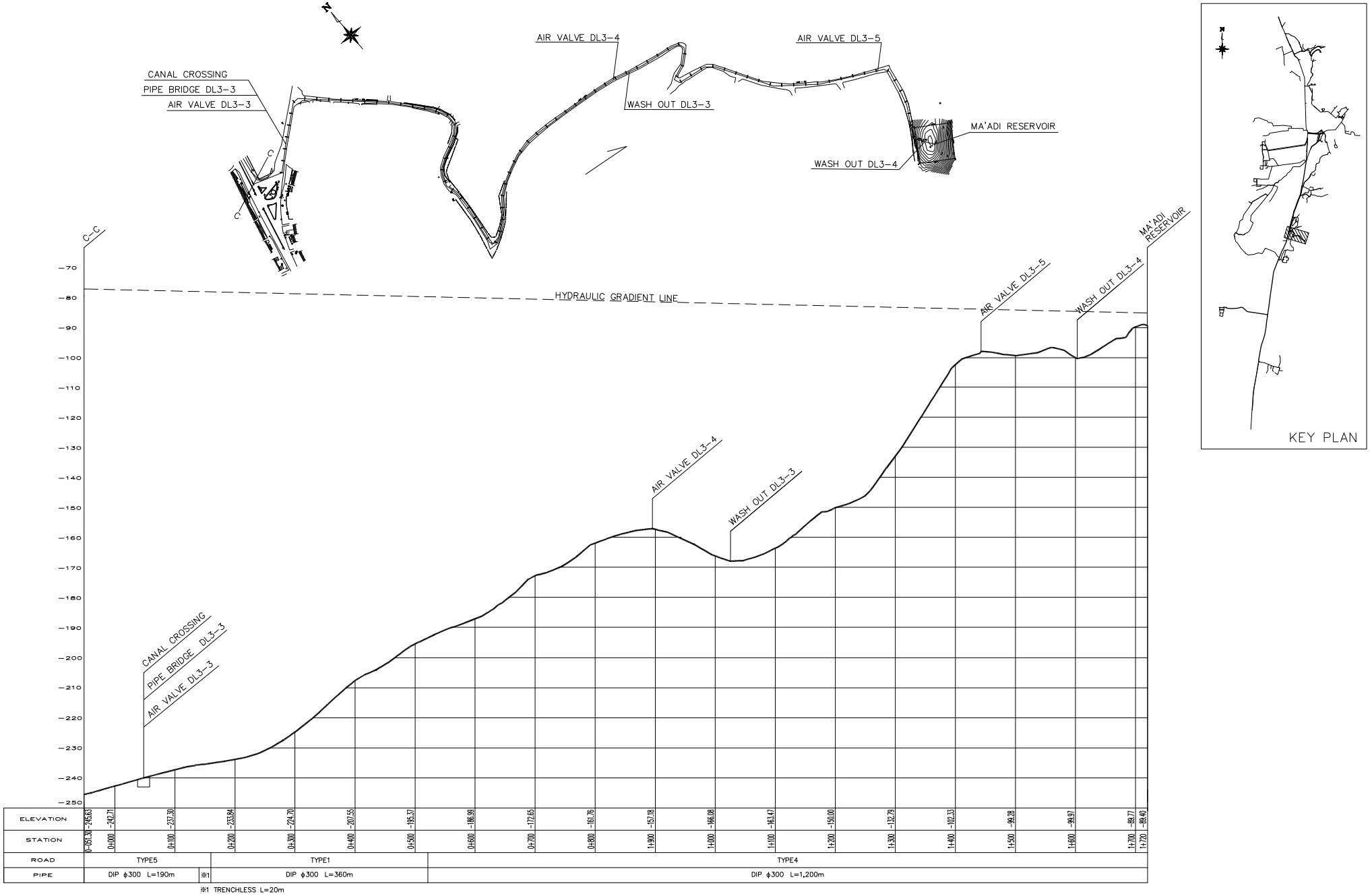






DA-TP-04	PLAN AND PROFILE OF TRANSMISSION LINE FROM MA'ADI PUMPING STATION TO MA'ADI RESERVOIR (1/2)

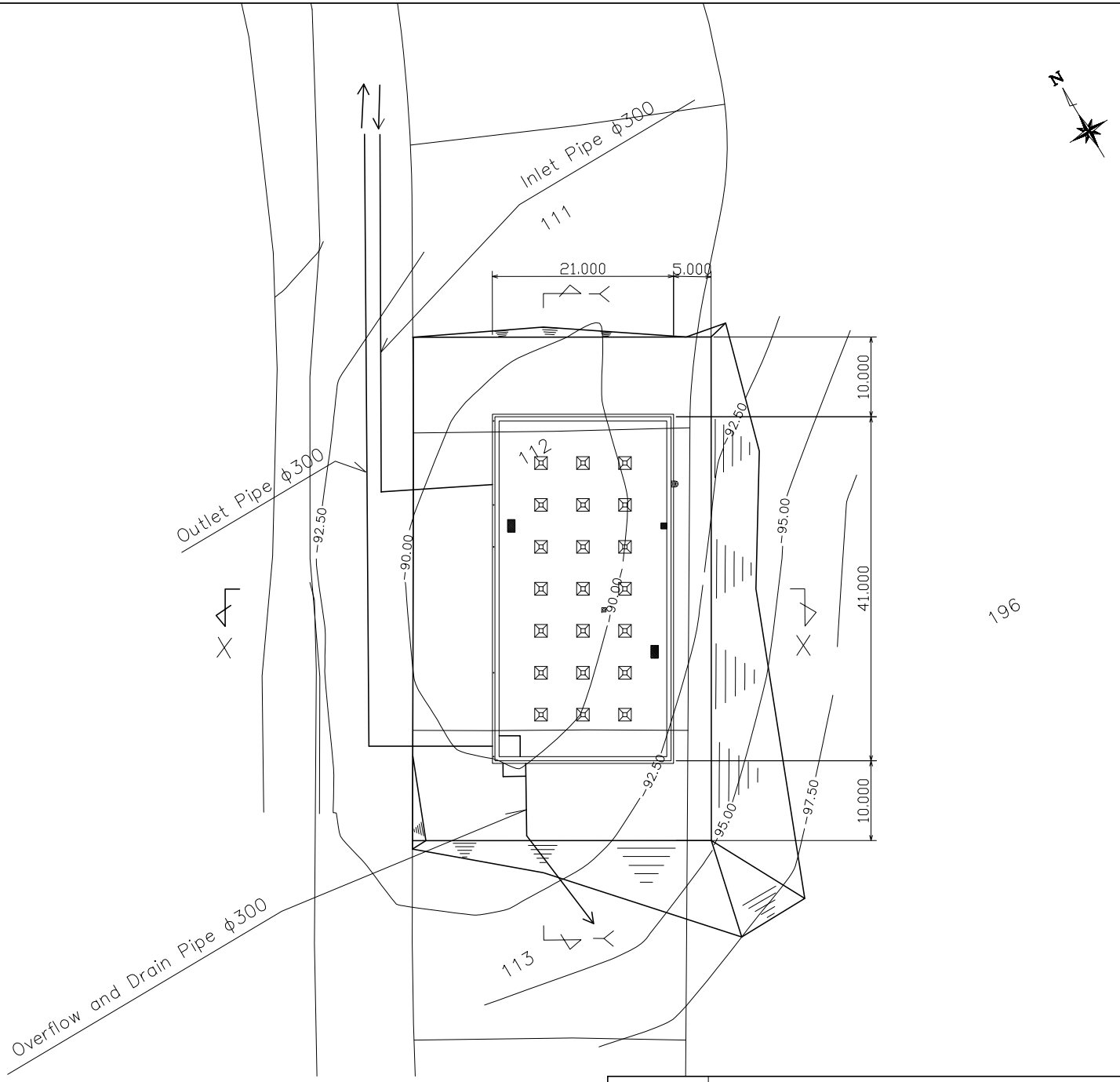
送水管　平面図・断面図（マアディポンプ場～マアディ配水池）（1/2）



A-24

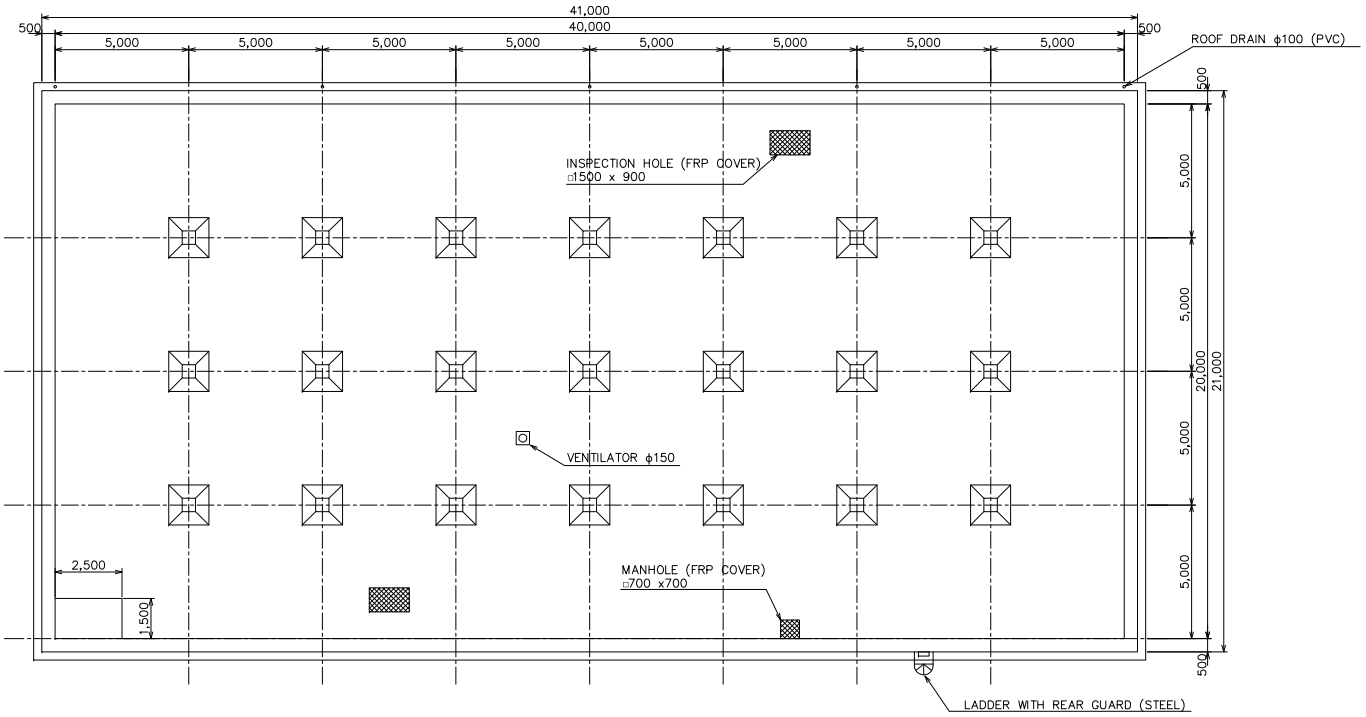
DA-TP-05	PLAN AND PROFILE OF TRANSMISSION LINE FROM MA'ADI PUMPING STATION TO MA'ADI RESERVOIR (2/2)

送水管　平面図・断面図（マアディポンプ場～マアディ配水池）(2/2)

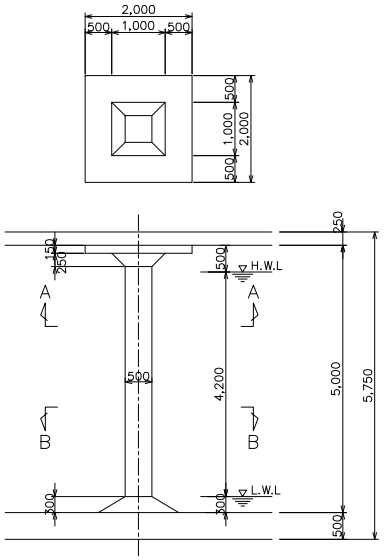


DA-RV-01	LAYOUT PLAN OF MA'ADI RESERVOIR (3,300m³)
	配水池一般平面図（マアディ配水池） 3,300m³

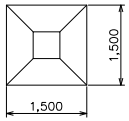
PLAN S=1/200



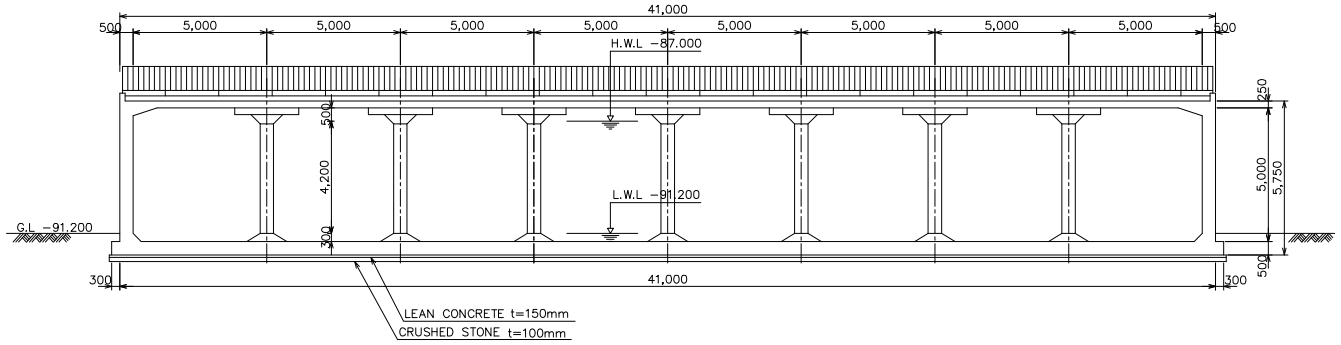
SECTION A−A S=1/100



SECTION B−B S=1/100



SECTION S=1/200



EXTERIOR FINISHING

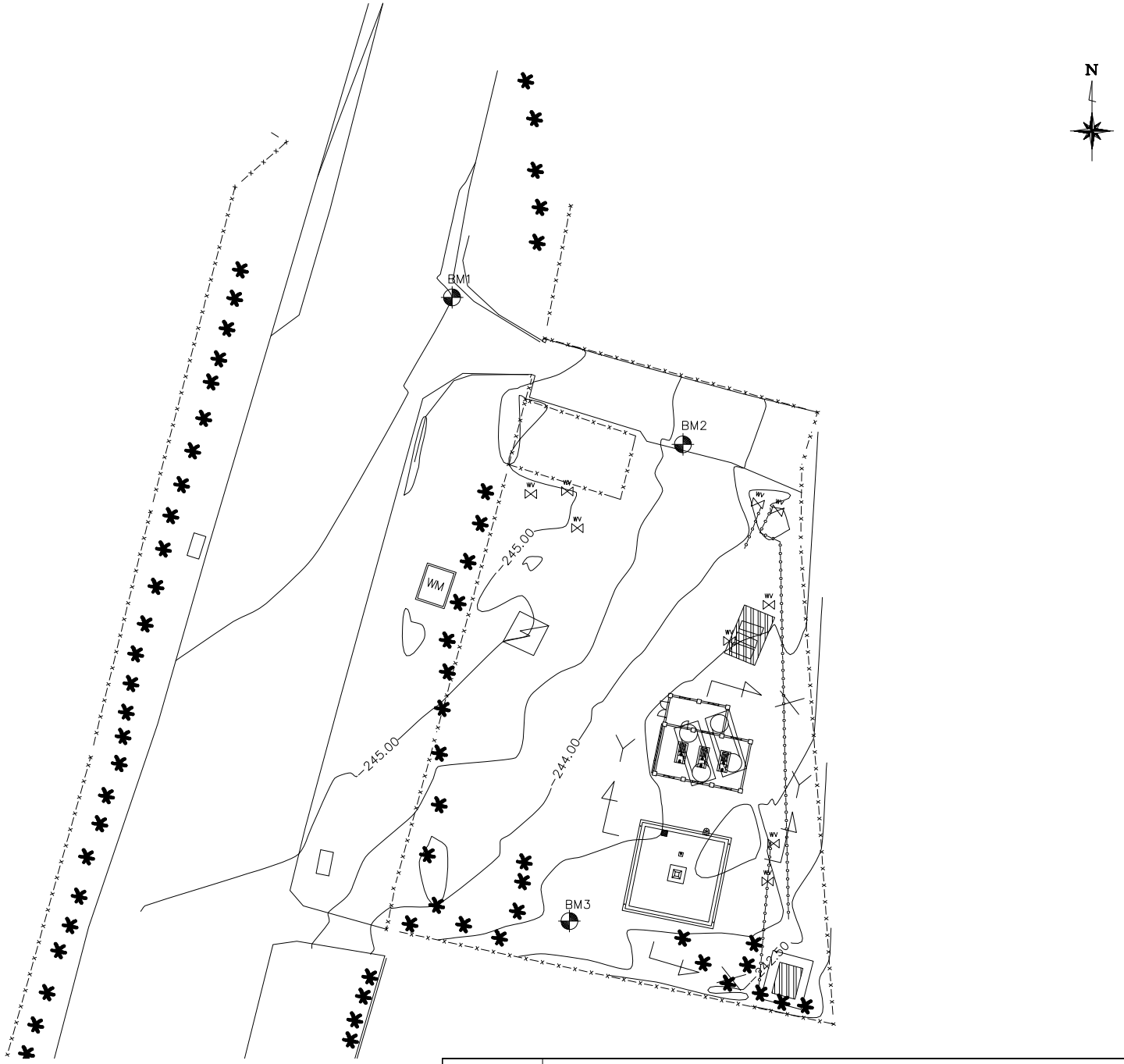
ITEM	FINISHING/SPECIFICATION
EXTERIOR WALL ABOVE G.L	ACRYL EMULSION PAINT ON EXPOSED CONCRETE
EXTERIOR WALL & BASE BELOW G.L	BITUMINOUS COATING ON EXPOSED CONCRETE

INTERIOR FINISHING

ITEM	FINISHING/SPECIFICATION	
DISTRIBUTION RESERVOIR	BASE	WATER PROOFING PAINT
	WALL	WATER PROOFING PAINT
	CEILING	WATER PROOFING PAINT
	COLUMN	WATER PROOFING PAINT

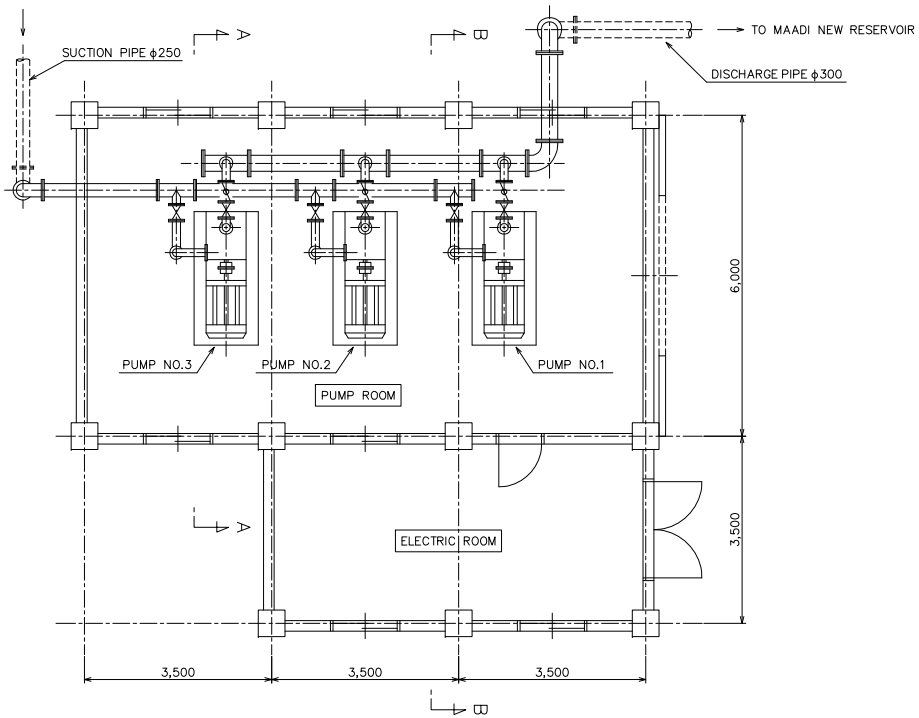
DA-RV-02	STRUCTURAL PLAN AND SECTION VIEW OF MA'ADI RESERVOIR (3,300m³)
	配水池構造図（マアディ配水池） 3,300m³

DA-RV-03	ACCESS ROAD OF MA'ADI RESERVOIR
配水池アクセス道路（マアディ配水池）	



DA-PS-01	LAYOUT PLAN OF MA'ADI PUMPING STATION
ポンプ場一般平面図（マアディポンプ場）	

PLAN S=1/100

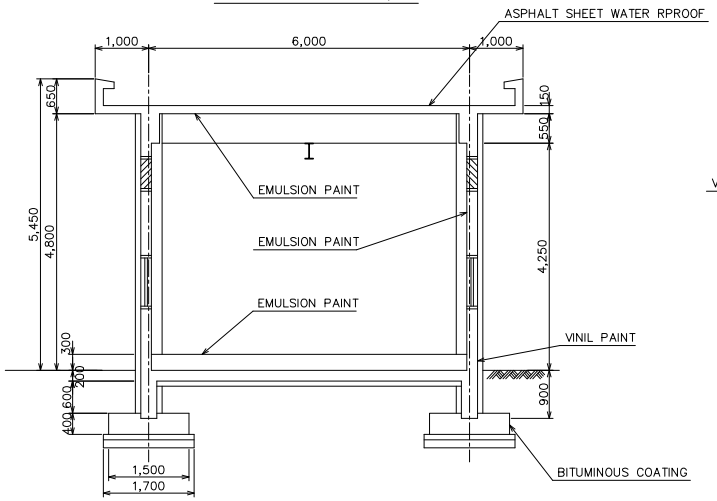


PUMP NO.1			
PUMP		MOTOR	
TYPE	MULTI STAGE HORIZONTAL CENTRIFUGAL PUMP	TYPE	HORIZONTAL SQUIRREL CAGE INDUCTION MOTOR
SUCTION DIA	150 mm	RATED OUTPUT	110 KW
DISCHARGE DIA	125 mm	VOLTAGE	400 V
TOTAL HEAD	170 m	FREQUENCY	50 Hz
CAPACITY	141 m^3/min	NO. OF POLE	4 P
REVOLUTION	1,450 min^{-1}		

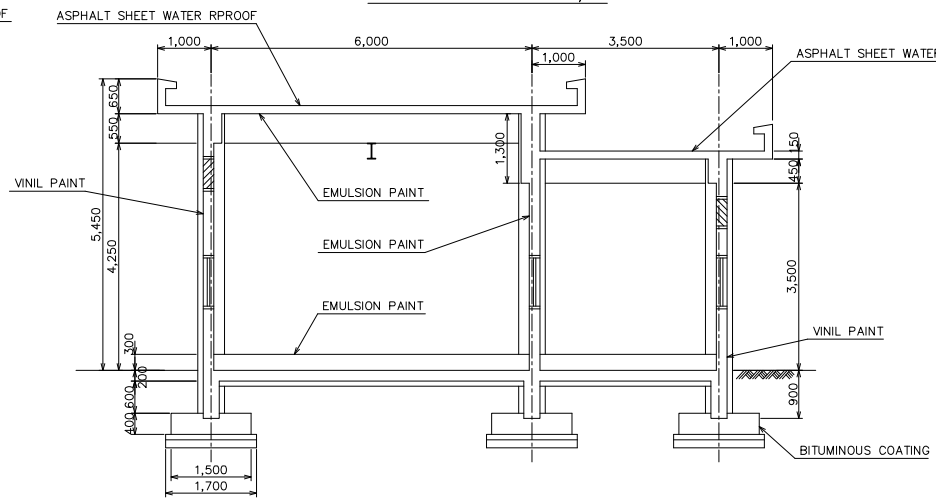
PUMP NO.2			
PUMP		MOTOR	
TYPE	MULTI STAGE HORIZONTAL CENTRIFUGAL PUMP	TYPE	HORIZONTAL SQUIRREL CAGE INDUCTION MOTOR
SUCTION DIA	150 mm	RATED OUTPUT	110 KW
DISCHARGE DIA	125 mm	VOLTAGE	400 V
TOTAL HEAD	170 m	FREQUENCY	50 Hz
CAPACITY	141 m^3/min	NO. OF POLE	4 P
REVOLUTION	1,450 min^{-1}		

PUMP NO.3			
PUMP		MOTOR	
TYPE	MULTI STAGE HORIZONTAL CENTRIFUGAL PUMP	TYPE	HORIZONTAL SQUIRREL CAGE INDUCTION MOTOR
SUCTION DIA	150 mm	RATED OUTPUT	110 KW
DISCHARGE DIA	125 mm	VOLTAGE	400 V
TOTAL HEAD	170 m	FREQUENCY	50 Hz
CAPACITY	141 m^3/min	NO. OF POLE	4 P
REVOLUTION	1,450 min^{-1}		

SECTION A-A S=1/100

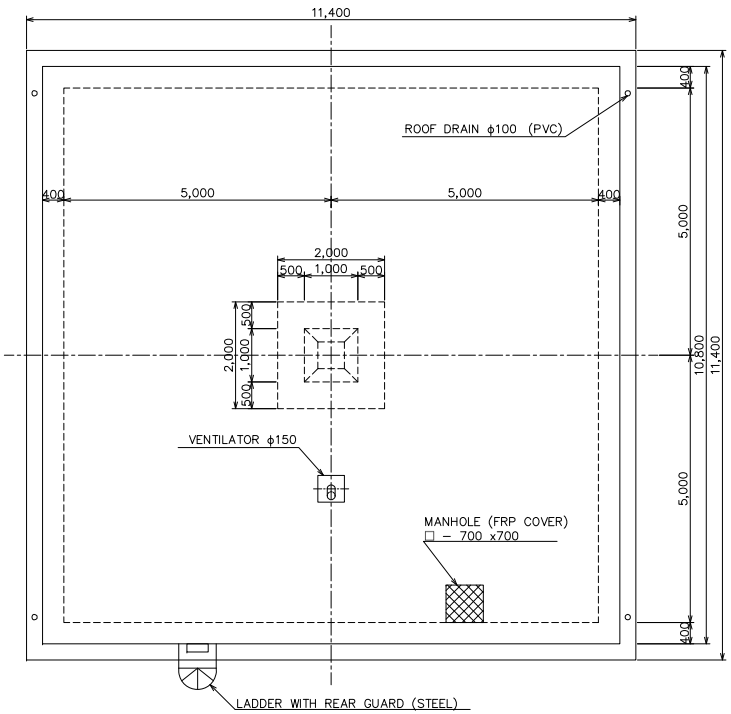


SECTION B-B S=1/100

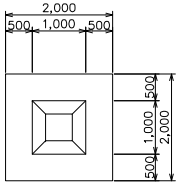


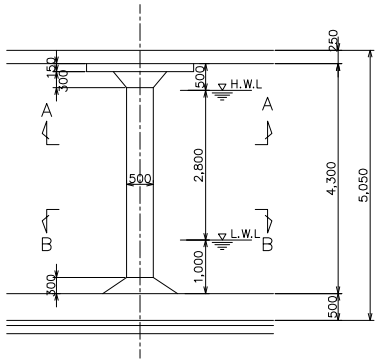
DA-PS-02	STRUCTURAL PLAN AND SECTION VIEW OF MA'ADI PUMPING STATION
	ポンプ場構造図（マアディポンプ場）

PLAN S=1/100

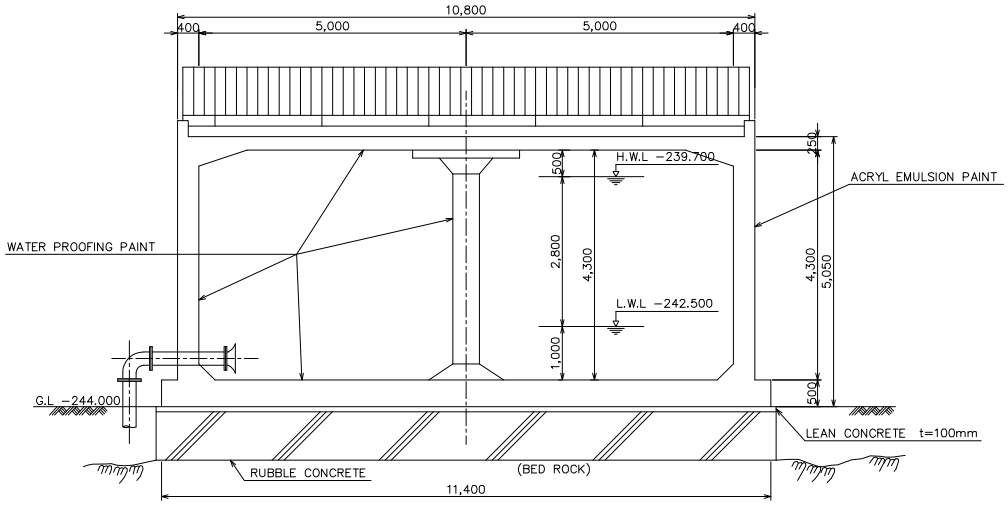


SECTION A–A S=1/100

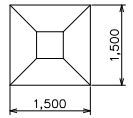




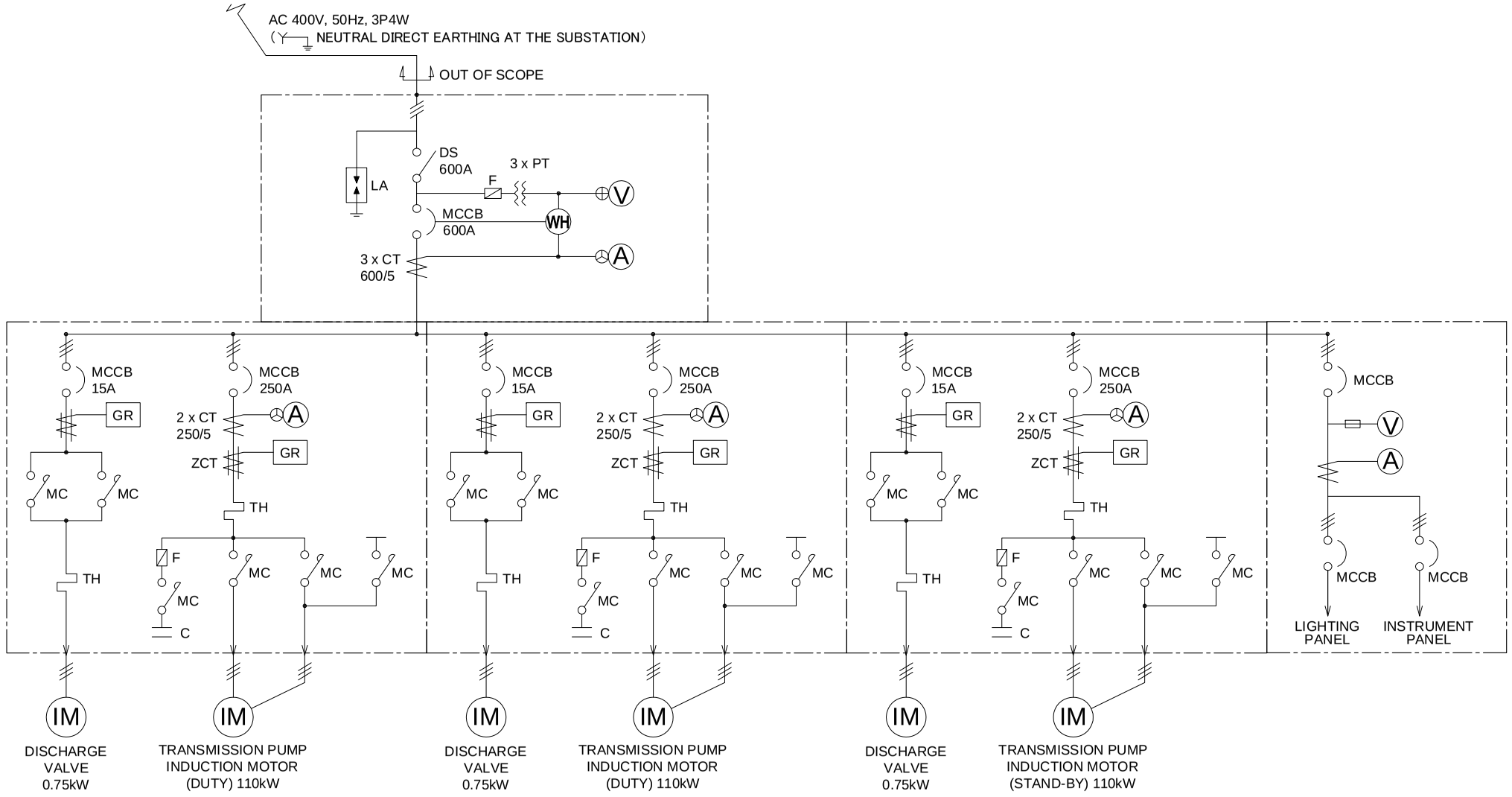
SECTION S=1/100



SECTION B–B S=1/100

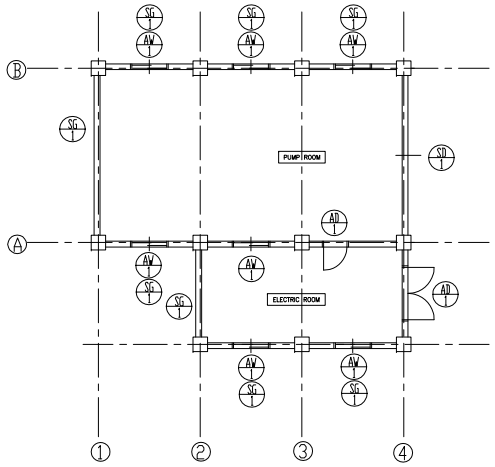


DA-PS-03	STRUCTURAL PLAN AND SECTION VIEW OF MA'ADI PUMP SUCTION TANK
	ポンプ井構造図（マアディポンプ場）

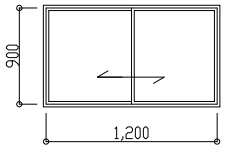


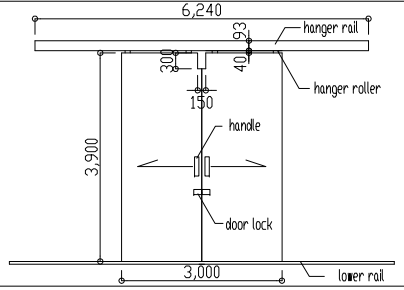
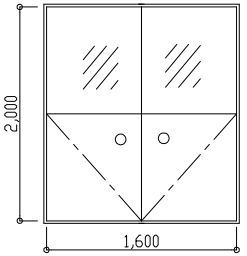
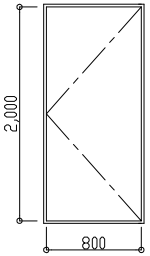
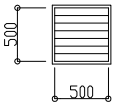
DA-PS-04	SINGLE LINE DIAGRAM OF MA'ADI P/S
	ポンプ場単線結線図（マアディポンプ場）

DOOR AND WINDOWS SCHEDULE IN MAADI PUMP STATION



KEY PLAN

MARK QUANTITY	AW 1 Double sliding window	7 P.C.S				
FIGURE						
ROOM	PUMP ROOM & ELECTRIC ROOM					
MATERIAL FINISH	Aluminum frame					
FRAME WIDTH	70					
GLASS	Clear Float Glass t=6mm					
HARDWARE	Aluminum sash accessories					
REMARK						

MARK QUANTITY	SD 1 both sliding door	1 P.C	AD 1 double swing door	1 P.C	AD 2 double swing door	1 P.C	SG 1 Louver	8 P.C.S
FIGURE								
ROOM	PUMP ROOM		ELECTRIC ROOM		PUMP ROOM		PUMP ROOM ELECTRIC ROOM	
MATERIAL FINISH	steel / oil paint						steel / oil paint	
FRAME WIDTH			70		70		70	
GLASS			Frosted Glass t=6mm					
HARDWARE	handle door lock hanger rail hanger roller 60φ lower rail		cylinder lock with grip ball hinge / door closer		cylinder lock with grip ball hinge / door closer			
REMARK	bracket :L-90×90							

DA-PS-05	DOOR AND WINDOWS SCHEDULE IN MAADI PUMP STATION
ポンプ場建具表（マアディポンプ場）	

primary power supply, asphalt paving roads within premises, planting, and construction of fencing and gates, can be performed by the Jordanian side considering WAJ's financial situation. Therefore, the works to be undertaken by the recipient country should be carried out without fail for successful completion of the project.

In the light of the budget arrangement of the recipient country for the project and construction schedule of the project, the recipient country shall preparing the work schedule of the components and monitor implementation progress of procurement of the project, and so on.

(2) Capacity development of the O&M ability through soft-component

To continuously operate and maintain the new facilities constructed during the project, capacity development of the O&M ability of the staff in the two WAJ district offices is important. For this purpose, soft component will be implemented. Special care should be taken to select trainees and an understanding of the importance of the soft component should be enhanced in the organizations, to achieve sure outcomes of the soft component.

3-3 Important Assumptions

(1) No deterioration of security and political conditions in Jordan

Conflict of neighboring countries, increased number of refugees from neighboring countries due to it, especially a rapid increase of the Syrian refugees, etc. are the elements of destabilization of security. It is required that the security situation in Jordan will not be deteriorated extremely so that the project cannot be completed.
In addition, like the "Arab Spring", mayhem has occurred in the request process of democratization of the people in the Arab countries in recent years. It is required that the political situation in Jordan will not deteriorated extremely in these regards.

(2) Continuous transfer of water to Balqa Governorate

The water source of Balqa Governorate relies on water transfer from the Miyahuna Water Company. In addition, it is planned that additional water supply amount will be transferred from the surplus water generated by Disi project implementation. The water transfer from these sources outside Balqa governorate will be continuously carried out to Balqa.

(3) No degrease of water sources in Jordan due to drought

When it becomes drought as rainfall is small, there is a possibility that the water amount to the target

area is reduced.

3-4 Project Evaluation

3-4-1 Relevance

(1) Beneficiaries and population

The water service for the approximately167,000 residents in 2020 of the project area in Baqa'a which is one of the less developed governorates of Jordan shall be improved by implementing the project. The benefits of water service will be expected also for the residents living both in Palestinian refugee camp and other refugee camps in Baqa'a having the influx from Syria.

(2) Project objective and BHN

The water supply time of the project area is 1~3 days/week, and the average daily revenue water per capita is only 51L for Ain Al Basha and 71L for Deir Alla, therefore the residents are forced to have inconvenient lives. The implementation of the project can lead to appropriate water supply pressure, reduce the leakage ratio, resulting in increase of water consumption, or enable water supply to more population in the future from the same water resource volume. Additionally, water supply time will be increased. The project enables to upgrade the water supply service to a certain level required for minimum standard of life and can contribute to satisfy the basic human needs (BHN).

(3) Improvement of residents' lives and stabilization of standard of life

The project contributes to improving the residents' lives through improvement of water supply service and decreasing of the frequency of purchasing expensive water from water venders. The project area includes refugee camp and thus the project contributes to improvement of the welfare and the stabilization of people's livelihood in the camp.

(4) Improvement of financial situation

The project enables to contribute to reduction of NRW, increase of water supply amount and of efficiency of pump operation and to supply water by using residual pressure from Zai water treatment plant. Thus increase of revenue and reduction of electricity costs are expected to improve financial situation of WAJ Baqa'a office.

(5) Facilities that are easily operated and maintained

By setting up of water distribution zones, and restructuring the trunk transmission and distribution system, water supply facilities that can easily be operated and maintained will be developed. As a result, amount of work for operation and maintenance, and thus reduction of related costs are expected. Additionally, the reduced work will be utilized for implementing the activities for planned NRW management.

(6) Contribution to mid-to-long term development plan

In the policy of the mid-to-long term plan of Jordan, the "National Water Strategy", the limited water resource shall be effectively used as much as possible. This project contributes to achieving the objective of the mid-to-long term plan through reducing leakages and NRW.

(7) Utilization of prominent Japanese technology and products

For the project, prominent Japanese products of ductile cast iron pipe (DCIP), pressure reducing valve (PRV), and pumps, etc. and prominent Japanese technology for pipe connection method of under-pressure connection / branching works and trenchless construction method are applicable.

(8) Contribution to measures for environment and climate change

The project enables to reduce leakage, use efficient pump operation, and use residual pressure, which will contribute to reducing the power consumption, resulting in reducing CO_2. Japan is addressing assistance for projects that settle the environmental and climate change issues including global warming, thus, the project matches the aid policy of Japan.

3-4-2 Effectiveness

(1) Quantitative Outcomes

Implementation of this project is expected to yield the quantitative outcome as shown in the table below, in which the conditions of the base year in 2012 and the outcomes are estimated in 2020 by area.

Table 3-1 Expected quantitative outcomes of the project

Indicators	Unit	Current values in 2012		Target values in 2020	
		Deir Alla	Ain Al Basha	Deir Alla	Ain Al Basha
Supply pressure	MPa	0.01 - 3.0	0.01 - 2.0	0.1 – 0.7	0.1 - 0.7
Daily average water supply amount	m^3/day	8,900	20,000	9,100	27,200
Electricity consumption per m^3	kWh/m^3	0.688	0.458	0.611	0.239

Note:

1) Supply pressure: The current values are referred to water pressure survey result (Appendix6.9) and the target values are estimated from the existing pump head (Figure 2-10 and 2-16)
2) Daily average water supply amount: The target values are obtained water supply amount in 2012 and the target values are referred to Table 2-13 and Table 2-15.
3) Electricity consumption per m^3: The current values and target values are referred to Appendix 6.7 (Study on Effect of Reduction of Power Consumption and CO_2).

(2) Qualitative Outcomes

a. The living environment of the residents is improved because of improvement in water supply conditions through reduction of non-revenue water (NRW), improvement in water quality, and reduction of insufficient water pressure areas.
b. The project enables WAJ to carry out efficient water distribution management.

3-4-3 Conclusions

The project eventually contributes to satisfy the BHN of residential people and stabilize people's livelihood in Jordan. Also this project matches the assistance policy for Syrian refugee and the aid policy of Japan, thereby it can be said that the relevance is high. Increase of water supply time and amount by optimization of water supply pressure are expected to be the effects of the project implementation. Therefore, considering the above, it can be expected that the relevance and the effectiveness of the project is high.