Appendices

Appendix 1. Member List of the Survey Team

【First Stage Survey in Jordan】

Name	Job Title	Occupation
Mr, Junji YOKOKURA	Leader	Senior Advisor,Office for Climate Change, JICA
Ms. Tomoko NOMURA	Procurement Planning	Japan International Cooperation System (JICS)
Mr. Tomohiro KAWASE	Study Planning	Program Officer, Water Resource Management Division I Water Resource and Disaster Management Group Global Environment Department, JICA
Mr. Shigeo OTANI	Chief Consultant / Technical Assistance Planning / Operation and Maintenance Planning	Manager, International Department Kyowa Engineering Consultants Co., Ltd.
Mr. Koji NAITO	Water Supply Planning	International Department Kyowa Engineering Consultants Co., Ltd.
Mr. Yuichi MATSUMOTO	Equipment Planning	International Department Kyowa Engineering Consultants Co., Ltd.

【Second Stage Survey in Jordan】

Name	Job Title	Occupation
Mr. Junji YOKOKURA	Leader	Senior Advisor,Office for Climate Change, JICA
Ms. Tomoko NOMURA	Procurement Planning	Japan International Cooperation System (JICS)
Mr. Tomohiro KAWASE	Study Planning	Program Officer, Water Resource Management Division I Water Resource and Disaster Management Group Global Environment Department, JICA
Mr. Shigeo OTANI	Chief Consultant / Technical Assistance Planning / Operation and Maintenance Planning	Manager, International Department Kyowa Engineering Consultants Co., Ltd.
Mr. Koji NAITO	Water Supply Planning	International Department Kyowa Engineering Consultants Co., Ltd.
Mr. Yuichi MATSUMOTO	Equipment Planning	International Department Kyowa Engineering Consultants Co., Ltd.
Mr. Tadashi OHASHI	Procurement Planning / Cost Estimate O&M planning	International Department Kyowa Engineering Consultants Co., Ltd.

【**Explanation on Draft Outline Design Study Report**】

Name	Job Title	Occupation
Mr. Shigeru OKAMOTO	Team Leader	Chief Representative, Jordan Office, JICA
Mr. Tomohiro KAWASE	Study Planning	Program Officer, Water Resource Management Division I Water Resource and Disaster Management Group Global Environment Department, JICA
Mr. Shigeo OTANI	Chief Consultant / Technical Assistance Planning / Operation and Maintenance Planning	Manager, International Department Kyowa Engineering Consultants Co., Ltd.
Mr. Yuichi MATSUMOTO	Equipment Planning	International Department Kyowa Engineering Consultants Co., Ltd.
Mr. Tadashi OHASHI	Procurement Planning / Cost Estimate O&M planning	International Department Kyowa Engineering Consultants Co., Ltd.

Appendix 2. Survey Schedule

【Itinerary of the First Stage Survey in Jordan】

Day	Date		JCA and JICS Team (Leader, Procurement Planning, Study Planning)	Consultant Team		
				Chief Consultant/ Technical Assistance Planning/Operation and Maintenance Planning	Water Supply Planning	Equipment Planning
1	3-Apr-09	Fri		Transfer Tokyo(10:30)→Bangkok(15:05)		
2	4-Apr-09	Sat	Transfer Tokyo(19:55) → Kansai(21:10) Transfer Kansai(23:15) → Dubai(05:30)	Transfer Bangkok(0:30)→Amman(05:15) Site Survey		
3	5-Apr-09	Sun	Transfer Dubai(07:25) → Amman (9:40)	Site Survey (Hitten Reservoir, Russaifa High/Low Reservoir)		
			JICA Jordan Office(12:30), Meeting at MOPIC(14:00), WAJ Secretary General (15:00), Meeting in WAJ(15:45), Embassy of Japan (16:30)			
4	6-Apr-09	Man	Discussion of IC/R(9:00)、Interview with GTZ/IEE Project Manager(13:30)、Visit to MCC(15:00)			
5	7-Apr-09	Tue	Site Survey (WAJ Zarqa、Zarqa PS, Khaw PS, Central Work Shop, Hitten Reservoir, Russerifa Reservoir			
6	8-Apr-09	Wed	Meeting at MOPIC(8:30)	Internal Meeting of Consultant		
			Discussion of M/D with WAJ(10:00), Sign of M/D(15:30)			
7	9-Apr-09	Thu	Embassy of Japan(9:00), JICA Jordan Office(10:00) Transfer Amman(17:30) → Dubai (21:15)	Data Collection in WAJ		
8	10-Apr-09	Fri	Transfer Dubai(02:35) → Kansai(17:20) Transfer Kansai(19:15) → Tokyo(20:25)	Site Survey (Awajanm, Sukhna PS, Sukhna Reservoir, Hashemeyeh (Reservoir, Well, PS)		
9	11-Apr-09	Sat		Site Survey (Zarqa PS)、Data Collection at WAJ Zarqa		
10	12-Apr-09	Sun		Data Collection at WAJ Zarqa, Site Survey (Azraq PS, Azraq Well, Transmission Pipeline)		
11	13-Apr-09	Man		Meeting at WAJ Zarqa, Inverview as GIS Section, Survey at PS(Hallabat, Khaw)		
12	14-Apr-09	Tue		Data Collection as WAJ Central, Confirmation of Request Materials, Interview with Construction Company		
13	15-Apr-09	Wed		Data Collection, Site Survey at Merheb PS		
14	16-Apr-09	Thu		Data Collection		
15	17-Apr-09	Fri		Data Collection		
16	18-Apr-09	Sat		Data Arrangement, Meeting at WAJ Zarqa		
17	19-Apr-09	Sun		Confirmation of Requested Items at site, Meeting with WAJ-COD		
18	20-Apr-09	Man		Confirmation of other project by other donor, Interview with Construction Company and Supplier		
19	21-Apr-09	Tue		Meeting with WAJ, Meeting with GTZ(10:00), Data Collection, Collection of Water Payment Data		Transfer Amman (2:10)→ Bangkok(15:15 22:25)→
20	22-Apr-09	Wed		Data Collection		→Tokyo(6:30)
21	23-Apr-09	Thu		Preparation of Technical Memorandum, Meeting with WAJ-PMU, Sign of M/M,		
22	24-Apr-09	Fri		Data Arrangement		
23	25-Apr-09	Sat		Site Survey (Zarqa PS, WAJ Zarqa, Basateen PS, WAJ Russaifa, Distribution Network and Meter)		
24	26-Apr-09	Sun		Meeting at WAJ, JICA Jordan Office(15:00)、Embassy of Japan(16:30)		
25	27-Apr-09	Man		Transfer Amman(2:10)→Bangkok(15:15 22:25) →		
26	28-Apr-09	Tue		→Tokyo(6:30)		

[Itinerary of the Second Stage Survey in Jordan]

Day	Date		JCA and JICS Team (Leader, Procurement Planning, Study Planning)	Consultant Team			
				Chief Consultant/ Technical Assistance Planning/Operation and Maintenance Planning	Water Supply Planning	Equipment Planning	Procurement Planning/Cost Estimation
			Mr. Yokokura, Ms. Nomura, Mr. Kawase	Mr. Otani	Mr. Naito	Mr. Matsumoto	Mr. Ohashi
1	13-Jun-09	Sat	Transfer Tokyo(20:30) → Kansai (21:45) Transfer Kansai(23:15) → Dubai(04:45)	Transfer Tokyo(10:30)→Bangkok(15:05)			
2	14-Jun-09	Sun	Transfer Dubai(07:25) → Amman(9:20) 13:00 Meeting at JICA Jordan Office 14:00 Courtesy call to Ministry of Planning & International Cooperation 15:00 Ministry of Water & Irrigation and WAJ Secretary General, Submission of Interim Report to WAJ, Meeting with WAJ 17:30 Meeting with Embassy of	Transfer Bangkok(0:30)→Amman(05:15)			
3	15-Jun-09	Man	9:00 Meeting with GTZ (IEE Project) and WAJ (@WAJ) Discussion about Interim Report 14:00 Meeting with MCC				
4	16-Jun-09	Tue	Site Survey (WAJ Zarqa Office, Azraq PS, Hallabat PS)				
5	17-Jun-09	Wed	Discussion with WAJ, Ministry of Planning & Irrigation				
6	18-Jun-09	Thu	Signing of M/D 15:00 Report to JICA 16:30 Report to Embassy of Japan				
7	19-Jun-09	Fri	Transfer Amman(17:15) → Dubai (21:10)	Individual Study		Transfer Tokyo(10:30) →Bangkok(15:05)	
8	20-Jun-09	Sat	Transfer Dubai(03:10) → Kansai(17:20) Transfer Kansai(19:15) → Tokyo(20:25)	Individual Study		Transfer Bangkok(0:30) →Amman(05:15)	
9	21-Jun-09	Sun		Survey of Construction Capacity & Procurement Condition	Data Collection in WAJ Dept. Statistics	Inspection of Pumping Stations	
10	22-Jun-09	Man			Khaw PS, Azraq PS Mesurement of Base Line Data		Survey of Procurement Condition
11	23-Jun-09	Tue			Khaw PS, Hallabat PS Mesurement of Base Line Data		am Survey of Procurement Condition pm Hallabat PS
12	24-Jun-09	Wed			Data Collection and Analisis		Survey of Construction Condition
13	25-Jun-09	Thu			Zarqa Desalination Plant Mesurement of Base Line Data		
14	26-Jun-09	Fri		Data Arrangement			
15	27-Jun-09	Sat		Survey of Maintenance System & Capacity	Merheb PS Mesurement of Base Line Data		**Survey of Procurement Condition**
16	28-Jun-09	Sun		Survey of Maintenance System & Capacity	Pipeline Survey	Survey of Procurement Condition	
17	29-Jun-09	Man					
18	30-Jun-09	Tue					
19	1-Jul-09	Wed			Merheb PS Mesurement of Base Line Data		Survey of Procurement Condition
20	2-Jul-09	Thu			Hydraylic Analisis, Design of Pump		
21	3-Jul-09	Fri		Data Arrangement	Hydraylic Analisis, Design of Pump		Data Arrangement
22	4-Jul-09	Sat		am Meeting at WAJ Zarqa pm Survey of Pipeline Network	am Meeting at WAJ Zarqa pm Hallabat PS		am Meeting at WAJ Zarqa pm Survey of Procurement Condition
23	5-Jul-09	Sun		Survey of Financial Condition	Azraq PS	Survey of Electricity, Specification of Pump	Market Survey
24	6-Jul-09	Man			Layout of Pump Stations		Market Survey
25	7-Jul-09	Tue					Market Survey
26	8-Jul-09	Wed		Survey of Maintenance System & Capacity	Azraq PS		Market Survey
27	9-Jul-09	Thu		am Meeting at WAJ PMU pm Data Arrangement			
28	10-Jul-09	Fri		Data Arrangement	Transfer Amman(2:10) →Bangkok(15:15 22:25)→	Survey of Electricity, Specification of Pump	Data Arrangement
29	11-Jul-09	Sat		am Meeting at WAJ PMU pm Data Arrangement	→Tokyo(6:30)	am Meeting at WAJ PMU pm Data Arrangement	Individual Study
30	12-Jul-09	Sun		Data Collection in WAJ		Data Collection in WAJ	Market Survey
31	13-Jul-09	Man		Report to JICA & Embassy of Japan		Transfer Amman(2:10) →Bangkok(15:15 22:25)→	Market Survey
32	14-Jul-09	Tue		Transfer Amman(2:10) →Bangkok(15:15 22:25)→		→Tokyo(6:30)	Market Survey
33	15-Jul-09	Wed		→Tokyo(6:30)			Market Survey
34	16-Jul-09	Thu					Market Survey
35	17-Jul-09	Fri					Transfer Amman(2:10) →Bangkok(15:15 22:25)→
36	18-Jul-09	Sat					→Tokyo(6:30)

【Explanation on Draft Outline Design Study Report】

DATE				Leader (Mr. Okamoto)	Study Planning (Mr. Kawase)	Chief Consultant/ Technical Assistance Planning/Operation and Maintenance Planning (Mr. Otani)	Equipment Planning (Mr. Matsumoto)	Procurement Planning/ Cost Estimation (Mr. Ohashi)
–	Oct.	9	fri		Tokyo(19:55) → Osaka(21:10) Osaka(23:15) → Dubai(04:45)			
1		10	sat		Dubai(07:25) → Amman (9:20)	Tokyo(10:30)→Bangkok(15:05)		
2		11	sun			Bangkok(0:30)→Amman(5:15)		
				MTG with JICA Office Coutesy call to EOJ, MOPIC and WAJ (WAJ Presentation and discussion on the draft report outline design)				
3		12	mon	Discussion on M/M with WAJ MTG with GTZ, MCC and other donors				
4		13	tue	Discussion on M/M with WAJ (Zarqa GWA)				
5		14	wed	Discussion on M/M with WAJ (Signing on M/M)				
6		15	thu	Signing on M/M Report to JICA Office and EOJ				
7		16	fri			Amman (2:10) →Bangkok (15:15) Bangkok (22:25) →		
8		17	sat			→Tokyo (6:30)		

Appendix 3. List of Parties Concerned in Jordan

【Ministry of Planning & International Cooperation (MOPIC)】

Mr. Saleh Al-Kharabsheh	Director, Projects Department
Ms. Wafa Al-Saket	Head of Asian and Arab Relations Divisions, International Cooperation Department
Mr. Saif Baniata	Asian Relations Section, International Cooperation Department
Ms. Moha Al-Zo'bi	Deputy Director, Projects Department
Ms. Nida'a Al-Momsni	Resercher, Projects Department
Ms. Saif Bani Ara	Charge of Japanese Cooperation

【Water Authority of Jordan (WAJ)】

Eng. Munir Oweis	Secretary General
Mr. Waleed Sukkar	Director, NRW & Performance Indicators Initiative, Project Management Unit
Eng. Bassam Saleh	Assistant Secretary General, Water Affairs
Mr. Ziad Haddadin	Assistant Secretary General, Financial Affairs
Eng. Ahmad Househ	Director, Planning and Design Department
Ms. Reham Bani-Hani	Deputy Director, Planning and Design Department
Dr. Mustafa Al-Assaf	Director, Central Operation
Mr. Khalid Alobaidiyn	Director, Central Operation
Ms. Raja Ammani	Director, Finance Department
Eng. Nedaa Halaseh	Director of Tenders & Purchase Department
Mr. Anas Al-Halliq	Manager of Main Store Department

[Zarqa Governorate Water Authority (GWA)]

Eng. Nabil Al-Zoubi	Director of Zarqa GWA
Eng. Mohamed Al-Rifaea	Director, Technical Affairs Directorate
Eng. Qasem Ababna	Director, Non-revenue Water Directorate
Eng. Yahya Al-Khawalda	Director, Water Directorate
Eng. Amjad Al-sharea	Director, Rusaifa City water
Eng. Mofid Abed-Alatif	Head, Station Section
Mr. Ghassan Al-Rayyan	Head, Water Network Section
Mr. Hussam Sweilem	Operator GIS Center
Eng. Khaled Al-Dajah	Mechanical Engineer, Station Section
Mr. Kamal Al-Sa'ad	Supervisor, Zarqa Pumping Station

[WAJ Central Workshop]

Eng. Jabir Al-Hmoud	Director

Eng. Abdul Rahim Y. Odetalla	Director Work Shop & Maintenance
Eng. Atef S. Besharat	Head of Maintenance Water Equipment Section

【Prime Ministry, Millennium Challenge Unit】

Ms. Tamam El-Ghul	Director P.O.C
Mr. Mohye Al-Deen Al-Shbool	Deputy Director
Eng. Iyad E. Dahiyat	Project Director / Water & Wastewater, Millennium Challenge Account
Mr. Abdelhakim Shibli	Economic Expert, Millennium Challenge Unit
Mr. Khalid Al Hmoud	Economist, Millennium Challenge Unit

【Ministry of Environment】

Mr. Hussein Badarin	Director, Directorate of Monitoring & Assessment (EB Member)

【German Technical Cooperation (GTZ)】

Mr. Dieter Rothenberger	Programme Manager
Mr. Holge Lange	Advisor, Dorsch Consult
Mr. Dietrich Ossuald	Technical Advisor of DED, Dorsch Consult
Mr. Ronald Hagger	IEE Project Officer, Dorsch Consult
Mr. Asmaa Jarrar,	Project Officer
Mr. Keith Roberts	Project Manager, Dorsch Consult
Mrs. Maria Scheday	Project Engineer, Dorsch Consult

【Embassy of Japan in Jordan】

Tetsuro Shioguti	Ambassador
Yasuo Ichicawa	First Secretary, Economic Section

【JICA Jordan Office】

Shigeru Okamoto	Chef Representative
Yasuhiro Morimoto	Deputy Resident Representative
Makiko Okumura	Representative
Hani H. Al Kurdi	Deputy Chief Program Officer

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
ON
THE PROJECT FOR ENERGY CONSERVATION THROUGH UPGRADING WATER SUPPLY NETWORK IN THE HASHEMITE KINGDOM OF JORDAN

In response to the request from the Government of Hashemite Kingdom of Jordan (hereinafter referred to as "Jordan"), the Government of Japan decided to conduct the Preparatory Survey for the Outline Design on the Project for Energy Conservation Through Updating Water Supply Network (hereinafter referred to as the "Project") and entrusted the implementation of the survey to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Jordan the Preparatory Survey Team for the Outline Design (hereinafter referred to as "the Team"), headed by Dr. Junji Yokokura, Senior Advisor of the Office for Climate Change, JICA, which is scheduled to stay in the country from 5th April to 26 April 2009.

The Team held a series of discussions with the officials concerned from the Government of Jordan and conducted a field survey in the requested area.

In the course of discussions and field survey, both parties confirmed the main items described on the attached sheets. The Team will proceed with further works and prepare the Outline Design Study Report.

Amman, 8th April, 2009

Dr. Junji Yokokura
Leader,
the Preparatory Survey Team
Japan International Cooperation
Agency (JICA)

Eng. Munir Oweis
Secretary General,
Water Authority of Jordan (WAJ)
Ministry of Water and Irrigation
The Hashemite Kingdom of Jordan

ATTACHMENT

1. Objectives of the Project

The objectives of the Project are to save energy used for lifting, conveyance and distribution of water through rationalization of water network system (mitigation measure against climate change), and to stabilize water supply and secure water resource by reducing water loss (adaptation measure against climate change).

2. Scheme of the Project

Both sides confirmed that the Project would be implemented within Japan's Programme Grant Aid for Environment and Climate Change.

3. Survey Area and Project Site

The areas of the Survey are within the Zarqa governorate as shown in **Annex I**, and the sites of the Project will be defined in Preparatory Survey 2.

4. Responsible Agency and Implementing Agency

4-1) The Responsible Agency is the Ministry of Water and Irrigation (hereinafter referred to as "MWI").

4-2) The Implementing Agency is the Water Authority of Jordan (hereinafter referred to as "WAJ"). The Organization chart of WAJ is shown in **Annex II**

5. Items requested by the Government of Jordan

After discussions with the Team, the items described in **Annex III** were requested by the Jordanian side. The both sides confirmed that the Jordanian side would prepare the revised list of Items with its number, specification, installation location and priority, and submit the list to the Team during the further studies by the consultants. JICA will examine the appropriateness of the request and will recommend to the Government of Japan for approval.

6. Scheme of Japan's Programme Grant Aid for Environment and Climate Change

6-1) The Jordanian side understands the scheme of Japan's Programme Grant Aid for Environment and Climate Change explained by the Team as described in **Annex IV** and **Annex V**. The Team explained that the scheme of Japan's Grant Aid for Environment and Climate Change is under discussion and might be slightly modified.

6-2) The Jordanian side will take necessary measures, as described in **Annex VI**, to expedite the smooth implementation of the Project.

7. Administration of the Project

7-1) Both sides confirmed the administration of the Project as shown in **Annex VII.**

7-2) For promoting proper and smooth execution of the Project, both sides confirmed that the Consultative Committee of the Project (hereinafter referred to as "the Committee") would be established whose functions and provisional composition are described in **Annex VIII** and the composition of the Committee would be discussed and determined during the Preparatory Survey 2 in June 2009.

8. Schedule of the Survey

8-1) The consultants will proceed to further studies in Jordan until April 26, 2009.

8-2) If the Project is found feasible as the result of the Preparatory Survey, JICA will dispatch the Preparatory Survey 2 Team in June 2009, which aims at collecting data and information required for outline design and preliminary cost estimation of the Project, and at the same time, baseline data required for the measurement of the effect of the Project.

8-3) JICA will prepare the draft Outline Design Report and dispatch a mission in order to explain its contents to Jordanian side around October 2009.

8-4) In case that the contents of the report is accepted in principle by the Government of Jordan, JICA will complete the final report and send it to the Government of Jordan by December 2009.

9. Other Relevant Issues

9-1) Relevance between the Replacement of Pumps and the Future Water Distribution Plan

Both sides confirmed that the pumps requested to be replaced should be utilized even after water distribution system would be restructured from pumping distribution to gravity distribution by the completion of the Japan's Grant Aid projects in Zarqa Governorate.

9-2) Replacement and Installation Works of Procured Equipment

The Jordanian side requested that the cost of replacement and installation of pumps to be procured in the Project should be included within the Grant, while those of valves, water meters and pipes should be implemented by the WAJ's budget. JICA will examine the appropriateness of the request.

9-3) Relevance between Reconstruction of Zarqa Pumping Station and Equipment Procurement Plan of the Project

The Jordanian side explained that the Zarqa Pumping Station would be reconstructed under WAJ's responsibility before the delivery of the procured equipment. The both sides understood the necessity of coordination between the reconstruction plan of Zarqa Pumping and the equipment procurement plan of the Project.

9-4) Soft Assistance (Soft Component Programme and Technical Assistance)

The Team explained the Jordanian side that the Japan's Programme Grant Aid for Environment and Climate Change could be utilized for Soft Assistance which could contribute to mitigation and adoptation to the Climate Change. The Jordanian side suggested that a soft assistance to improve the operation and maintenance related to the procured equipment would be preferable.

9-5) Overlapping and Coordination with other projects

Both sides confirmed that the Project should not be overlapped with any other project supported by other donor agencies, NGOs, and Jordanian official organization(s). The both sides understood the necessity to coordinate the on-going projects on improvement of water supply facilities and network, especially funded by GTZ and Millennium Challenge Corporation (MCC). The Team explained that JICA would assess the feasibility of the Project in terms of overlapping and coordination with other projects, in accordance with the result of further studies by the consultants of the team.

9-6) Operation and maintenance of facilities and equipment

The Jordanian side agreed to take any necessary measures and allocate necessary budget in order to operate and maintain the facilities and equipment provided by the Project.

9-7) Tax exemption

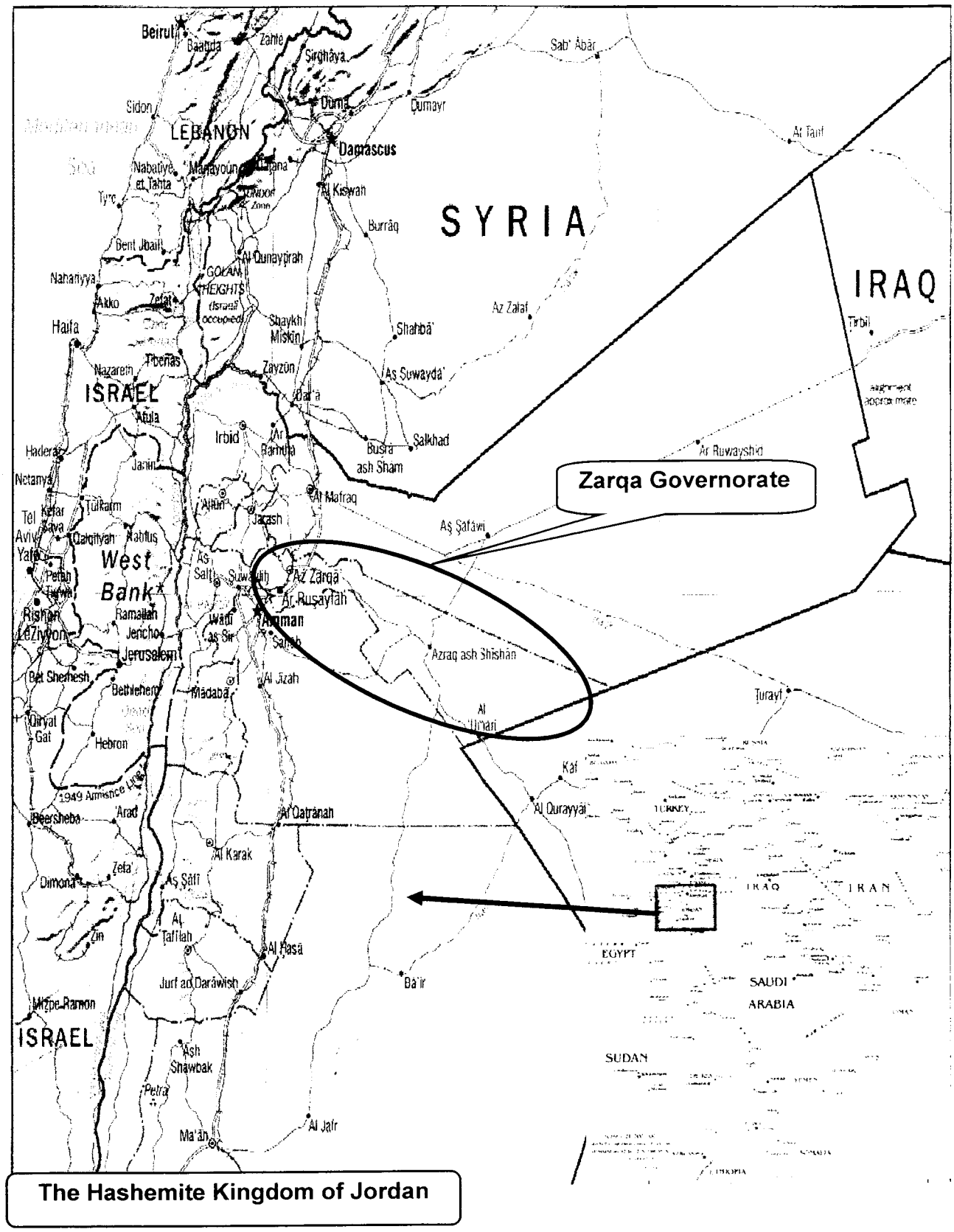
The tax exemption including Value Added Tax (VAT), custom duty, and any other taxes and fiscal levies in Jordan which is to be arisen from the Project activities will be ensured by WAJ. WAJ will take any procedures necessary for tax exemption, and in case that tax exemption is not secured, the cost of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

9-8) Environmental Impact Assessment (EIA)

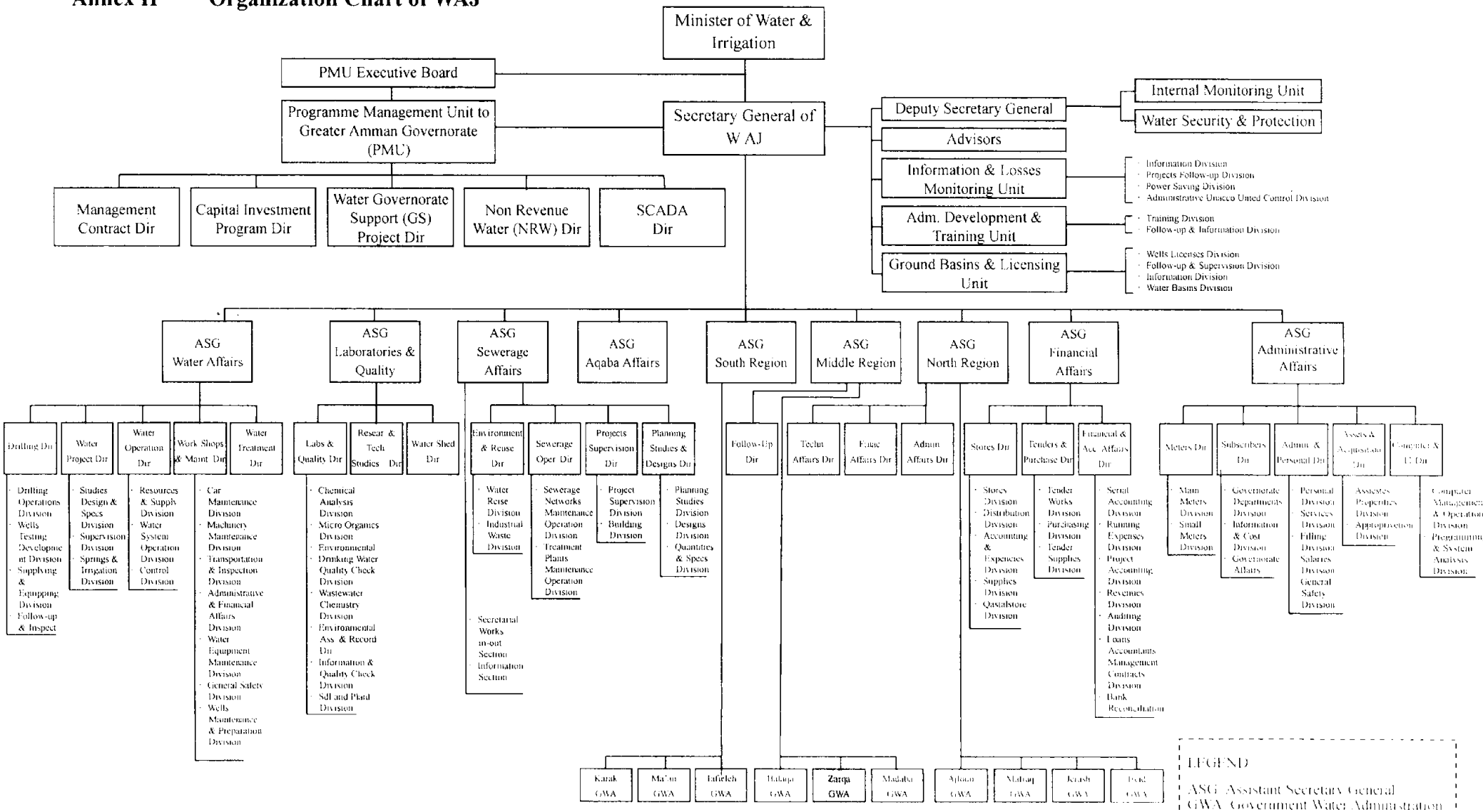
Both sides confirmed that the Jordanian side is responsible for taking any measures to complete EIA, in case that the Survey indicates necessity of EIA for implementing the Project.

Annex I	Survey and Project Site Map
Annex II	Organization Chart of WAJ
Annex III	Tentative List of Items Requested by the Government of Jordan
Annex IV	Japan's Programme Grant Aid for Environment and Climate Change Scheme
Annex V	Flow of Funds and Implementation of the Project
Annex VI	Major Undertakings to be Taken by Each Government
Annex VII	Organization Chart for the Implementation of the Project
Annex VIII	Consultative Committee

Annex I Survey and Project Site Map



Annex II Organization Chart of WAJ



* The division highlighted is subject to directly participate in the Project implementation

Annex III Tentative List of Items Requested by the Government of Jordan

No.	Area/Station	Mark	Materials	Diameter (inch)	Place	PN(bar)	Unit	Quantity
1	Old Azraq Station	GV	Gate Valve	8	Delivery Pipe	40	nos	8
2		GV	Gate Valve	12	Suction Pipe	16	nos	8
4		GV	Gate Valve	24	Pelving Pipe	40	nos	1
5		GV	Gate Valve	24	Pelving Pipe	25	nos	1
6		GV	Gate Valve	24	Suction Pipe	25	nos	1
3		NRV	Non-retaining Valve	8		40	nos	8
9		NRV	Non-retaining Valve	24	Delivery Pipe	40	nos	1
7		WM	Water Meter	24	on pipe from wells to pump	25	nos	1
8		WM	Water Meter	24	on pipe from pump station to Khaw	40	nos	1
10	New Azraq Station	V	Valve	10	Delivery Pipe	40	nos	7
11		V	Valve	12	Suction Pipe	25	nos	7
13		V	Valve	24	Delivery Pipe	40	nos	1
14		V	Valve	24	Suction Pipe	25	nos	1
12		NRV	Non-retaining Valve	10		40	nos	7
15		NRV	Non-retaining Valve	24	Delivery Piper	40	nos	1
16	Khaw Station (Amman)	V	Valve	8	Delivery Pipe	40	nos	8
17		V	Valve	12	Suction Pipe	25	nos	8
19		V	Valve	24	on succion pipe from tank	25	nos	4
20		V	Valve	24	Delivery Pipe	40	nos	1
18		NRV	Non-retaining Valve	8	Delivery Pipe	40	nos	8
21		NRV	Non-retaining Valve	24	Delivery Pipe	40	nos	1
22		WM	Water Meter	24		25	nos	1
23		WM	Water Meter	24		40	nos	1
26	Khaw Station (Zarqa)	V	Valve	16	Delivery Pipe	40	nos	6
27		V	Valve	16	Suction Pipe	16	nos	6
29		V	Valve	24	Delivery Pipe	40	nos	2
28		NRV	Non-retaining Valve	16		40	nos	6
24		WM	Water Meter	24		25	nos	1
25		WM	Water Meter	28		40	nos	1
30	Zarqa	P	Pump		Q=400m^3/h、H=150m	15	nos	4
31		P	Pump		Q=100m^3/h、H=150m	15	nos	3
32		P	Pump		Q=500m^3/h、H=250m	25	nos	3
33		P	Pump		Q=300m^3/h、H=250m	25	nos	2
34		P	Pump		Q=200m^3/h、H=200m	20	nos	4
35		P	Pump		Q=50m^3/h、H=200m	20	nos	2
36		P	Pump		Q=70m^3/h、H=200m	20	nos	1
41		P	Pump		Q=200m^3/h、H=300m	30	nos	3
42		P	Pump		Q=200m^3/h、H=320m	32	nos	1
43		P	Pump		Q=200m^3/h、H=300m	30	nos	1
44		P	Pump		Q=300m^3/h、H=350m	35	nos	1
45		P	Pump		Q=300m^3/h、H=250m	25	nos	1
46		P	Pump		Q=225m^3/h、H=275m	27.5	nos	1
47		P	Pump		Q=100m^3/h、H=100m	10	nos	2
37		V	Valve	8	Suction Pipe	25	nos	3
38		V	Valve	6	Delivery Pipe	25	nos	3
48		GV	Gate Valve	2	with Flange	40	nos	100
49		GV	Gate Valve	2	with Stim	40	nos	100
50		GV	Gate Valve	1	with Stim	25	nos	200

No.	Area/Station	Mark	Materials	Diameter (inch)	Place	PN(bar)	Unit	Quantity
51		GV	Gate Valve	1/2		25	nos	500
52		GV	Gate Valve	3/4		25	nos	300
53		GV	Gate Valve	1		25	nos	300
54		GV	Gate Valve	4		16	nos	200
55		GV	Gate Valve	4		25	nos	100
56		GV	Gate Valve	4		40	nos	100
57		NRV	Non-retaining Valve	4		16	nos	50
58		NRV	Non-retaining Valve	4		25	nos	50
59		NRV	Non-retaining Valve	4		40	nos	50
39		NRV	Non-retaining Valve	6		25	nos	3
40		WM	Water Meter	6		25		
60		GV	Gate Valve	6		16	nos	30
61		GV	Gate Valve	6		25	nos	30
62		GV	Gate Valve	6		40	nos	30
63		GV	Gate Valve	8		16	nos	30
64		GV	Gate Valve	8		25	nos	30
65		GV	Gate Valve	8		40	nos	30
74		BV	Butterfly Valve	12		25	nos	10
75	Zarqa	BV	Butterfly Valve	12		10	nos	10
76		BV	Butterfly Valve	16		25	nos	10
77		BV	Butterfly Valve	16		40	nos	10
80		BV	Butterfly Valve	24		25	nos	5
81		BV	Butterfly Valve	16		25	nos	10
66		NRV	Non-retaining Valve	6		16	nos	20
67		NRV	Non-retaining Valve	6		25	nos	20
68		NRV	Non-retaining Valve	6		40	nos	20
69		NRV	Non-retaining Valve	8		16	nos	20
70		NRV	Non-retaining Valve	8		25	nos	20
71		NRV	Non-retaining Valve	8		40	nos	20
72		NRV	Non-retaining Valve	12		25	nos	10
73		NRV	Non-retaining Valve	12		40	nos	10
78		NRV	Non-retaining Valve	16		25	nos	10
79		NRV	Non-retaining Valve	16		40	nos	10
82		NRV	Non-retaining Valve	24		25	nos	5
83		NRV	Non-retaining Valve	24		40	nos	5
84		DIP	Ductile iron pipes	300mm			m	6000
85		DIP	Ductile iron pipes	200mm			m	6000
86		DIP	Ductile iron pipes	150mm			m	2000

Annex IV

Programme Grant Aid for Environment and Climate Change of the Government of Japan (Provisional)

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 relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

Based on the "Cool Earth Partnership" initiative of the The Government of Japan (hereinafter referred to as "the GOJ"), the Programme Grant Aid for Environment and Climate Change (hereinafter referred to as "GAEC") aims to mitigate negative effects of global warming by reducing Green House Gas emission (mitigation measure such as improvement of energy efficiency) and to adapt the supposed effects (adaptation measures such as stabilization of water supply in a region suffering less precipitation due to the climate change).

GAEC may contain multiple components that can be combined to effectively achieve its objectives. The contractors and suppliers may not be confined to Japanese firms and construction, in principle, can be conducted by utilizing local standards.

1. GAEC Procedures

GAEC is executed through the following procedures.

- Application
  - Request made by the recipient country
- Preparatory Survey (hereinafter referred to as "the Survey")
  - The Survey for Outline Design conducted by Japan International Cooperation Agency (hereinafter referred to as "JICA")
- Appraisal & Approval
  - Appraisal by the GOJ and Approval by the 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

Firstly, the application or request for a GAEC project submitted by the recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether it is eligible for GAEC. If the request is deemed appropriate, the GOJ assigns JICA to conduct a survey on the request.

Secondly, JICA conducts the Survey for Outline Design with Japanese consulting firms.

Thirdly, the GOJ appraises the project to see whether it is suitable for Japan's GAEC, based on the Survey report prepared by JICA, then the result is submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes (hereinafter referred to as E/N) signed by the GOJ and the recipient country. Simultaneously, the Grant will be made available by concluding the G/A between the recipient country and JICA.

JICA is designated by the GOJ as the organization responsible for necessary works for proper execution of the Grant.

Procurement Management Agent (hereinafter referred to as "the Agent") is designated to conduct the procurement services of products and services (including fund management, preparing tenders, contracts) for GAEC on behalf of the recipient country. The Agent is an impartial and specialized organization that shall render services according to the Agent Agreement with the recipient country. The Agent is recommended to the recipient country by the GOJ and agreed between the two Governments in the Agreed Minutes (hereinafter referred to as "A/M").

2. Preparatory Survey for Outline Design

1) Contents of the Survey

The purpose of the Survey, conducted by JICA on a requested project ("the Project"), is to provide the basic documents necessary for the appraisal of the Project by the GOJ. The contents of the Survey are as follows:

(1) Confirmation of background, objectives, and benefits of the Project and institutional capacity of agencies and communities concerned of the recipient country necessary for the implementation of the Project.
(2) Evaluation of relevance of the Project to be implemented under the Grant Aid Scheme from a

technical, social, and economic point of view.

(3) Confirmation of items agreed upon by both parties concerning the basic concept of the Project.

(4) Preparation of the outline design of the Project.

(5) Preliminary Estimation of cost for 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 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 the smooth implementation of the Survey, JICA will conduct the Survey with JICA-registered consulting firms. JICA selects the firms based on proposals submitted by firms with interest in implementing the Survey. The firms selected will carry out the Outline Design Survey and prepare a report, based on the terms of reference set by JICA.

The consulting firms that will implement the Project after the G/A can be, in principle, Japanese firms recommended by JICA for maintaining technical consistency with the Survey.

3. Implementation of GAEC after the E/N

1) The E/N and the G/A

The content of GAEC will be determined in accordance with the E/N exchanged by the two Governments, in which the objectives of the Project, length of the Project, conditions and amount of the Grant Aid are confirmed. The conclusion of the G/A between the recipient country and JICA follows the exchange of E/N to determine the paying conditions responsibilities of the recipient country and procurement conditions.

2) Details of Procedures

Details of procedures on implementing the Project under GAEC will be agreed between the

authorities of the two governments concerned at the time of the signing of the E/N and the G/A. Essential points to be agreed are outlined as follows:

a) JICA will supervise the implementation of the Project.

b) Products and services shall be procured and provided in accordance with JICA's "Procurement Guidelines for the Programme Grant Aid (Type I – E) for Environment and Climate Change."

c) The recipient country shall conclude a contract with the Agent.

d) The Agent is the representative acting in the name of the recipient country concerning all transfers of funds to the Agent.

3) Focal points of the "Procurement Guidelines for the Programme Grant Aid (Type I – E) for Environment and Climate Change"

a) The Agent

The Agent is the organization, which provides procurement of products and services on behalf of the recipient country according to the Agent Agreement with the recipient country. The Agent is recommended to the recipient country by the GOJ and agreed between the two Governments in the A/M.

b) Agent Agreement

The recipient country shall conclude the Agent Agreement, in principle, within two months after the signing of the G/A, in accordance with the A/M. The scope of the Agent's services shall be clearly specified in the Agent Agreement.

c) Approval of the Agent Agreement

The Agent Agreement is prepared as two identical documents and the copy of the Agent Agreement shall be submitted to JICA by the recipient country through the Agent. JICA will confirm whether the Agent Agreement is concluded in conformity with the E/N, A/M, and G/A and the Procurement Guidelines for the Programme Grant Aid for Environment and Climate Change then approves the Agent Agreement.

The Agent Agreement concluded between the recipient country and the Agent shall become effective after the approval by JICA in a written form.

d) Payment Methods

The Agent Agreement shall stipulate that "Regarding all transfers of the fund to the Agent, the recipient country shall designate the Agent to act on behalf of the Government and issue a Blanket Disbursement Authorization ("the BDA") to conduct the transfer of the fund (hereinafter

referred to as "the Advances") to the Procurement Account from Account of the Government.

The Agent Agreement shall clearly state that the payment to the Agent shall be made in Japanese yen from the Advances and that the final payment to the Agent shall be made when the total remaining amount become less than three percent (3%) of the Grant and its accrued interests.

e) Products and Services Eligible for Procurement

Products and services to be procured shall be selected from those defined in the G/A.

f) Selection of firms

In principle, firms of any nationality could be contracted as long as the firms satisfies the conditions specified in the tender documents.

g) Method of Procurement

When conducting the procurement, sufficient attention shall be paid to transparency in selecting the firms and for this purpose, in principle, competitive tendering shall be employed.

h) Tender Documents

The tender documents should contain all information necessary to enable tenderers to prepare valid offers for the products and services to be procured by GAEC.

The rights and obligations of the recipient country, the Agent and the firms supplying products and services should be stipulated in the tender documents to be prepared by the Agent.

i) Pre-qualification Examination of Tenderers

The Agent may conduct a pre-qualification examination of tenderers in advance of the tender so that the invitation to the tender can be extended only to eligible firms. The pre-qualification examination should be performed only with respect to whether the prospective tenderers have the capability of concluding the contracts.

For this, the following points should be taken into consideration:

(1) Experience and past performance in contracts of similar kind
(2) Financial credibility (including assets such as real estate)
(3) Existence of offices and other items to be specified in the tender documents.
(4) Their potentialities to use necessary personnel and facilities.

j) Tender Evaluation

The tender evaluation should be implemented on the basis of the conditions specified in the tender documents.

Those tenderers which substantially conform to the technical specifications and other stipulations of the tender documents, shall be judged in principle on the basis of the submitted price, and the tenderer who offers the lowest price shall be designated as the successful tenderer.

The Agent shall submit a detailed evaluation report of tenders to JICA for its information, while the notification of the results to the tenderers will not be premised on the confirmation by JICA.

k) Additional procurement

If there is any remaining balance after the competitive and/or selective tendering and/or direct negotiation for a contract, and if the recipient country would like to procure additional items, the Agent is allowed to conduct this additional procurement, following the points mentioned below:

(1) Procurement of same products and services

When the products and services to be additionally procured are identical with the initial tender and a competitive tendering is judged not efficient, additional procurement can be conducted by a negotiated contract with the successful tenderer of the initial tender.

(2) Other procurements

When products and services other than those mentioned above in (1) are to be procured, the procurement should be conducted through competitive tendering. In this case, the products and services for additional procurement shall be selected from among those in accordance with the G/A.

l) Conclusion of the Contracts

In order to procure products and services in accordance with the guideline, the Agent shall conclude contracts with firms selected by tendering or other methods.

m) Terms of Payment

The contract shall clearly state the terms of payment. The Agent shall make payment from the "advances," against the submission of the necessary documents from the firm on the basis of the conditions specified in the contract. When the services are the object of procurement, the Agent may pay certain portion of the contract amount in advance to the firms on the conditions that such firms submit the advance payment guarantee worth the amount of the advance payment to

the Agent.

4) Undertakings required by the recipient country

In the implementation of the Grant Aid Project, the recipient country is required to undertake necessary measures as the following:

a) To secure land necessary for the sites of the Project.

b) To provide facilities for distributing electricity, water supply and drainage and other incidental facilities in and around the sites if necessary.

c) To assist prompt execution for domestic transportation of products purchased under the Grant Aid as necessary,

d) To ensure that customs duty, internal tax and other fiscal levies that may be imposed in Jordan with respect to the purchase of the Components and the Agent's services shall be exempted by the recipient country.

e) To accord all the concerned parties, whose services may be required in connection with supply of the products and services under the contracts, such facilities as may be necessary for their entry into Jordan and stay therein for the performance of their work.

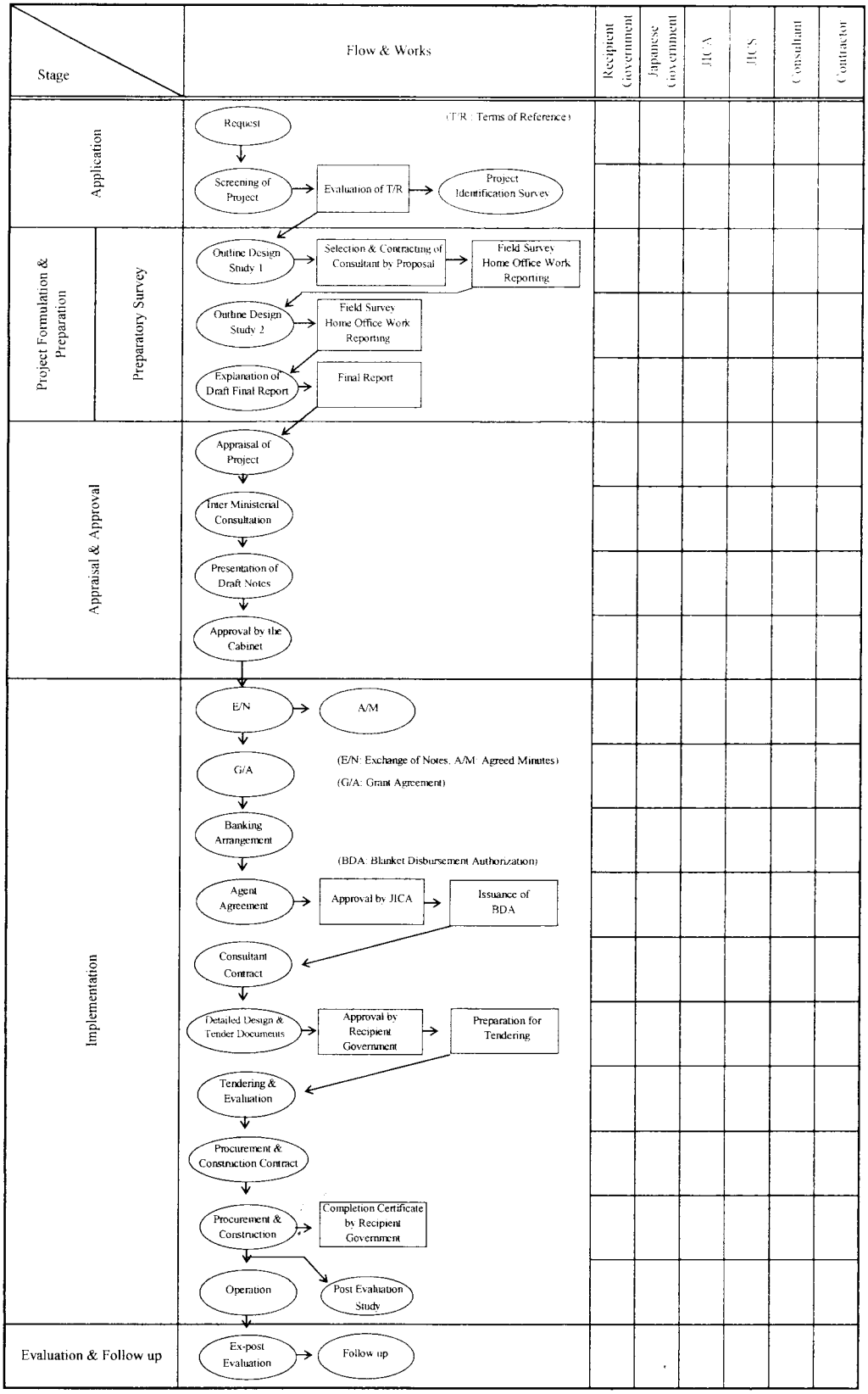
5) "Proper use of funds"

The recipient country is required to take necessary actions so that the facilities constructed under the Grant Aid are properly and effectively used and to ensure sustainable operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

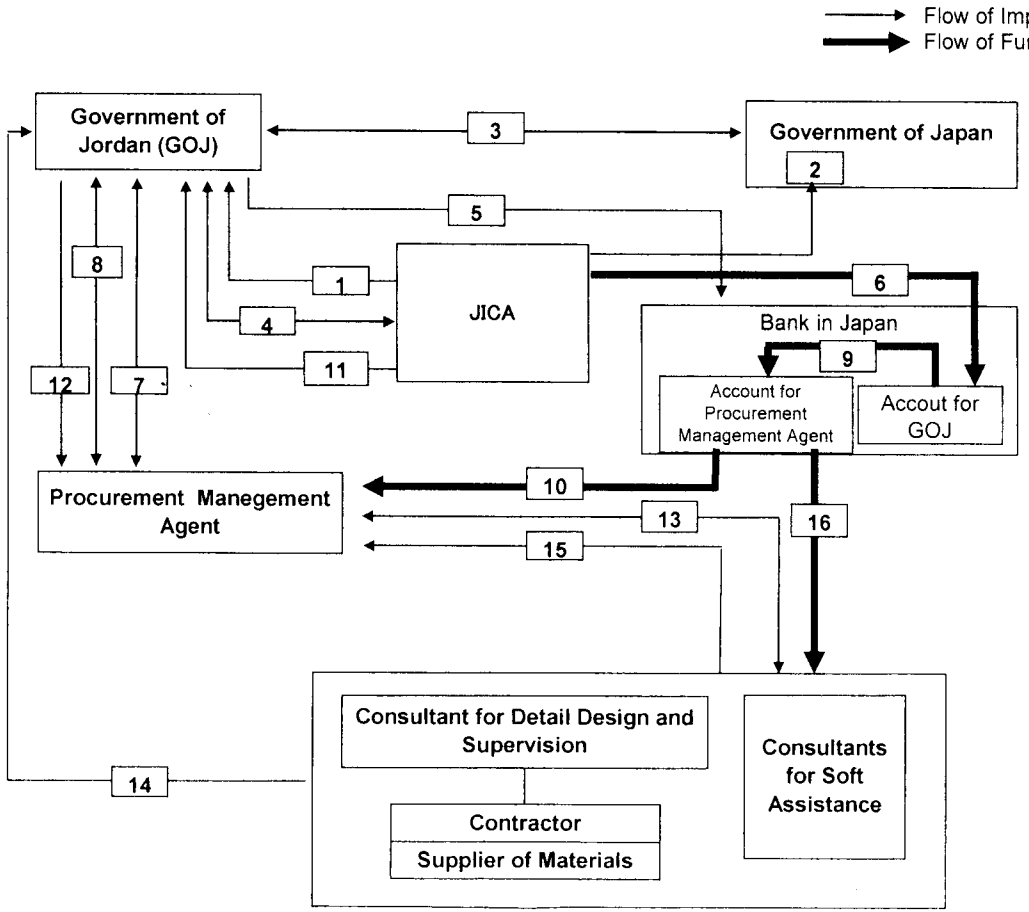
6) "Exported or Re-export"

The products purchased under the Grant shall not be exported or re-exported from Jordan.

FLOW CHART OF JAPAN's PROGRAMME GRANT AID FOR ENVIRONMENT AND CLIMATE CHANGE PROCEDURES



Annex V Flow of Funds and Implementation of the Project



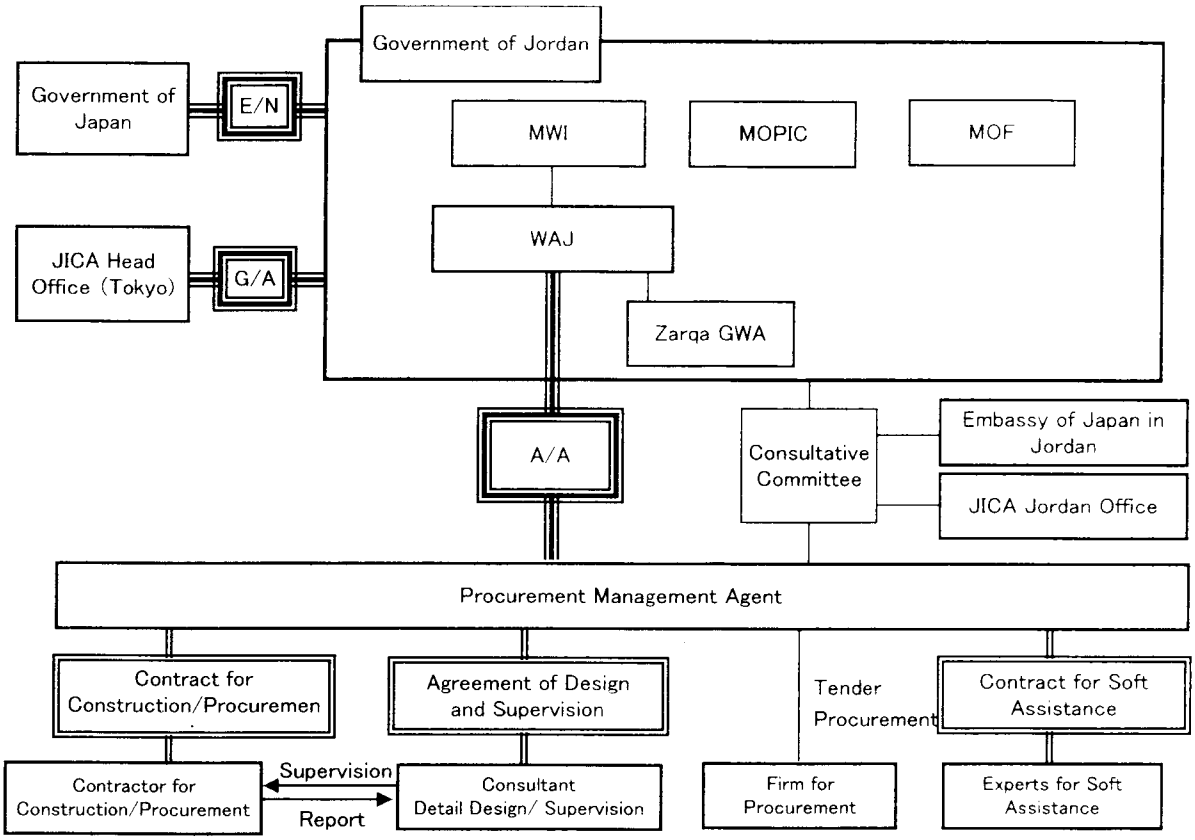
1 Preparatory Survey/ Materials for Outline Design
2 Approval of Cabinet
3 Signing of Exchange of Notes (E/N)
4 Signing of Grant Agreement (G/A)
5 Banking Arrangement
6 Payment of funds from the Government of Japan
7 Signing of Agent Agreement(A/A)
8 Decision of project components
9 Transfer of funds (the Advances)
10 Payment of Remuneration for Agent
11 Recommendation of Consultant for Detail Design/Supervision (JICA→Government of Jordan)
12 Recommendation of Consultant for Detail Design / Supervision (Government of Jordan→Procurement Agent)
13 Conclusion of Contract
14 Construction, Procurement, and Technical Assistance
15 Application for Payment
16 Payment

Annex VI Major Undertakings to be Taken by each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure land		●*
2	To clear, level and reclaim the site when needed urgently		●*
3	To construct gates and fences in and around the site		●*
4	To construct a parking lot		●*
5	To construct roads		
	1) Within the site		●*
	2) Outside the site		●*
6	To construct the building, hospital and school*	●*	
7	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities:		
	1) Electricity		
	a. The power distribution line to the site		●*
	b. The drop wiring and internal wiring within the site	●*	
	c. The main circuit breaker and transformer for the site	●*	
	2) Water Supply		
	a. The city water distribution main to the site		
	b. The supply system within the site (receiving and elevated tanks)	●*	
	3) Drainage		
	a. The city drainage main (for conveying storm water, sewage, etc. from the site)		●*
	b. The drainage system within the site (for sewage, ordinary waste, storm water, etc.)	●*	
	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 applied by the bank in Japan for banking services based upon the Bank Arrangement (B/A):		
	1) Payment of bank commission		●
9	To ensure prompt unloading and customs clearance at the port of disembarkation in the recipient country		
	1) Marine or air transportation of the products from the produciton countries to the recipient	●	
	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 and / or nationals of third countries, including persons employed by the agent whose services may be required in connection with the Components such facilities as may be necessary for their entry into recipient country and stay therein for the performance of their work.		●
11	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the Components and to the employment of the Agent shall be exempted by the Government of recipient country		●
12	To maintain and use properly and effectively the facilities that are constructed and the equipment that is provided under the Grant.		●
13	To bear all the expenses, other than those covered by the Grant and its accrued interest, necessary for the purchase of the Components as well as for the agent's fees.		●
14	To ensure environmental and social consideration for the Project.		●

Note
*: items necessary in case that the construction components shall be included in the Project

Annex VII Organization Chart for the Implementation of the Project



LEGEND:	═══	:Official Agreement (Jordan－Japan)
	═══	:Contract(Procurement Management Agent－Firms & Consultants)
	———	:Report・Supervision・Cordination
	E/N	:Exchange of Notes
	G/A	:Grant Agreement
	A/A	:Agent Agreement
	MWI	:Ministry of Water and Irrigation
	MOPIC	:Ministry of Planning and International Cooperation
	MOF	:Ministry of Finance
	WAJ	:Water Authority of Jordan
	Zarqa GWA	:Zarqa Governorate Water Authority
	JICA	:Japan International Cooperation Agency
	JICS	:Japan International Cooperation System

Annex VIII Consultative Committee

1. Functions

The Consultative Committee (hereinafter referred to as "the Committee") will be established in order to fulfill the following functions:

1) to confirm an implementation schedule of the Programme for the speedy and effective utilization of the Grant and its accrued interest;
2) to discuss determination and/or modification of the Components, taking into account of the products enumerated in the list attached to the Procurement Guidelines and/or the result of the preparatory survey for the Programme by JICA;
3) to discuss modifications of the Programme;
4) to exchange views on allocations of the Grant and its accrued interest as well as on potential end-users;
5) to identify problems which may delay the utilization of the Grant and its accrued interest, and to explore solutions to such problems;
6) to exchange views on publicity related to the utilization of the Grant and its accrued interest; and
7) to discuss any other matters that may arise from or in connection with the G/A.

The first meeting of the Committee shall be held immediately after the approval of the Agent Agreement by the JICA, which shall be concluded between WAJ and the Procurement Management Agent (hereinafter referred to as "the Agent").

The selection of the Agent will be agreed between the two governments in the Agreed Minutes attached in the Exchange of Notes.

Further meetings will be held by the request of either the Jordanian side or the Japanese side. The Agent also may advise both sides on the necessity to call a meeting of the Committee.

2. Composition (Provisional)

1) Representative of Ministry of Planning and International Cooperation
2) Representative of MWI
3) Representative of WAJ
4) Representative of Zarqa Governorate Water Authority
5) Representative of the Procurement Management Agent
6) Representative of Embassy of Japan in the Hashemite Kingdom of Jordan
7) Representative of JICA Jordan Office

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY II
ON
THE PROGRAMME FOR ENERGY CONSERVATION THROUGH UPGRADING WATER SUPPLY NETWORK IN THE HASHEMITE KINGDOM OF JORDAN

Based on the result of the Preparatory Survey, the Government of Japan decided to conduct a Preparatory Survey 2 for the Outline Design on the Programme for Energy Conservation through Upgrading Water Supply Network (hereinafter referred to as the "Programme") and entrusted the implementation of the survey to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to the Hashemite Kingdom of Jordan (hereinafter referred to as "Jordan") the Preparatory Survey 2 Team for the Outline Design (hereinafter referred to as "the Team"), headed by Dr. Junji Yokokura, Senior Advisor of the Office for Climate Change, JICA, which is scheduled to stay in the country from 14 June to 17 July 2009.

The Team held a series of discussions with the officials concerned from the Government of Jordan and conducted a field survey in the requested area.

In the course of discussions and field survey, both parties confirmed the main items described on the attached sheets. The Team will proceed with further works and prepare the Outline Design Study Report.

Amman, 18 June, 2009

Dr. Junji Yokokura
Leader,
the Preparatory Survey Team
Japan International Cooperation
Agency (JICA)

Eng. Munir Oweis
Secretary General,
Water Authority of Jordan (WAJ)
Ministry of Water and Irrigation
The Hashemite Kingdom of Jordan

ATTACHMENT

1. Objectives of the Programme

The objectives of the Programme are to save energy used for transmission and distribution of water through rationalization of water network system (mitigation measure against climate change), and to stabilize water supply and secure water resource by reducing water loss (adaptation measure against climate change).

2. Survey Area and Programme Site

The site of the Programme is the Zarqa governorate as shown in **Annex I**.

3. Responsible Agency 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 II**

4. Items requested by the Government of Jordan

After discussions with the Jordanian side and the Team (hereinafter referred to as "the both sides"), the items described in **Annex III** were finally 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 for the estimation of the Programme would be decided by the Japanese side.

5. Scheme of Japan's Programme Grant Aid for Environment and Climate Change

The Jordanian side understood the scheme of Japan's Programme Grant Aid for Environment and Climate Change and the necessary measures to be taken by the Government of Jordan as explained by the Team and described in as described in **Annex IV**, **Annex V** and **Annex VI** of the Minutes of Discussions signed by both parties on 8 April, 2009.

6. Administration of the Programme

6-1) Both sides confirmed the administration of the Programme as shown in **Annex VII.**

6-2) For promoting proper and smooth execution of the Programme, both sides confirmed that the Consultative Committee of the Programme (hereinafter referred to as "the Committee") would be established whose functions and provisional composition are described in **Annex VIII**.

7. Schedule of the Survey

7-1) The consultants will proceed to further studies in Jordan until 17 July, 2009.

7-2) JICA will prepare the draft Outline Design Report and dispatch a mission in order to explain its contents to the Jordanian side around October 2009.

7-3) In case that the contents of the report are accepted in principle by the Government of Jordan, JICA will complete the final report and send it to the Government of Jordan by December 2009.

8. Other Relevant Issues

The following issues were discussed and agreed by both sides.

8-1) Switch of Distribution System to Gravity-Flow and Procurement of Materials

The equipment and materials requested for distribution network should be designed under the gravity-flow distribution condition which shall be realized with the completion of the projects by the other donors. Thus, the procurement shall be separated into two lots and the equipment and materials for distribution network shall be procured in the second lot after the gravity-flow distribution condition is prepared, while transmission pumps, equipment related to the pumps and transmission pipes shall be procured in the first lot.

8-2) Reconstruction of Zarqa Pumping Station and Equipment Procurement Plan

The Jordanian side would launch the detail design of the reconstruction of the Zarqa Pumping Station following the final Outline Design Report to be submitted at the end of 2009, and complete the construction before the delivery of the transmission pumps and equipment related to the pumps.

8-3) Soft Assistance

The Soft Assistance of the Programme would aim at improving the operation and maintenance of transmission pumps to be procured in the Programme by preparing standard operational and maintenance procedures, and the targets of the Soft Assistance shall be;

1) to suitably control pumping flow according to production of water resources and demand of distribution areas,
2) to monitor the operational efficiency by accumulating pumping flow data and energy consumption of pumping facilities,
3) to select suitable methods for keeping equipment and materials in appropriate condition, by acquisition of accurate knowledge on "Corrective Maintenance,"
4) to execute accurate maintenance work that contributes to trouble prevention by acquisition of accurate knowledge on "Preventive Maintenance," and
5) to execute safety operation control by acquisition of accurate knowledge on "Safety Operation Control."

8-4) Replacement and Installation Works of Procured Equipment

The cost of replacement and installation of pumps and relevant equipment to be procured in the Programme should be included within the Grant, while those of valves and water meters in the distribution network and transmission pipes should be implemented by the WAJ's budget.

8-5) Overlapping and Coordination with other projects

The Programme should not be overlapped with any other projects supported by other donor agencies, NGOs, and Jordanian official organization(s). Thus, the Jordanian side takes the responsibility for coordinating the on-going projects on improvement of water supply facilities and networks, especially funded by GTZ, KfW, Millennium Challenge Corporation (MCC), etc. Especially, the equipment of Zarqa Treatment plant listed in the requested items (**Annex III**) would be coordinated between GTZ and the Team after the completion of the final report on GTZ's Improving Energy Efficiency project in the end of June 2009.

8-6) Programme Indicators and Methods of Acquiring Baseline Data

The indicators of the Programme effects would be the amount of electricity consumption necessary for operation of pumping facilities and pumping discharge. The Jordanian side would prepare and install electric power meters in the pumping stations targeted in the Programme in order to acquire the baseline data of the indicators and monitor it.

8-7) Eligible Country for Procurement

Regarding the procurement of transmission pumps, equipment related pumps, and transmission pipes in the first lot, the Jordanian side requested that the eligible country for the procurement supplier shall be Japan because of the quality of supervision for the installment of pumps and smooth implementation of the Programme, while procurement supplier of the second lot is of no restriction.

The country origin of the equipment to be procured in the both lots shall be countries belonging to Development Assistance Committee (DAC), due to the reliability of the products.

The Team promised to convey the request to JICA headquarters and related authorities for their consideration.

8-8) Operation and maintenance of facilities and equipment

The Jordanian side agreed to take any necessary measures and allocate necessary budget in order to operate and maintain the facilities and equipment provided by the Programme.

8-9) Tax Exemption

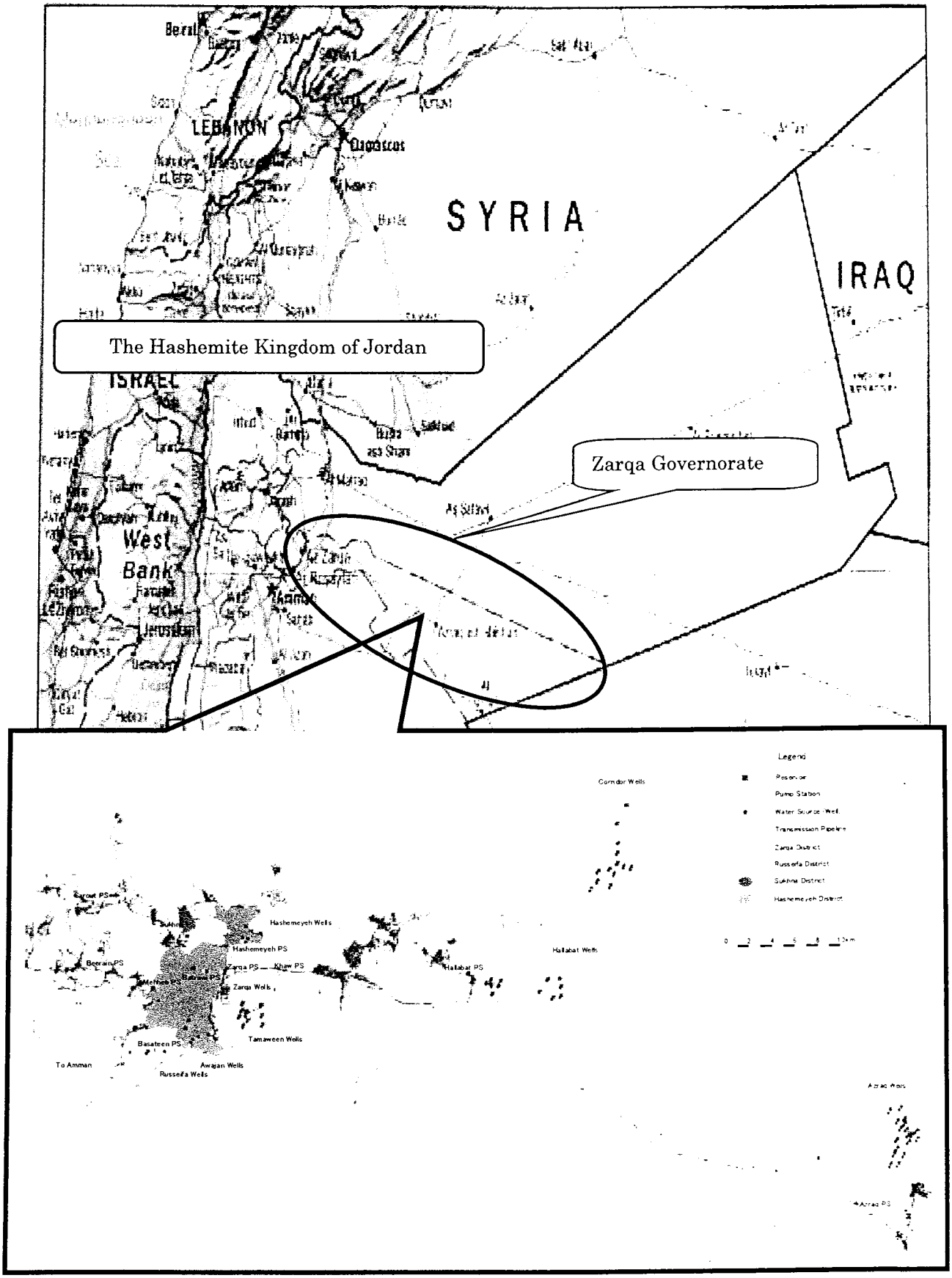
The tax exemption including Value Added Tax (VAT), custom duty, and any other taxes and fiscal levies in Jordan which is to be arisen from the Programme activities will be ensured by WAJ. WAJ will take any procedures necessary for tax exemption, and in case that tax exemption is not secured, the cost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

8-10) Project title

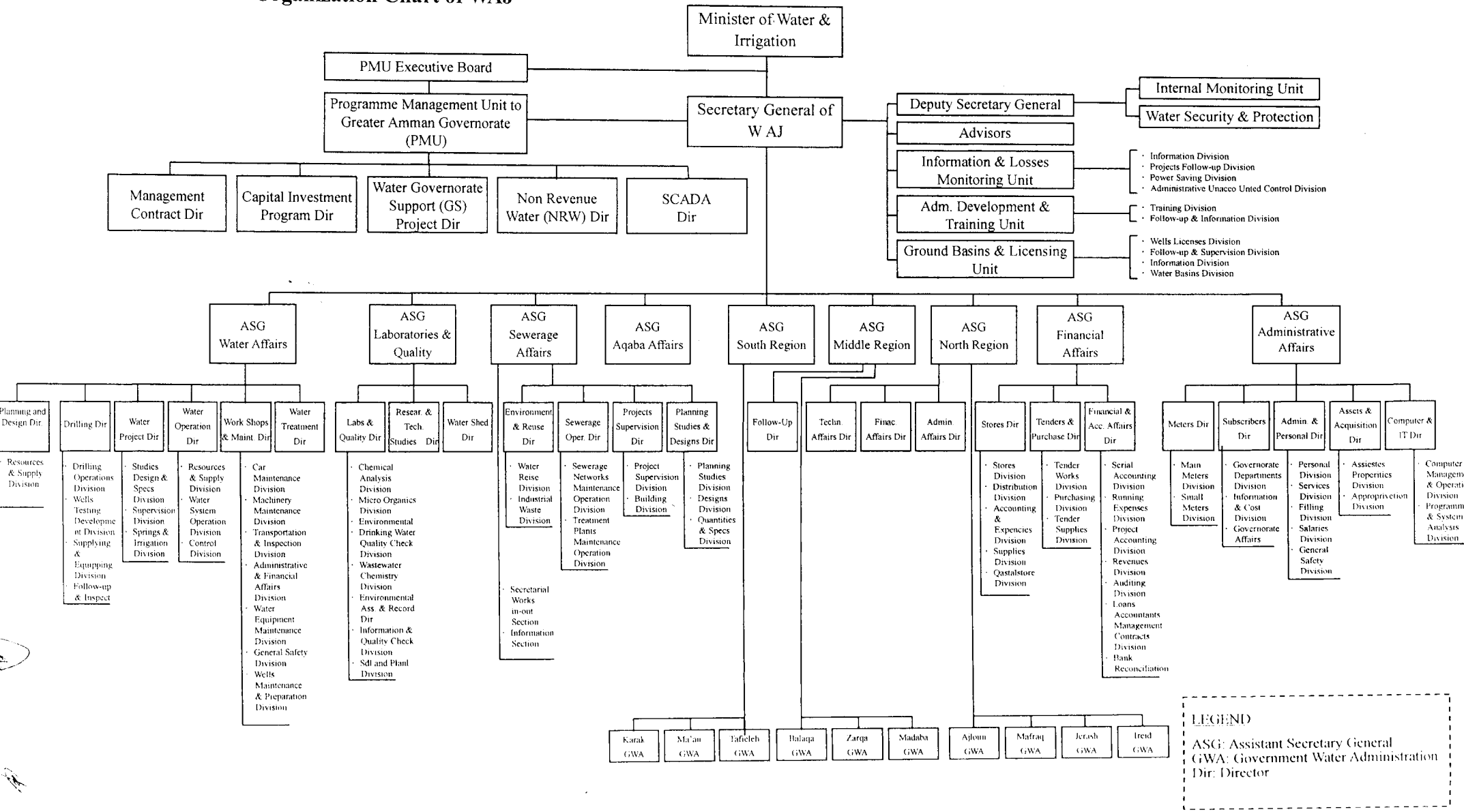
Both sides agreed to modify the title of the Programme as "the Programme for Energy Conservation through Upgrading Water Supply Network."

Annex I	Programme Site Map
Annex II	Organization Chart of WAJ
Annex III	List of Items Requested by the Government of Jordan
Annex IV	Programme Grant Aid for Environment and Climate Change of the Government of Japan
Annex V	Flow of Funds and Implementation of the Programme
Annex VI	Major Undertakings to be Taken by Each Government
Annex VII	Organization Chart for the Implementation of the Programme
Annex VIII	Consultative Committee

Annex I Programme Site Map



Annex II Organization Chart of WAJ



Annex III List of Items Requested by the Government of Jordan

Category	Mark	Materials	Diameter (inch)	Location	PN(bar)	Unit	Quantity	Priority
1	P	Pump (Q=500m3/h, H=350m)	-	Azraq P.S. (to Khaw P.S.)	35	nos	2	1
	P	Pump (Q=300m3/h, H=350m)	-	Azraq P.S. (to Khaw P.S.)	35	nos	2	
	WM	Water Meter (Ultrasonic)	24	Azraq P.S.: Inlet pipeline from wells to reservoir	-	nos	1	
	WM	Water Meter (Ultrasonic)	24	Azraq P.S.: Outlet pipeline to Khaw P.S.	-	nos	1	
	WM	Water Meter (Ultrasonic)	24	Khaw Reservoir : Inlet pipeline from Azraq P.S	-	nos	1	
	P	Pump (Q=500m3/h, H=150m)		Halabat station (to Khaw)	15	nos	1	2
	WM	Water Meter (Ultrasonic)	24	Hallabat P.S.: Inlet pipeline from wells to reservoir	-	nos	1	
	WM	Water Meter (Ultrasonic)	24	Hallabat P.S.: Outlet pipeline to Khaw P.S.	-	nos	1	
	WM	Water Meter (Ultrasonic)	24	Khaw Reservoir : Inlet pipeline from Hallabat P.S	-	nos	1	
2	P	Pump (Q=400m3/h, H=100m)	-	Zarqa P.S. to Batrawi Reservoir	16	nos	3	3
	DIP	Ductile iron pipes	600mm	Transmission from Zarqa P.S. to Batrawi Reservoir	-	m	-	
	WM	Water Meter (Ultrasonic)	-	Zarqa P.S.: Outlet pipeline to Batrawi	-	nos	1	
	V	Valve	16	New Khaw P.S.: Delivery Pipeline	16	nos	6	4
	V	Valve	16	New Khaw P.S.: Suction Pipeline	16	nos	6	
	V	Valve	24	New Khaw P.S.: Delivery Pipeline	16	nos	2	
	NRV	Non-retaining Valve	16	New Khaw P.S.	16	nos	3	
	WM	Water Meter (electronic)	28	New Khaw P.S.: Outlet pipeline to Batrawi Reservoir	-	nos	1	
	WM	Water Meter (electronic)	16	New Khaw P.S.: Outlet pipeline to Zarqa P.S.	-	nos	1	
	DIP	Ductile iron pipes	Variable	New Khaw P.S.: Inside Connection Pipes	-	m	-	
	P	Pump (Q=500m3/h, H=50m)	-	Zarqa Treatment Plant: Outlet pipeline to Zarqa Reservoir	5	nos	1	5
3	P	Pump (Q=100m3/h, H=350m)	-	Merheb P.S.: To Berein Reservoir	35	nos	1	6
	P	Pump (Q=200m3/h, H=100m)	-	Merheb P.S.: To Awajan Reservoir	10	nos	1	
	WM	Water Meter (Turbin)	6	Merheb P.S.: Outlet pipeline to Berein	40	nos	1	
	WM	Water Meter (Turbin)	6	Merheb P.S.: Outlet pipeline to Awajan	10	nos	1	
4	GV	Gate Valve	2	Zarqa network	16	nos	100	7
	GV	Gate Valve	2	Zarqa network	25	nos	100	
	GV	Gate Valve	4	Zarqa network	16	nos	100	
	GV	Gate Valve	4	Zarqa network	25	nos	100	
	GV	Gate Valve	6	Zarqa network	16	nos	30	
	GV	Gate Valve	6	Zarqa network	25	nos	30	
	GV	Gate Valve	8	Zarqa network	16	nos	30	
	GV	Gate Valve	8	Zarqa network	25	nos	30	
	GV	Gate Valve	12	Zarqa network	16	nos	10	
	GV	Gate Valve	12	Zarqa network	25	nos	10	
	GV	Gate Valve	16	Zarqa network	16	nos	3	
	GV	Gate Valve	24	Zarqa network	25	nos	2	
	WM	Water Meter (Ultrasonic)	16	Transmission Line to Russeifa	-	nos	1	
	WM	Water Meter (Ultrasonic)	24	Khaw-Amman Pipiline: Awajan Junction	-	nos	1	
	AV	Air release valve	2	Zarqa network	25	nos	20	
	AV	Air release valve	4	Zarqa network	25	nos	20	

Note: The specification and quantity of the equipment and materials are subject to be modified by the study.

Category: 1. Water Transmission form major well water sources, 2. Water Transmission to Batrawi Reservoir
3. Water Transmission to Awajan and Rusaifa Reservoirs, 4. Water Transmission and distribution pipelines in Zarqa district

Annex IV

Programme Grant Aid for Environment and Climate Change of the Government of Japan (Provisional)

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 relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

Based on the "Cool Earth Partnership" initiative of the The Government of Japan (hereinafter referred to as "the GOJ"), the Programme Grant Aid for Environment and Climate Change (hereinafter referred to as "GAEC") aims to mitigate negative effects of global warming by reducing Green House Gas emission (mitigation measure such as improvement of energy efficiency) and to adapt the supposed effects (adaptation measures such as stabilization of water supply in a region suffering less precipitation due to the climate change).

GAEC may contain multiple components that can be combined to effectively achieve its objectives. The contractors and suppliers may not be confined to Japanese firms and construction, in principle, can be conducted by utilizing local standards.

1. GAEC Procedures

GAEC is executed through the following procedures.

- Application
  - Request made by the recipient country
- Preparatory Survey (hereinafter referred to as "the Survey")
  - The Survey for Outline Design conducted by Japan International Cooperation Agency (hereinafter referred to as "JICA")
- Appraisal & Approval
  - Appraisal by the GOJ and Approval by the 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 Programme on the basis of the G/A

Firstly, the application or request for a GAEC Programme submitted by the recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether it is eligible for GAEC. If the request is deemed appropriate, the GOJ assigns JICA to conduct a survey on the request.

Secondly, JICA conducts the Survey for Outline Design with Japanese consulting firms.

Thirdly, the GOJ appraises the programme to see whether it is suitable for Japan's GAEC, based on the Survey report prepared by JICA, then the result is submitted to the Cabinet for approval.

Fourthly, the programme, once approved by the Cabinet, becomes official with the Exchange of Notes (hereinafter referred to as E/N) signed by the GOJ and the recipient country. Simultaneously, the Grant will be made available by concluding the G/A between the recipient country and JICA.

JICA is designated by the GOJ as the organization responsible for necessary works for proper execution of the Grant.

Procurement Management Agent (hereinafter referred to as "the Agent") is designated to conduct the procurement services of products and services (including fund management, preparing tenders, contracts) for GAEC on behalf of the recipient country. The Agent is an impartial and specialized organization that shall render services according to the Agent Agreement with the recipient country. The Agent is recommended to the recipient country by the GOJ and agreed between the two Governments in the Agreed Minutes (hereinafter referred to as "A/M").

2. Preparatory Survey for Outline Design

1) Contents of the Survey

The purpose of the Survey, conducted by JICA on a requested programme ("the Programme"), is to provide the basic documents necessary for the appraisal of the Programme by the GOJ. The contents of the Survey are as follows:

(1) Confirmation of background, objectives, and benefits of the Programme and institutional capacity of agencies and communities concerned of the recipient country necessary for the implementation of the Programme.
(2) Evaluation of relevance of the Programme to be implemented under the Grant Aid Scheme

from a technical, social, and economic point of view.

(3) Confirmation of items agreed upon by both parties concerning the basic concept of the Programme.

(4) Preparation of the outline design of the Programme.

(5) Preliminary Estimation of cost for the Programme.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Programme. The Outline Design of the Programme 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 Programme. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Programme. Therefore, the implementation of the Programme is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

2) Selection of Consultants

For the smooth implementation of the Survey, JICA will conduct the Survey with JICA-registered consulting firms. JICA selects the firms based on proposals submitted by firms with interest in implementing the Survey. The firms selected will carry out the Outline Design Survey and prepare a report, based on the terms of reference set by JICA.

The consulting firms that will implement the Programme after the G/A can be, in principle, Japanese firms recommended by JICA for maintaining technical consistency with the Survey.

3. Implementation of GAEC after the E/N

1) The E/N and the G/A

The content of GAEC will be determined in accordance with the E/N exchanged by the two Governments, in which the objectives of the Programme, length of the Programme, conditions and amount of the Grant Aid are confirmed. The conclusion of the G/A between the recipient country and JICA follows the exchange of E/N to determine the paying conditions responsibilities of the recipient country and procurement conditions.

2) Details of Procedures

Details of procedures on implementing the Programme under GAEC will be agreed between the

authorities of the two governments concerned at the time of the signing of the E/N and the G/A. Essential points to be agreed are outlined as follows:

a) JICA will supervise the implementation of the Programme.

b) Products and services shall be procured and provided in accordance with JICA's "Procurement Guidelines for the Programme Grant Aid (Type I – E) for Environment and Climate Change."

c) The recipient country shall conclude a contract with the Agent.

d) The Agent is the representative acting in the name of the recipient country concerning all transfers of funds to the Agent.

3) Focal points of the "Procurement Guidelines for the Programme Grant Aid (Type I – E) for Environment and Climate Change"

a) The Agent

The Agent is the organization, which provides procurement of products and services on behalf of the recipient country according to the Agent Agreement with the recipient country. The Agent is recommended to the recipient country by the GOJ and agreed between the two Governments in the A/M.

b) Agent Agreement

The recipient country shall conclude the Agent Agreement, in principle, within two months after the signing of the G/A, in accordance with the A/M. The scope of the Agent's services shall be clearly specified in the Agent Agreement.

c) Approval of the Agent Agreement

The Agent Agreement is prepared as two identical documents and the copy of the Agent Agreement shall be submitted to JICA by the recipient country through the Agent. JICA will confirm whether the Agent Agreement is concluded in conformity with the E/N, A/M, and G/A and the Procurement Guidelines for the Programme Grant Aid for Environment and Climate Change then approves the Agent Agreement.

The Agent Agreement concluded between the recipient country and the Agent shall become effective after the approval by JICA in a written form.

d) Payment Methods

The Agent Agreement shall stipulate that "Regarding all transfers of the fund to the Agent, the recipient country shall designate the Agent to act on behalf of the Government and issue a Blanket Disbursement Authorization ("the BDA") to conduct the transfer of the fund (hereinafter

referred to as "the Advances") to the Procurement Account from Account of the Government.

The Agent Agreement shall clearly state that the payment to the Agent shall be made in Japanese yen from the Advances and that the final payment to the Agent shall be made when the total remaining amount become less than three percent (3%) of the Grant and its accrued interests.

e) Products and Services Eligible for Procurement

Products and services to be procured shall be selected from those defined in the G/A.

f) Selection of firms

In principle, firms of any nationality could be contracted as long as the firms satisfies the conditions specified in the tender documents.

g) Method of Procurement

When conducting the procurement, sufficient attention shall be paid to transparency in selecting the firms and for this purpose, in principle, competitive tendering shall be employed.

h) Tender Documents

The tender documents should contain all information necessary to enable tenderers to prepare valid offers for the products and services to be procured by GAEC.

The rights and obligations of the recipient country, the Agent and the firms supplying products and services should be stipulated in the tender documents to be prepared by the Agent.

i) Pre-qualification Examination of Tenderers

The Agent may conduct a pre-qualification examination of tenderers in advance of the tender so that the invitation to the tender can be extended only to eligible firms. The pre-qualification examination should be performed only with respect to whether the prospective tenderers have the capability of concluding the contracts.

For this, the following points should be taken into consideration:

(1) Experience and past performance in contracts of similar kind
(2) Financial credibility (including assets such as real estate)
(3) Existence of offices and other items to be specified in the tender documents.
(4) Their potentialities to use necessary personnel and facilities.

j) Tender Evaluation

The tender evaluation should be implemented on the basis of the conditions specified in the tender documents.

Those tenderers which substantially conform to the technical specifications and other stipulations of the tender documents, shall be judged in principle on the basis of the submitted price, and the tenderer who offers the lowest price shall be designated as the successful tenderer.

The Agent shall submit a detailed evaluation report of tenders to JICA for its information, while the notification of the results to the tenderers will not be premised on the confirmation by JICA.

k) Additional procurement

If there is any remaining balance after the competitive and/or selective tendering and/or direct negotiation for a contract, and if the recipient country would like to procure additional items, the Agent is allowed to conduct this additional procurement, following the points mentioned below:

(1) Procurement of same products and services

When the products and services to be additionally procured are identical with the initial tender and a competitive tendering is judged not efficient, additional procurement can be conducted by a negotiated contract with the successful tenderer of the initial tender.

(2) Other procurements

When products and services other than those mentioned above in (1) are to be procured, the procurement should be conducted through competitive tendering. In this case, the products and services for additional procurement shall be selected from among those in accordance with the G/A.

l) Conclusion of the Contracts

In order to procure products and services in accordance with the guideline, the Agent shall conclude contracts with firms selected by tendering or other methods.

m) Terms of Payment

The contract shall clearly state the terms of payment. The Agent shall make payment from the "advances," against the submission of the necessary documents from the firm on the basis of the conditions specified in the contract. When the services are the object of procurement, the Agent may pay certain portion of the contract amount in advance to the firms on the conditions that such firms submit the advance payment guarantee worth the amount of the advance payment to

the Agent.

4) Undertakings required by the recipient country

In the implementation of the Programme Grant Aid, the recipient country is required to undertake necessary measures as the following:

a) To secure land necessary for the sites of the Programme.

b) To provide facilities for distributing electricity, water supply and drainage and other incidental facilities in and around the sites if necessary.

c) To assist prompt execution for domestic transportation of products purchased under the Grant Aid as necessary,

d) To ensure that customs duty, internal tax and other fiscal levies that may be imposed in Jordan with respect to the purchase of the Components and the Agent's services shall be exempted by the recipient country.

e) To accord all the concerned parties, whose services may be required in connection with supply of the products and services under the contracts, such facilities as may be necessary for their entry into Jordan and stay therein for the performance of their work.

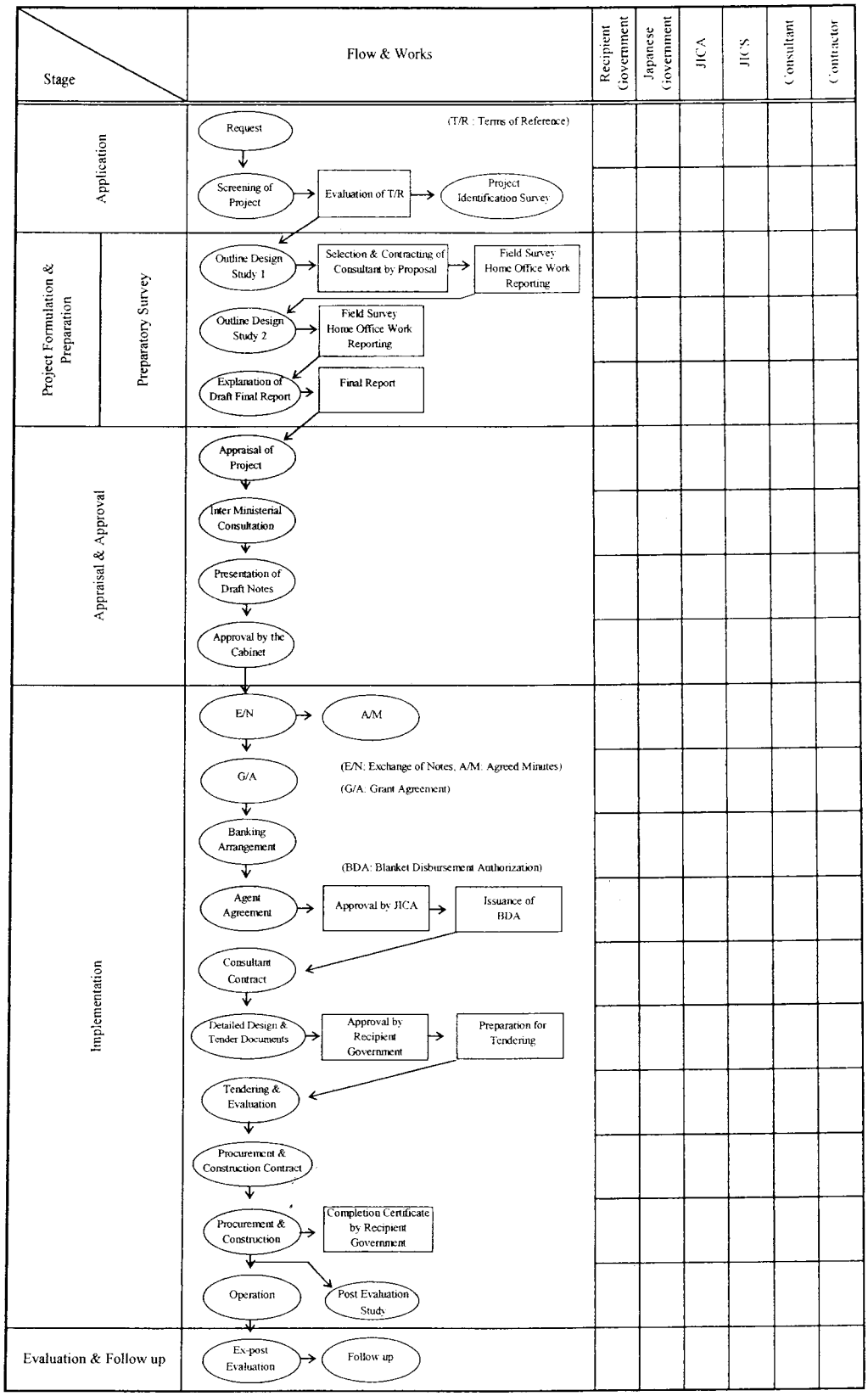
5) "Proper use of funds"

The recipient country is required to take necessary actions so that the facilities constructed under the Grant Aid are properly and effectively used and to ensure sustainable operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

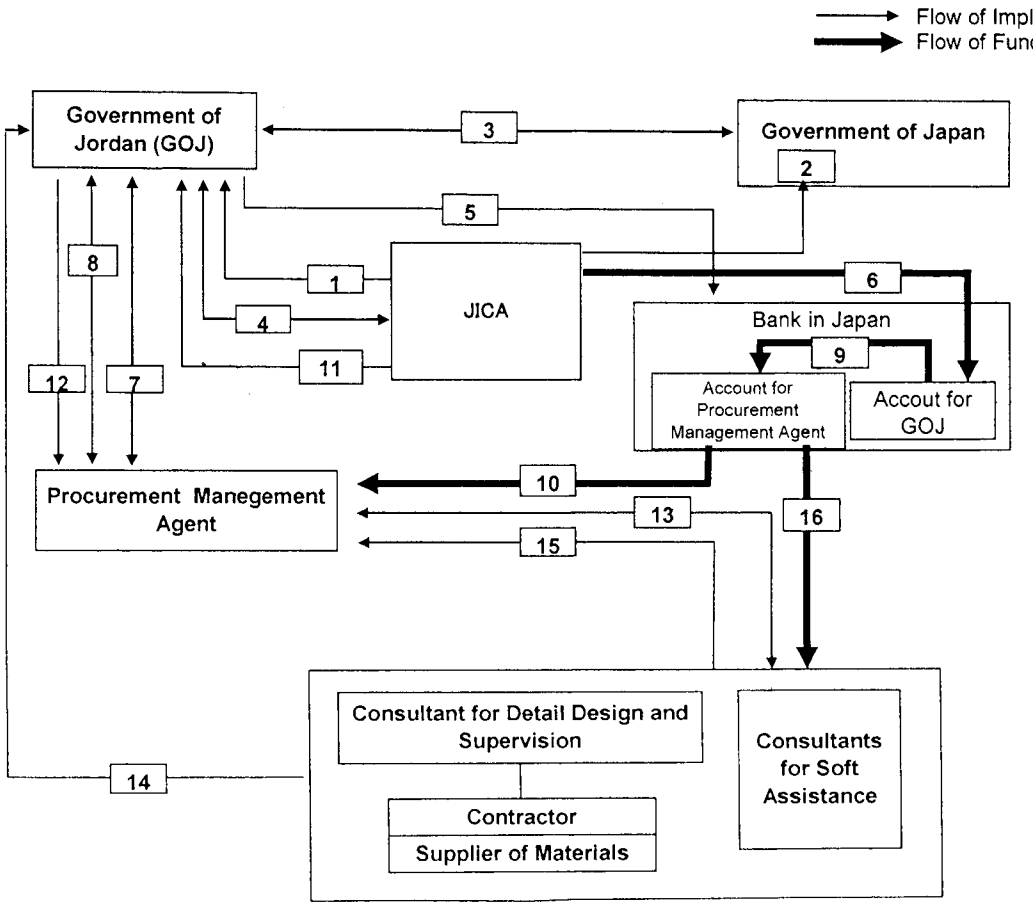
6) "Exported or Re-export"

The products purchased under the Grant shall not be exported or re-exported from Jordan.

FLOW CHART OF JAPAN's PROGRAMME GRANT AID FOR ENVIRONMENT AND CLIMATE CHANGE PROCEDURES



Annex V Flow of Funds and Implementation of the Programme

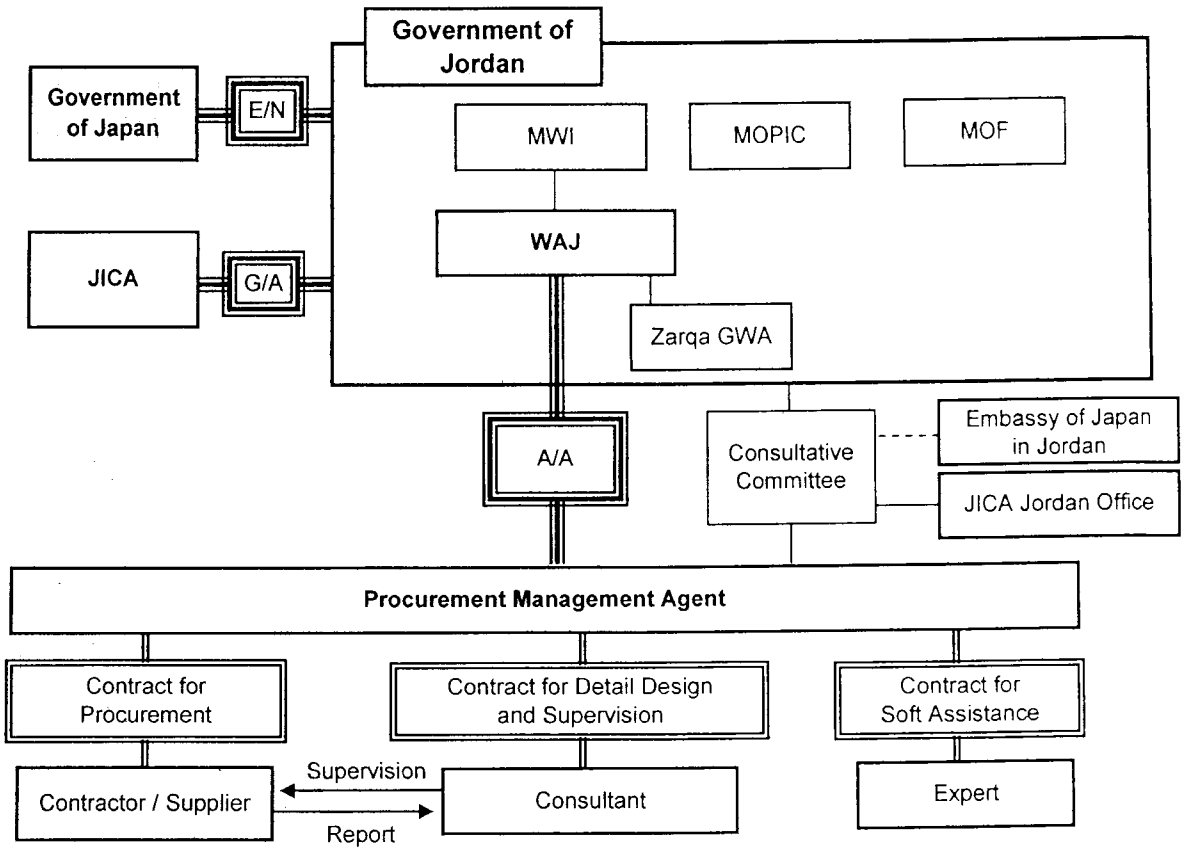


1 Preparatory Survey/ Materials for Outline Design
2 Approval of Cabinet
3 Signing of Exchange of Notes (E/N)
4 Signing of Grant Agreement (G/A)
5 Banking Arrangement
6 Payment of funds from the Government of Japan
7 Signing of Agent Agreement(A/A)
8 Decision of project components
9 Transfer of funds (the Advances)
10 Payment of Remuneration for Agent
11 Recommendation of Consultant for Detail Design/Supervision (JICA→Government of Jordan)
12 Recommendation of Consultant for Detail Design / Supervision (Government of Jordan→Procurement Agent)
13 Conclusion of Contract
14 Construction, Procurement, and Technical Assistance
15 Application for Payment
16 Payment

Annex VI Major Undertakings to be Taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To bear the following commissions applied by the bank in Japan for banking services based upon the Bank Arrangement (B/A):		
	1) Payment of bank commission		●
2	To ensure prompt unloading and customs clearance at the port of disembarkation in the recipient country		
	1) Marine or air transportation of the products from the produciton countries to the recipient	●	
	2) Tax exemption and customs clearance of the products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the programme site	●	
3	To accord Japanese nationals and / or nationals of third countries, including persons employed by the agent whose services may be required in connection with the Components such facilities as may be necessary for their entry into recipient country and stay therein for the performance of their work.		●
4	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the Components and to the employment of the Agent shall be exempted by the Government of recipient country		●
5	To maintain and use properly and effectively the facilities that are constructed and the equipment that is provided under the Grant.		●
6	To bear all the expenses, other than those covered by the Grant and its accrued interest, necessary for the purchase of the Components as well as for the agent's fees.		●

Annex VII Organization Chart for the Implementation of the Programme



LEGEND:
- ═══ :Official Agreement
- ═══ :Contract(Procurement Management Agent—Firms & Consultants)
- ——— :Report・Supervision・Cordination

E/N	:Exchange of Notes
G/A	:Grant Agreement
A/A	:Agent Agreement
MWI	:Ministry of Water and Irrigation
MOPIC	:Ministry of Planning and International Cooperation
MOF	:Ministry of Finance
WAJ	:Water Authority of Jordan
Zarqa GWA	:Zarqa Governorate Water Authority
JICA	:Japan International Cooperation Agency
JICS	:Japan International Cooperation System

Annex VIII Consultative Committee

1. Functions

The Consultative Committee (hereinafter referred to as "the Committee") will be established in order to fulfill the following functions:

1) to confirm an implementation schedule of the Programme for the speedy and effective utilization of the Grant and its accrued interest;
2) to discuss determination and/or modification of the Components, taking into account of the products enumerated in the list attached to the Procurement Guidelines and/or the result of the preparatory survey for the Programme by JICA;
3) to discuss modifications of the Programme;
4) to exchange views on allocations of the Grant and its accrued interest as well as on potential end-users;
5) to identify problems which may delay the utilization of the Grant and its accrued interest, and to explore solutions to such problems;
6) to exchange views on publicity related to the utilization of the Grant and its accrued interest; and
7) to discuss any other matters that may arise from or in connection with the G/A.

The first meeting of the Committee shall be held immediately after the approval of the Agent Agreement by the JICA, which shall be concluded between WAJ and the Procurement Management Agent (hereinafter referred to as "the Agent").

The selection of the Agent will be agreed between the two governments in the Agreed Minutes attached in the Exchange of Notes.

Further meetings will be held by the request of either the Jordanian side or the Japanese side. The Agent also may advise both sides on the necessity to call a meeting of the Committee.

2. Composition (Provisional)

1) Representative of Ministry of Planning and International Cooperation
2) Representatives of Water Authority of Jordan
   - Secretary General (Chairman of the Committee)
   - Manager of NRW / Performance Indicators & Benchmarking
   - Director of Planning and Design Department
   - Director of Zarqa Governorate Water Authority
3) Representative of the Procurement Management Agent
4) Representative of JICA Jordan Office

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY II
ON
THE PROGRAMME FOR ENERGY CONSERVATION THROUGH UPGRADING WATER SUPPLY NETWORK IN THE HASHEMITE KINGDOM OF JORDAN

(EXPLANATION ON DRAFT OUTLINE DESIGN STUDY REPORT)

In June 2009, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Survey 2 for the Outline Design on the Programme for Energy Conservation through Upgrading Water Supply Network (hereinafter referred to as the "Programme") to the Hashemite Kingdom of Jordan (hereinafter referred to as "Jordan") and through discussion, field survey and technical examination of the results in Japan, JICA prepared a draft outline design study report (hereinafter referred to as "the Draft Report").

In order to explain and to consult with the Government of Jordan on the components of the Draft Report, JICA sent to Jordan the Draft Report Explanation Team (hereinafter referred to as "the Team"), which is headed by Shigeru Okamoto, Chief Representative, JICA Jordan Office, from 10th October to 16th October, 2009.

As a result of discussions, both sides confirmed the main items described on the attached sheets.

Amman, 15th October, 2009

Mr. Shigeru Okamoto
Leader,
Draft Report Explanation Team
Japan International Cooperation Agency
(JICA)

Eng. Munir Oweis
Secretary General,
Water Authority of Jordan (WAJ)
Ministry of Water and Irrigation
The Hashemite Kingdom of Jordan

ATTACHMENT

1. Components of the Draft Report

The Jordanian side agreed and accepted in principle the components of the Draft Report explained by the Team. The components of the Programme are shown in **Annex-1.**

2. Japan's Programme Grant Aid for Environment and Climate Change

The Jordanian side understands the Scheme of Japan's Programme Grant Aid for Environment and Climate Change and the necessary measures to be taken by the Government of Jordan as explained by the Team and described in Annex IV, Annex V and Annex VI of the Minutes of Discussions signed by both sides on 8 April, 2009.

In addition, both sides confirmed the provisional composition of the consultative committee described in **ANNEX-2**

3. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to the Government of Jordan by January 2010.

4. Other Relevant Issues

The following issues were discussed and confirmed by both sides.

4-1) Programme Cost Estimation

The team explained to the Jordanian side the Programme Cost Estimation as described in **Annex-3** and this cost estimation is provisional and would be further examined by the Government of Japan for the approval of the Grant. Both sides agreed that the Programme Cost Estimation should never be duplicated or released to any outside parties until signing of all the contract(s) for the Programme.

The Jordanian side understood that the Programme Cost Estimation is not final and subject to be modified.

4-2) Undertakings and Obligations of the Jordanian Side

In case that the Programme would be approved by the government of Japan, the Jordanian side would execute the obligations in pace with the progress of the procurement of materials and equipment, in additional to the major undertakings described in Annex VI of the Minutes of discussions signed by both sides on June 18, 2009. The list of the obligations is described in **ANNEX-4.**

4-2-1) Budget Allocation Schedule

The budget for reconstruction of Zarqa pumping station, would be approved and allocated by the end of 2009. Regarding the budget for installation of transmission

pipeline to Batrawi reservoir from Zarqa Pumping Station and other related materials and equipment, the Jordanian side would request the necessary budget for the cabinet to be allocated in 2011 of the Jordanian fiscal year.

4-2-2) Target Areas for Equipment to be Procured in the Second Lot

Equipment to be procured in the Second Lot, such as gate valves and air valves, are restricted to be installed in the distribution networks under gravity distribution system.

4-2-3) Arrangements with Power Distribution Company

The Jordanian side would support the contract between the supplier firm and the power distribution company to install transformers to be procured in the Programme, and to make arrangements for switchover to the medium voltage power receiving system in Azraq pumping station.

4-2-4) Monitoring of Effects on Energy Efficiency Improvement

The Jordanian side would collect and report operational data to JICA, such as the amount of water distribution and electricity consumption by the pumping stations targeted in the Programme, in order to evaluate the effects of the Programme in terms of energy efficiency improvement at the end of the Programme.

4-3) Environmental Impact Assessment (EIA)

The Jordanian side would inform JICA that EIA is not necessary for implementation of the Programme, and send to JICA the official letter approved by the Ministry of Environment by the end of October 2009.

4-4) Jordanian Authority Signing the Agent Agreement

The Jordanian side would determine the signer of the Agent Agreement as the authority representing the Jordanian side, and inform the result to JICA by the end of October 2009.

ANNEX-1	**Components of the Programme**
ANNEX-2	**Consultative Committee**
ANNEX-3	**Programme Cost Estimation (CONFIDENTIAL)**
ANNEX-4	**Obligations of the Jordanian side (Table3.1.1 of the Draft Report)**

ANNEX-1 Components of the Programme

Equipment	Dia. (inch)	Location	PN(bar)	Unit	Quantity
I. Procurement Lot 1					
1. Azraq Pumping Station					
Pump (Q=425m^3/h, H=360m)	-	Azraq P.S. to Khaw P.S.	36	nos	5
Water Meter	24	Inlet pipeline from wells to reservoir	-	nos	2
Water Meter	24	Outlet pipeline to Khaw P.S.	-	nos	1
Water Meter	24	Khaw Reservoir : Inlet pipeline from Azraq P.S	-	nos	1
2. Hallabat Pumping Station (to Khaw)					
Pump (Q=500m^3/h, H=135m)	-	Hallabat station to Khaw	14	nos	2
Water Meter	16	Inlet pipeline from wells to reservoir	-	nos	1
Water Meter	12	Inlet pipeline from wells to reservoir	-	nos	1
Water Meter	24	Outlet pipeline to Khaw P.S.	-	nos	1
Water Meter	24	Khaw Reservoir : Inlet pipeline from Hallabat P.S	-	nos	1
3. Zarqa Pumping Station					
Pump (Q=400m^3/h, H=100m)	-	Zarqa P.S. to Batrawi Reservoir	16	nos	3
Ductile iron pipes	20	Transmission from Zarqa P.S. to Batrawi Reservoir	16	km	2
Water Meter	20	Zarqa P.S.: Outlet pipeline to Batrawi	-	nos	1
4. Khaw New Pumping Station					
Valve	16	Delivery Pipeline	16	nos	4
Valve	16	Suction Pipeline	16	nos	4
Valve	28	Delivery Pipeline	16	nos	1
Non-retaining Valve	16	Delivery Pipeline	16	nos	4
Water Meter	28	Outlet pipeline to Batrawi Reservoir	-	nos	1
5. Hallabat Pumping Station (to Hallabat Village)					
Pump (Q=150m^3/h, H=150m)	-	Hallabat station to Hallabat Village	15	nos	2
Water Meter	8	Outlet pipeline to Hallabat Village	-	nos	1
6. Air release valve on Transmission Pipe to Khaw and Water Meter				nos	
Air release valve	4	Transmission Line from Azraq to Khaw	-	nos	40
Air release valve	4	Transmission Line from Hallabat to Khaw	-	nos	15
Water Meter	16	Transmission Line to Russeifa	16	nos	1
Water Meter	24	Khaw-Amman Pipeline: Awajan Junction	25	nos	1
II. Procurment Lot 2					
7. Transmission and Distribution Network					
Gate Valve	4	Zarqa network	16	nos	222
Gate Valve	6	Zarqa network	16	nos	69
Gate Valve	8	Zarqa network	16	nos	32
Gate Valve	12	Zarqa network	16	nos	13
Gate Valve	16	Zarqa network	16	nos	5
Gate Valve	24	Zarqa network	16	nos	2
Air release valve	2	Zarqa network	16	nos	15

ANNEX-2 Consultative Committee

1. Functions

The Consultative Committee (hereinafter referred to as "the Committee") will be established in order to fulfill the following functions:

1) to confirm an implementation schedule of the Programme for the speedy and effective utilization of the Grant and its accrued interest;
2) to discuss determination and/or modification of the Components, taking into account of the products enumerated in the list attached to the Procurement Guidelines and/or the result of the preparatory survey for the Programme by JICA;
3) to discuss modifications of the Programme;
4) to exchange views on allocations of the Grant and its accrued interest as well as on potential end-users;
5) to identify problems which may delay the utilization of the Grant and its accrued interest, and to explore solutions to such problems;
6) to exchange views on publicity related to the utilization of the Grant and its accrued interest; and
7) to discuss any other matters that may arise from or in connection with the G/A.

The first meeting of the Committee shall be held immediately after the approval of the Agent Agreement by the JICA, which shall be concluded between WAJ and the Procurement Management Agent (hereinafter referred to as "the Agent").

The selection of the Agent will be agreed between the two governments in the Agreed Minutes attached in the Exchange of Notes.

Further meetings will be held by the request of either the Jordanian side or the Japanese side. The Agent also may advise both sides on the necessity to call a meeting of the Committee.

2. Composition (Provisional)

1) Representative of Ministry of Planning and International Cooperation
2) Representatives of Water Authority of Jordan
   - Assistant Secretary General on Water Affairs Department (Chairman of the Committee)
   - Manager of NRW / Performance Indicators & Benchmarking
   - Director of Planning and Design Department
   - Director of Zarqa Governorate Water Authority
3) Representative of the Procurement Management Agent
4) Representative of JICA Jordan Office

ANNEX-4 Obligations of the Jordanian side

Item	Obligations of the Jordanian side
1. General matters	• Application for and acquisition of permission/approval relevant to Programme implementation from the organizations concerned • Banking procedures including Banking Arrangement (B/A) and Blanket Disbursement Authorization (BDA) • Payment of commission for opening the B/A account, commission for BDA notification and other bank commissions • Guarantee of unloading and customs clearance at the port of disembarkation and domestic transportation of the equipment to be procured in this Programme • Arrangement for exemption from internal taxes including customs duties and IVA and other fiscal charges on the equipment and services to be procured in this Programme • Assistance to employees of the consultant and the procurement contractor involved in Programme implementation for their entry into, exit from and stay in Jordan • Implementation of environmental impact assessment and acquisition of permission for installation of the equipment from the Ministry of Environment, if necessary • Guarantee of the safety of the activities for Programme implementation
2. Content and schedule of Programme implementation	• Discussion on the content of the Lot 2 equipment after conclusion of the contract for the procurement of Lot 1 (at the Consultative Committee) • Discussion on when to implement the process of selecting the contractor for the procurement of Lot 2 (at the Consultative Committee) • Selection of areas in which installation of Lot 2 is to be implemented (at the Consultative Committee)
3. Preparation for procurement of equipment	• Reservation and improvement of storage area for equipment and spare parts (at Ain Ghazal Central Warehouse)
4. Preparation for installation of equipment	Azraq Pumping Station • Necessary arrangements with the power distribution company for switchover of the power distribution system (from low to medium voltage power receiving) • Partial replacement of distribution cables (for switchover to the medium voltage power receiving system) • Removal of the existing transformer at the new pumping station • Relocation of Pump No.3 to the new pumping station (for installation of the procured equipment) • Removal of existing electric panels for generators in the electric room Hallabat Pumping Station • Repair of the existing station building • Relocation of Pump No.1 (for installation of the procured equipment) Zarqa Pumping Station • Construction and furnishing of the new pumping station building • Arrangement of transformer facilities (1,200 kVA transformer for the transmission pumps procured by the Japanese side and transformer for the distribution pumps procured by the Jordanian side) • Installation of inflow pipeline at the new pumping station (from Zarqa Reservoir) • Installation of outflow pipelines from the new pumping station (for the transmission pumps procured by the Japanese side and the distribution pumps procured by the Jordanian side)

Item	Obligations of the Jordanian side
	• Installation of trenches for wiring in the station (for the transmission pumps procured by the Japanese side and the distribution pumps procured by the Jordanian side) Khaw Pumping Station • Approval of constructing a flow meter chamber at the inflow pipeline from Hallabat
5. Installation of equipment	Azraq Pumping Station • Construction of water flow meter chambers and installation of cables for water flow meters (three places) • Installation of pipes for partial replacement of the transmission pipeline on the premises of the station (Dia.600mm, approx.. 40 m) • Repair of existing valve chamber for flow control valve and installation of valve(Dia.600mm, one place) • Installation of air valve on the discharge pipe of the water transmission pump (one place) • Installation of air valves and repair of existing air valve chambers on the water transmission pipeline to Khaw Reservoir (40 places) Hallabat Pumping Station • Construction of water flow meter chambers and installation of cables for water flow meters (two places) • Repair of water flow meter chamber and installation of cables for water flow meter (one place) • Construction of valve chamber for flow control valves and installation of valve (Dia.600mm) • Connection of bypass pipeline (between the transmission pipeline to Khaw and the distribution pipeline to the village) • Installation of air valves and repair of existing air valve chambers on the transmission pipeline to Khaw Reservoir (15 places) Zarqa Pumping Station • Installation of lead-in cables on the secondary side of the transformer to the electrical board for the water transmission pumps procured by the Japanese side • Construction of water flow meter chamber and installation of cables (one place: Pipes are to be installed as part of the discharge pipeline from the new pumping station) • Construction of valve chamber for flow control valve and installation of valve (Dia.600mm, one place: Pipes are to be installed as part of the discharge pipeline from the new pumping station) • Installation of water transmission pipeline to Batrawi Reservoir (Dia.600mm, approx.2 km) Khaw Pumping Station • Installation of valves for the pumps (Dia.400mm, 4 sets) • Construction of water flow meter chambers and installation of pipes and cables for water flow meters (three places) • Repair of valve chamber for flow control valve, removal of existing valve and water flow meter, and installation of flow control valve and pipes (Dia.700mm, one place) In the distribution networks • Construction of water flow meter chambers, installation of cables, supply of power source and construction of converter sheds for water flow meters (two places) • Installation of gate valves (Dia.100 – 600 mm, 343 valves) • Installation of air valves (Dia.50, 15 valves)

Item	Obligations of the Jordanian side
	Miscellaneous ・Measures to ensure water distribution in the case of temporary shortage of discharge during installation of the equipment
6. Operation and Maintenance Technical Guidance of Pumping Facilities, Soft Component	・Appointment of a counterpart for the Technical Guidance and Soft Component ・New and additional appointment of personnel in charge of operation management, maintenance / safety management at the assisted pumping stations ・Appointment of personnel from unassisted pumping stations to attend the seminars and OJT ・Purchase of two personal computers for sorting and analysis of the operation/maintenance records ・Payment of allowance for attendance at the above-mentioned seminars and OJT to the relevant personnel ・Reservation of lecture rooms suitable for seminars (at VTC) ・Contact and coordination with the relevant organizations to facilitate implementation of the Technical Guidance and Soft Component ・Monitoring and follow-up for sustainable operation and maintenance of the facilities after implementation of the Technical Guidance and Soft Component
7. Organization	Azraq Pumping Station ・Appointment of a safety manager for the medium voltage power receiving system Zarqa Pumping Station ・Additional appointment of an electrical facility engineer, mechanical facility engineer and electrical facility technician Khaw Pumping Station ・Appointment of a senior manager for the pumping station ・Additional appointment of a technician in chlorine management
8. Operation and maintenance of equipment	・Implementation of appropriate operation management, maintenance / safety management of the procured equipment ・Implementation of appropriate management of the operation of the water transmission system ・Implementation of appropriate inventory and procurement management of spare parts ・Maintenance contract for the medium voltage power receiving system with a private company

MEMORANDUM ON
THE PREPARATORY SURVEY ON
THE PROJECT FOR ENERGY CONSERVATION THROUGH UPGRADING WATER SUPPLY NETWORK IN THE HASHEMITE KINGDOM OF JORDAN

1. Revised list of Items to be procured and priority of the Items:

In accordance with Clause 5 of the Attachment of Minutes of Discussions signed on the 8th of April 2009 for the captioned Survey, WAJ has prepared the revised list of Items to be procured and the priority order of its Items as shown in the Attachment 1 and 2 of this memorandum. WAJ side understands that the priority order of the equipment for the direct distribution by pump to the water distribution area is lower priority in consideration with the conditions for the procurement described in Attachment 3.

2. GTZ project:

GTZ is now implementing the Improvement Energy Efficiency (IEE) project on Azraq pumping station, Hallabat pumping station, Khaw pumping station and Zarqa desalination plant in Zarqa governorate under the coordination of WAJ. On the other hand, the Jordanian side has requested procurement of the pump equipments of the same pumping stations to Japanese side. In order to adjust the implementation way of procurement of the equipment and operation and maintenance (O&M) of pumping facilities by Japan and German, the coordination meeting among JICA, GTZ and WAJ will be held at the middle of June after submission of the draft final report of IEE project by GTZ, as discussed in the meeting held on 21st of April 2009. A Minutes of Meeting is as shown in Attachment 4 of this memorandum. The priorities of these pump stations may be rearranged based on the result of the coordination meeting.

3. Pipe for the distribution network:

The location for installation of requested ductile iron pipes are indicated on the map of distribution networks, however the total length of that pipes is not meet with the requested pipeline length of 14.0 km. Also quantity, diameter, nominal pressure and location to be replaced or newly installed of the deformed pipes and valves such as bend, branch, drain, gate valve and air valve have not presented on that pipe lines. Therefore, the Jordanian side will clarify the items and its quantity, specification and locations based on the route survey that will be conducted by WAJ side. The result shall be prepared by the end of May 2009 and shall be handed to the JICA survey team of the second stage.

4. Construction plan of building facilities of Zarqa and Khaw old pumping stations

The reconstruction plan of Zarqa pump station is now under implementation. Through the required procedure of designing, tendering and construction work, the new building of the pump station will be constructed by the end of the year 2009. The draft design drawings will be prepared by the end of May 2009 and will be handed to the JICA survey team of the second stage for the coordination between the reconstruction plan of Zarqa Pump station and the equipment procurement plan of the Project.

Also, WAJ has plan of reconstruction of old Khaw pump station. Therefore, the draft design drawings on Khaw pump station will be prepared by the end of June 2009 and layout of new Khaw

pump station will be handed to the JICA office on the end of May.

5. Scenario of water source transmission schedule in Zarqa Governorate:

In accordance with the agreement between WAJ and Miyahouna at least 500m^3/h of water shall be exported to Amman. The reallocation of water resources of Disi-Amman conveyor project will be determined and rescheduled after the completion of this project in the year of 2012-2013. WAJ side will prepare the scenario of water source transmission schedule in Zarqa Governorate including such condition and new exploitation plan of wells in order to fix the design discharge for the pump facilities requested to Japanese side, and present it to the JICA survey team of the second stage on the middle of June, 2009.

6. Acquisition of base line data and establish of monitoring plan:

Electric power consumption shall be measured as the index for evaluation of project effect. WAJ understands this point and will equip electric power meters at each pumping station in cooperation with electric supply company.

1) Azraq pump station:

A power meter for new pump station is measuring total consumption of transmission pumps and well pumps. The power meter of transmission pumps should be separated from the meter of well pumps before beginning of July 2009.

2) Halabat pump station:

A power meter for pump station is measuring total consumption of transmission pumps and well pumps. The power meter of transmission pumps should be separated from the meter of well pumps before beginning of July 2009.

3) Zarqa pump station:

The power meter for new transmission pumps should be separated from the meter of well pumps and desalination plant.

Amman, 23rd April, 2009

Eng. Bassam Saleh
Assistant Secretary General for Water Affairs,
Water Authority of Jordan (WAJ)
Ministry of Water and Irrigation
The Hashemite Kingdom of Jordan

Eng. Munir Oweis
Secretary General,
Water Authority of Jordan (WAJ)
Ministry of Water and Irrigation
The Hashemite Kingdom of Jordan

Shigeo Otani
Chief Consultant
Kyowa Engineering Consultant Co., Ltd.
JICA Preparatory Survey Team

Attachment 1

List of Requested Equipment and Materials (21/Apr/09)

No.	Area/Station	Mark	Materials	Diameter (inch)	Place	PN(bar)	Unit	Quantity
1	New Azraq Station	GV	Gate Valve	8	Delivery Pipe	40	nos	4
2		GV	Gate Valve	12	Suction Pipe	16	nos	4
3		GV	Gate Valve	24	Pelving Pipe	40	nos	1
4		GV	Gate Valve	24	Pelving Pipe	25	nos	1
5		GV	Gate Valve	24	Suction Pipe	25	nos	1
6		NRV	Non-retaining Valve	8	on each pump delivery pipe	40	nos	4
7		NRV	Non-retaining Valve	24	Delivery Pipe	40	nos	1
8		WM	Water Meter (electronic)	24	on pipe from wells to reservoir	25	nos	1
9		WM	Water Meter (electronic)	24	on pipe from pump station to Khaw	40	nos	1
10	Old Azraq Station	V	Valve	10	Delivery Pipe	40	nos	7
11		V	Valve	12	Suction Pipe	25	nos	7
12		V	Valve	24	Delivery Pipe	40	nos	1
13		V	Valve	24	Suction Pipe	25	nos	1
14		NRV	Non-retaining Valve	10	on each pump delivery pipe	40	nos	7
15		NRV	Non-retaining Valve	24	Delivery Piper	40	nos	1
16	Khaw Station (Amman)	NRV	Non-retaining Valve	8	Delivery Pipe	40	nos	8
17		NRV	Non-retaining Valve	24	Delivery Pipe	40	nos	1
18		WM	Water Meter (electronic)	24	from Azraq pipeline	25	nos	1
19		WM	Water Meter (electronic)	24	to amman pipeline	40	nos	1
20	Khaw Station (Zarqa)	V	Valve	16	Delivery Pipe	40	nos	6
21		V	Valve	16	Suction Pipe	16	nos	6
22		V	Valve	24	Delivery Pipe	40	nos	2
23		NRV	Non-retaining Valve	16		40	nos	3
24		WM	Water Meter (electronic)	28	to Batrawi pipeline	25	nos	1
25		WM	Water Meter (electronic)	16	to Zarka pipeline	40	nos	1
26	Zarqa	P	Pump (Q=400m3/h、H=150m)		Zarqua station (to Zarka network)	15	nos	3
27		P	Pump (Q=200m3/h、H=150m)		Zarqua station (to Zarka network)	15	nos	2
28		P	Pump (Q=500m3/h、H=250m)		Zarqua station (to Rusaifa)	25	nos	3
29		P	Pump (Q=200m3/h、H=250m)		Zarqua station (to Rusaifa)	25	nos	2
30		P	Pump (Q=500m3/h、H=350m)		Azraq Station (to Khaw)	35	nos	2
31		P	Pump (Q=300m3/h、H=350m)		Azraq Station (to Khaw)	35	nos	2
32		P	Pump (Q=500m3/h、H=150m)		Halabat station (to Khaw)	15	nos	1
33		P	Pump (Q=300m3/h、H=150m)		Halabat station (to Halabat area)	15	nos	1
34		P	Pump (Q=100m3/h、H=350m)		Merheb station (to berein area)	35	nos	1
35		P	Pump (Q=200m3/h、H=100m)		Merheb station (to Awajan area)	10	nos	1
36		P	Pump (Q=500m3/h、H=50m)		treatment station (to Zarka PS)	5	nos	1
37		P	Pump (Q=50m3/h、H=350m)		Sokhneh station	35	nos	1
38		P	Pump (Q=500m3/h、H=350m)		Khaw station (to Amman)	35	nos	2
39		P	Pump (Q=300m3/h、H=350m)		Khaw station (to Amman)	35	nos	2

Note: pump includes pump+ all fittings on suction and delivery + electrical panel + cables+power distrubuation panel for the station

No.	Area/Station	Mark	Materials	Diameter (inch)	Place	PN(bar)	Unit	Quantity
40		GV	Gate Valve (with flange)	2	Zarqua network	16	nos	100
41		GV	Gate Valve (with flange)	2	Zarqua network+pump stations	25	nos	100
42		GV	Gate Valve (with stim)	2	Zarqua network+pump stations	40	nos	100
43		GV	Gate Valve	4	Zarqua network	16	nos	100
44		GV	Gate Valve	4	Zarqua network	25	nos	100
45		GV	Gate Valve	4	Zarqua network+pump stations	40	nos	100
46		GV	Gate Valve	6	Zarqua network+pump stations	16	nos	30
47		GV	Gate Valve	6	Zarqua network+pump stations	25	nos	30
48		GV	Gate Valve	6	Zarqua network+pump stations	40	nos	30
49		GV	Gate Valve	8	Zarqua network+pump stations	16	nos	30
50		GV	Gate Valve	8	Zarqua network+pump stations	25	nos	30
51		GV	Gate Valve	8	Zarqua network+pump stations	40	nos	30
52		GV	Gate Valve	12	Zarqua network+pump stations	25	nos	10
53		GV	Gate Valve	12	Zarqua network+pump stations	40	nos	10
54		BV	Butterfly Valve	12	Pump stations (merheb+Basatin+Tamwin+standby)	25	nos	10
55		BV	Butterfly Valve	16	Pump stations (Zarqa+ standby)	25	nos	3
56		BV	Butterfly Valve	16	Pump stations (Zarqa (russaifa)+ standby)	40	nos	3
57		GV	Gate Valve	24	Zarqua network+pump stations	40	nos	2
58		BV	Butterfly Valve	24	Pump stations (Zarqa+ standby)	40	nos	2
59		NRV	Non-retaining Valve	4	Pump stations + wells	16	nos	20
60		NRV	Non-retaining Valve	4	Pump stations + wells	25	nos	20
61		NRV	Non-retaining Valve	4	Pump stations	40	nos	20
62		NRV	Non-retaining Valve	6	Pump stations + wells	16	nos	20
63		NRV	Non-retaining Valve	6	Pump stations	25	nos	20
64	Zarqa	NRV	Non-retaining Valve	6	Pump stations	40	nos	10
65		NRV	Non-retaining Valve	8	Pump stations + wells	16	nos	20
66		NRV	Non-retaining Valve	8	Pump stations	25	nos	20
67		NRV	Non-retaining Valve	8	Pump stations	40	nos	10
68		NRV	Non-retaining Valve	12	Pump stations (merheb+Basatin+Tamwin+standby)	25	nos	8
69		NRV	Non-retaining Valve	12	Pump stations (Zarqa+ standby)	40	nos	3
70		NRV	Non-retaining Valve	16	Pump stations (Zarqa+ standby)	25	nos	3
71		NRV	Non-retaining Valve	16	Pump stations (Zarqa (russaifa))	40	nos	3
72		NRV	Non-retaining Valve	24	Pump stations (Zarqa+ standby)	40	nos	2
73		WM	Water Meter	4	Wells	16	nos	20
74		WM	Water Meter	4	Pump stations	25	nos	10
75		WM	Water Meter	6	Wells	16	nos	25
76		WM	Water Meter	6	Pump stations	25	nos	20
77		WM	Water Meter	8	Wells	16	nos	20
78		WM	Water Meter	8	Pump stations	25	nos	10
79		WM	Water Meter	8	Pump stations	40	nos	10
80		WM	Water Meter (electronic)	12	Pump stations + line (merheb+Basatin+Tamwin+standby)	40	nos	5
81		WM	Water Meter (electronic)	16	Pump stations (Zarqa+ standby)	40	nos	4
82		WM	Water Meter (electronic)	24	Pump stations (Zarqa+ standby)	40	nos	2
83		AV	Air release valve	2	Zarqua network + Wells	25	nos	20
84		AV	Air release valve	4	Zarqua network + main lines	25	nos	20
85		AV	Air release valve	4	Zarqua network + main lines	40	nos	10
86		DIP	Ductile iron pipes	300mm	Zarqua network		meter	6000
87		DIP	Ductile iron pipes	200mm	Zarqua network		meter	6000
88		DIP	Ductile iron pipes	150mm	Zarqua network		meter	2000

Attachment 2

THE PREPARATORY SURVEY ON
THE PROJECT FOR ENERGY CONSERVATION THROUGH UPGRADING WATER SUPPLY NETWORK
IN THE HASHEMITE KINGDOM OF JORDAN

Procurement Priority of the Requested Equipment

Priority order	Requested Items
1.	**Pump (Zarqa station, to Batrawi)**
2.	**Pump (Zarqa station, to other than Batrawi reservoir)**
3.	**Pump (Azraq station)**
4.	**Ductile iron pipes (in distribution lines)**
5.	**Pump (Halabat station)**
6.	**Water meter, Gate valve, Air valve (in distribution lines)**
7.	**Gate valve, Butterfly valve, Non-retaining valve, Air valve, Water meter (in pump stations for distribution networks and in wells)**
8.	**Pump (Khaw station to Amman)**
9.	**Valve, Water meter (Khaw pump station to Zarqa)**
10.	**Pump (Merheb station)**
11.	**Pump (Sokhneh station)**
12.	**Pump (treatment station of Zarqa to Zarqa reservoir)**

Attachment 3

THE PREPARATORY SURVEY ON
THE PROJECT FOR ENERGY CONSERVATION THROUGH UPGRADING WATER SUPPLY NETWORK
IN THE HASHEMITE KINGDOM OF JORDAN

Conditions for Procurement of Equipment

1. Relevance between the effects of procurement of equipment and project objectives

   The effects by the procurement of the requested equipment shall be meet with the project objectives such as reduction of energy consumption in the water supply system and the effective utilization of limited water resources by reduction in water losses.

2. Relevance between the replacement of pumps and the future water distribution plan

   The equipment requested to be replaced should be utilized even after water distribution system would be restructured from pumping distribution to gravity distribution.

3. Relevance between reconstruction of pump station and equipment procurement plan

   In the case existing building facility of pump station will not be used because of its deterioration, the new building facility shall be constructed under WAJ's responsibility before the delivery of the procured equipment.

4. Overlapping and Coordination with other projects

   The Project should not be overlapped with any other project supported by other donor. and Jordanian official organization.

5. Beneficiary

   The beneficiary of the Project is the people in Zarqa Governorate.

Minutes of Meeting – Decisions Concerning Energy Efficiency/ Water Loss Reduction Projects JICA, GTZ and KfW

Date of Meeting:	21.04.2009
Time:	10:00 -11:30 am
Place:	WAJ, Meeting Room 7. Floor
Participants:	Dr. Mustafa Assaf (WAJ), Eng. Ahmed Hoseh (WAJ), Eng. Waleed Sukkar (PMU). Eng. Reham Bani-Hani (WAJ) Hani Kurdi (JICA), Makiko Okumura (JICA), Shigeo Otani (JICA/Kyowa Engineering Consultants Co., Ltd), Koji Naito (JICA/Kyowa Engineering Consultants Co., Ltd) Dieter Rothenberger (GTZ), Maria Scheday (GTZ/KfW/Dorsch), Abdelrahim Arrafat (GTZ/KfW/Dorsch), Dietrich Osswald (GTZ/DED), Ronald Hagger (GTZ)
Distribution List:	H.E. Munir Oweis, SG WAJ; Dianna Kawwa, Donor Coordination, WAJ: Guy Honore (GTZ) Participants

Topic 1: Coordination of Energy Efficiency Activities in Pumping Stations in Zarqa Governorate

In order to achieve a close cooperation of the projects of GTZ and JICA, and to result in the best effects for WAJ, the following has been agreed:

- GTZ-IEE will focus on 4 pumping stations in Zarqa: Azraq, Khaw (To Amman), Halabat and the Zarqa Desalination Plant
- GTZ-IEE will provide to WAJ and JICA during the first half of June the final drafts of the detailed reports from the energy audit in these four pumping stations. These results will include the existing situation in terms of energy consumption and energy efficiency indicators for these pumping stations, major deficiencies and reasons for high electricity consumption, proposed measures and expected results. It will also include a recommendation concerning the institutional implementation of the recommended measures (e.g. GTZ procurement, outsourcing of operations and maintenance, procurement with extended maintenance contract, Micro-PSPs (Energy contracting), etc.)
- GTZ and WAJ will discuss with JICA the allocation of investment for the recommended measures for these four pumping stations, i.e. where GTZ will be able to provide funding, where private sector funding should be sought, and where JICA could provide funding.
- Measures in other pumping stations in Zarqa Governorate (e.g. Zarqa, Merheb, Sokhneh) will not be part of the GTZ IEE project. This also holds for measures in the distribution network.
- Beginning of June meetings between GTZ and WAJ will take place, to discuss the findings of the Energy Audit and the recommended implementation mechanisms. The results will also be discussed with JICA and the JICA Consultant mission in mid of June.
- JICA agreed to wait for the final draft on the 4 pumping stations before taking any measures and will use the results for their own study.

Topic 2: Coordination of Project Activities with regard to the KfW project in Zarqa Pilot Zone Distribution Network

- Stage I of preparatory survey on 'the Project for Energy Conservation through Upgrading Water Supply Network' by JICA has been completed in April. Stage II survey will take place in June 2009 and the draft final report will be submitted in September 2009 and final report will be submitted in November 2009. If the Project will be approved by Japanese Government. JICA will finance the procurement of equipment, while WAJ will be responsible for the installation.
- Under the Project for Energy Conservation through Upgrading Water Supply Network by JICA a few distribution pipes are planned to be exchanged / newly installed within the KfW Project Zarqa Pilot Zone. It has been mentioned by Dorsch that any JICA interference in that Pilot Zone shall be avoided to keep the projects activities separate. WAJ agreed to keep the activities of both projects separate.
- Plans for procurement of pumps at a new Pump Station for Zarqa, opposite the existing PS are under investigation by JICA consultant.
- Under another Japan's grant aid project, the new Batrawi reservoir is under construction with a capacity of 14,000 m3 at the same place of the existing one and shall supply some zones in Zarqa by gravity.
- GTZ / Dorsch and JICA / Kyowa Engineering Consultants together with WAJ Zarqa shall coordinate the various activities for Zarqa Distribution Network in order to achieve the best outcome of the projects.

Minutes Approved (valid without signature, as agreed in telephone call)

Dieter Rothenberger	Maria Scheday	Hani Kurdi	Ahmad Hoseh
Project Manager GTZ-IEE	Dorsch	JICA	WAJ

MEMORANDUM ON THE PREPARATORY SURVEY ON THE PROGRAMME FOR ENERGY CONSERVATION THROUGH UPGRADING WATER SUPPLY NETWORK IN THE HASHEMITE KINGDOM OF JORDAN

1. Transmission water discharge, quantity of the pump set and installation plan of the pumping equipment

Design discharge of the pump to be procured in the Programme for Energy Conservation Through Upgrading Water Supply Network (hereafter referred to as "the Programme") was proposed by the Consultant based on the data such as actual well yield of water source, current discharge of existing pump and flow capacity of the transmission pipeline. Also, reasonable quantity of the pump set and installation plan were proposed as shown in the following table and in the Attachment-2 of this Memorandum.

WAJ side confirmed the appropriateness of these figures and plan, and basically accepted the Consultant's proposal. However, these figures and plan may be modified in accordance with the further analysis in Japan.

Pump Station	Transmission Discharge	Quantity of Pump Set	Design Discharge per unit	Total Head	Motor Capacity
	m^3/h	set	m^3/h	m	kW
1. Azraq PS	1700	5	425	360	740
2. Hallabat PS	500	2	500	140	330
3. Zarqa PS	800	3	400	100	200

* Quantity of pump set include one stand-by at each pump station
* Motor capacity is approximately figure

2. Switch of electricity receiving system to medium voltage system

Though the electric receiving system for most of all pumping stations in WAJ is low voltage (400V), middle voltage system (6,600V) has been adopted for Zai of Miyahuna, Zara Ma'in of WAJ and Wadi Arab in NGWA. Introduction of medium voltage system shall be considered at the opportunity of replacement of existing deteriorated pumping equipment with new equipment in this Programme in order to make assure the future maintenance work and to reduce electric energy consumption for Azraq pumping stations. WAJ has confirmed the reliability of the applying medium voltage system without any problem with the electric power supply company (Electricity Distribution Company: EDCO). However the introduction of medium voltage system for Zarqa pumping station is not reasonable because the voltage 11 kV of primary line is not applicable for that switch of the system. And also medium voltage system for Hallabat pumping station is not recommendable because the safety condition of the existing building is not satisfied with the requirement for the new system.

In the case medium voltage system was introduced, WAJ shall assign a technical supervisor qualified on the medium voltage system for the safety operation and maintenance. The supervisor, electric engineer and operator shall be trained not only on general operation and maintenance but also on medium voltage system, in the Programme. Also, WAJ shall make maintenance contract with private

company specialized for medium voltage use.

WAJ side requests that the transformer to be replaced for switch the system shall be procured and installed by Japanese side through entrustment of the electric power supply company (EDCO) for the future maintenance. In case that the cost of transformer is not financed by Japanese side, WAJ will maintain existing electricity supply system.

3. Zarqa treatment plant and Mreheb pumping station

1) Zarqa Treatment Plant

According to the information of GTZ's programme manager of Improving Energy Efficiency (IEE) project, GTZ has decided to finance the necessary investments for the Zarqa Desalination Plant based on the final report on GTZ's IEE project in the end of June 2009.

The Programme should not be overlapped with any other projects supported by other donor. Therefore, Japanese side will exclude the Zarqa Desalination Plant from the list of the pumping stations to be financed by Japanese side.

2) Merheb Pumping Station

Though the Merheb pumping station is listed in the "List of Items Requested "of Annex III of Minute of Discussions signed between WAJ and JICA on the 18th of June 2009 for the captioned Survey, the possibility of the implementation of the project on that station is low because of the no advantage on the reduction of energy consumption. Present pump operating point (Q and H) is nearly same as design duty point according to the Consultant's actual measurement of discharge and pressure. Furthermore, the transmission line to the Awajan High reservoir is being used as distribution line rather than transmission line.

WAJ side requested to include the pump equipment for the Hallabat Village in the Hallabat pumping station into the procurement list of the Equipment instead of Merheb pumping station.

3) List of Items Requested by the Government of Jordan

The WAJ side requested to revise above-mentioned "List of Items Requested" as the Attachement-1 of this memorandum by the reasons mentioned above.

4. Construction plan of building facilities of Zarqa pumping stations:

The WAJ side would complete the construction of new building facilities before delivery of the pump equipment to be procured in the Programme by Japanese side.

In this matter WAJ is now taking measures for the acquisition of the Budget. Total cost required for construction of new pump building and piping rearrangement is estimated as about 400,000JD. Among this total, 160,000JD can be disbursed from WAJ's remaining budget of the year 2009, and the balance of 240,000JD shall be allocated from the budget of the year 2010. Therefore, WAJ has already made application for additional budget from Ministry of Finance as shown in the Attachment-3 herewith.

5. Transmission line between Zarqa pumping station and Batrawi reservoir

The equipment such as pipes and accessories of the transmission line between Zarqa new pumping station and Batrawi reservoir of about 2.2 km will be procured by Japanese side, but installation work of the equipment shall be made by WAJ side.

6. Equipment for the transmission line to Khaw station

The existing air valves on the transmission pipelines from Azraq and Hallabat pumping stations to Khaw reservoir are deteriorated and not in functional. These valves shall be replaced in order to make assure transmission capacity by the pumps to be replaced in the Programme in Azraq and Hallabat pumping stations.

7. Equipment for the distribution network

The gate valves and air release valves requested for replacement of existing valves or additional installation in the distribution network shall be used under the condition of gravity flow system. Therefore only 16 bar of nominal pressure is required for the said equipment.

8. Delivery destination of the Equipment

The delivery destination of the Equipment to be procured in the Programme shall be at the WAJ's Central Warehouse of Ain Ghazal. WAJ side shall take proper measures to keep the space and good circumstances for the store of the Equipment until their installation.

9. Undertakings of the work to be taken by each side

The undertakings of the work to be taken by each side, Japanese and WAJ are confirmed as follows on the Equipment requested.

(1) Equipment for pumping station and flow meter

The Japanese side:

- Procurement and installation of pumping facilities such as pumps, motors, power receiving and distribution panels, control panels, cables, valves, pipes, fittings and accessories for the pumps
- Construction of the foundations required for installation of the above-mentioned pump equipments
- Removal of the existing pumping facilities to be replaced
- Procurement and replacement of electric transformer where middle voltage power reception is required
- Replacement of the existing electric transformer used for the facilities other than the Equipment to be procured by Japanese side to meet with the appropriate power capacity, if required
- Procurement, installation and setting of water meter excluding concrete chamber

WAJ side:

- Construction and improvement of buildings and its related facilities for the installation of pumps
- Translocation and improvement of piping within the site of pumping stations
- Preparation of the space for installation of pumps
- Construction of water meter concrete chamber, installation of short pipe and its connection with

existing pipeline and connection of electric power incoming line to the water meter distribution panel

(2) Equipment for transmission pipeline and distribution network

The Japanese side:

- Procurement of pipes and its accessories, gate valves, water meters and air valves
- Installation of water meters excluding concrete chamber

WAJ side:

- Installation of the equipment procured by Japanese side
- Construction of water meter concrete chamber and connection of electric power incoming line to the water meter device
- Repair of the existing concrete chamber of the air valve on the transmission pipeline

10. Environmental Impact Assessment (EIA)

WAJ is now under confirmation on necessity of the Environment Impact Assessment (EIA) for the implementation of the Programme to the Ministry of Environment, however WAJ's understanding is that EIA is not required for the Programme. Inquiring letter on EIA is as Attachment-4 herewith

Amman, 12th July 2009

Eng. Bassam Saleh
Assistant Secretary General for Water Affairs,
Water Authority of Jordan (WAJ)
Ministry of Water and Irrigation
The Hashemite Kingdom of Jordan

Shigeo Otani
Chief Consultant
Kyowa Engineering Consultant Co., Ltd.
JICA Preparatory Survey Team

Attachment 1: Revised List of Items Requested by the Government of Jordan
Attachment 2: Installation Plan of Pumping Facilities
Attachment 3: Application of the budget for the year 2010 on the construction of the Zarqa new pumping station
Attachment 4: Inquiring letter on EIA

Attachement-1

Revised List of Items Requested by the Government of Jordan (July12, 2009)

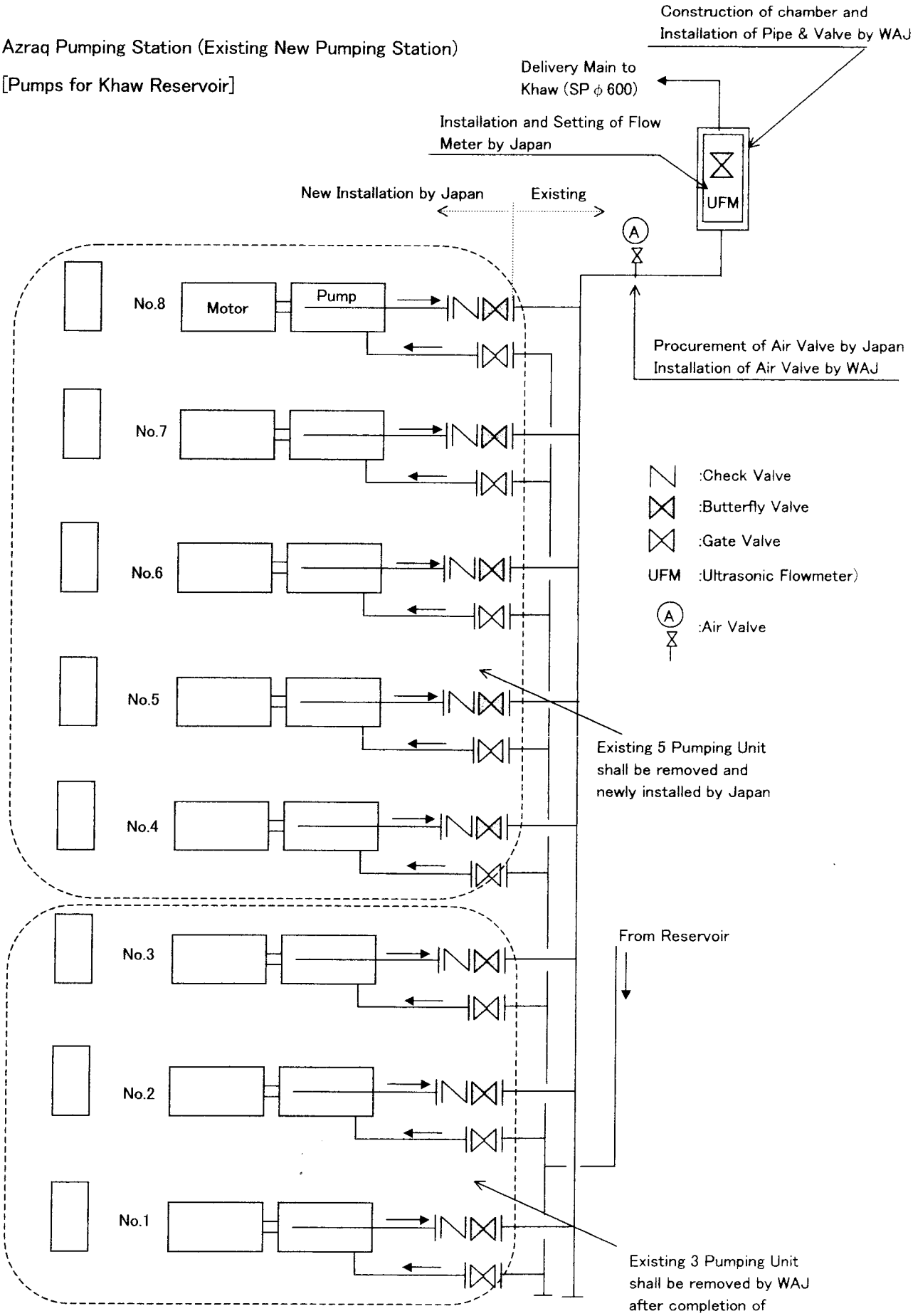
Equipment	Diameter (inch)	Location	PN(bar)	Unit	Quantity
I. Procurement Lot 1					
1. Azraq Pumping Station					
Pump (Q=425m^3/h、H=360m)	-	Azraq P.S. to Khaw P.S.	36	nos	5
Water Meter	24	Inlet pipeline from wells to reservoir	-	nos	2
Water Meter	24	Outlet pipeline to Khaw P.S.	-	nos	1
Water Meter	24	Khaw Reservoir : Inlet pipeline from Azraq P.S	-	nos	1
2. Hallabat Pumping Station (to Khaw)					
Pump (Q=500m^3/h、H=135m)	-	Hallabat station to Khaw	14	nos	2
Water Meter	16	Inlet pipeline from wells to reservoir	-	nos	1
Water Meter	12	Inlet pipeline from wells to reservoir	-	nos	1
Water Meter	24	Outlet pipeline to Khaw P.S.	-	nos	1
Water Meter	24	Khaw Reservoir : Inlet pipeline from Hallabat P.S	-	nos	1
3. Zarqa Pumping Station					
Pump (Q=400m^3/h、H=100m)	-	Zarqa P.S. to Batrawi Reservoir	16	nos	3
Ductile iron pipes	20	Transmission from Zarqa P.S. to Batrawi Reservoir	16	km	2.2
Water Meter	20	Zarqa P.S.: Outlet pipeline to Batrawi	-	nos	1
4. Khaw New Pumping Station					
Valve	16	Delivery Pipeline	16	nos	4
Valve	16	Suction Pipeline	16	nos	4
Valve	28	Delivery Pipeline	16	nos	1
Non-retaining Valve	16	Delivery Pipeline	16	nos	4
Water Meter	28	Outlet pipeline to Batrawi Reservoir	-	nos	1
5. Hallabat Pumping Station (to Hallabat Village)					
Pump (Q=200m^3/h、H=148m)	-	Halabat station to Hallabat Village	15	nos	2
Water Meter	8	Outlet pipeline to Hallabat Village	-	nos	1
6. Air release valve on Transmission Pipe to Khaw and Water Meter				nos	
Air release valve	4	Transmission Line from Azraq to Khaw	-	nos	40
Air release valve	4	Transmission Line from Hallabat to Khaw	-	nos	15
Water Meter	16	Transmission Line to Russeifa	16	nos	1
Water Meter	24	Khaw-Amman Pipeline: Awajan Junction	25	nos	1
II. Procurment Lot 2					
7. Transmission and Distribution Network					
Gate Valve	4	Zarqa network	16	nos	222
Gate Valve	6	Zarqa network	16	nos	69
Gate Valve	8	Zarqa network	16	nos	32
Gate Valve	12	Zarqa network	16	nos	13
Gate Valve	16	Zarqa network	16	nos	5
Gate Valve	24	Zarqa network	16	nos	2
Air release valve	2	Zarqa network	16	nos	15

Attachement-2

Installation Plan of Pumping Facilities

1. Azraq Pumping Station (Existing New Pumping Station)

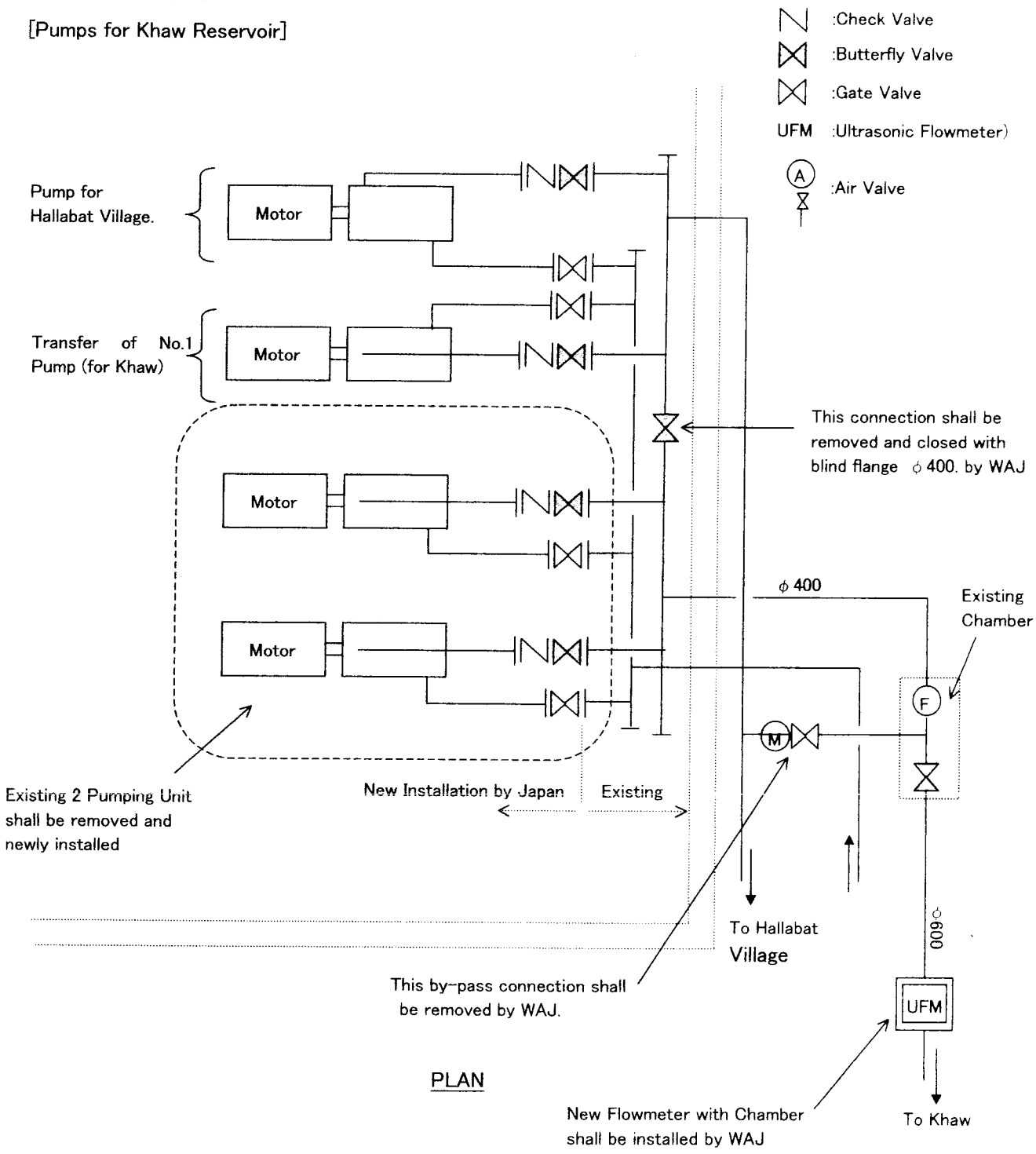
[Pumps for Khaw Reservoir]



PLAN

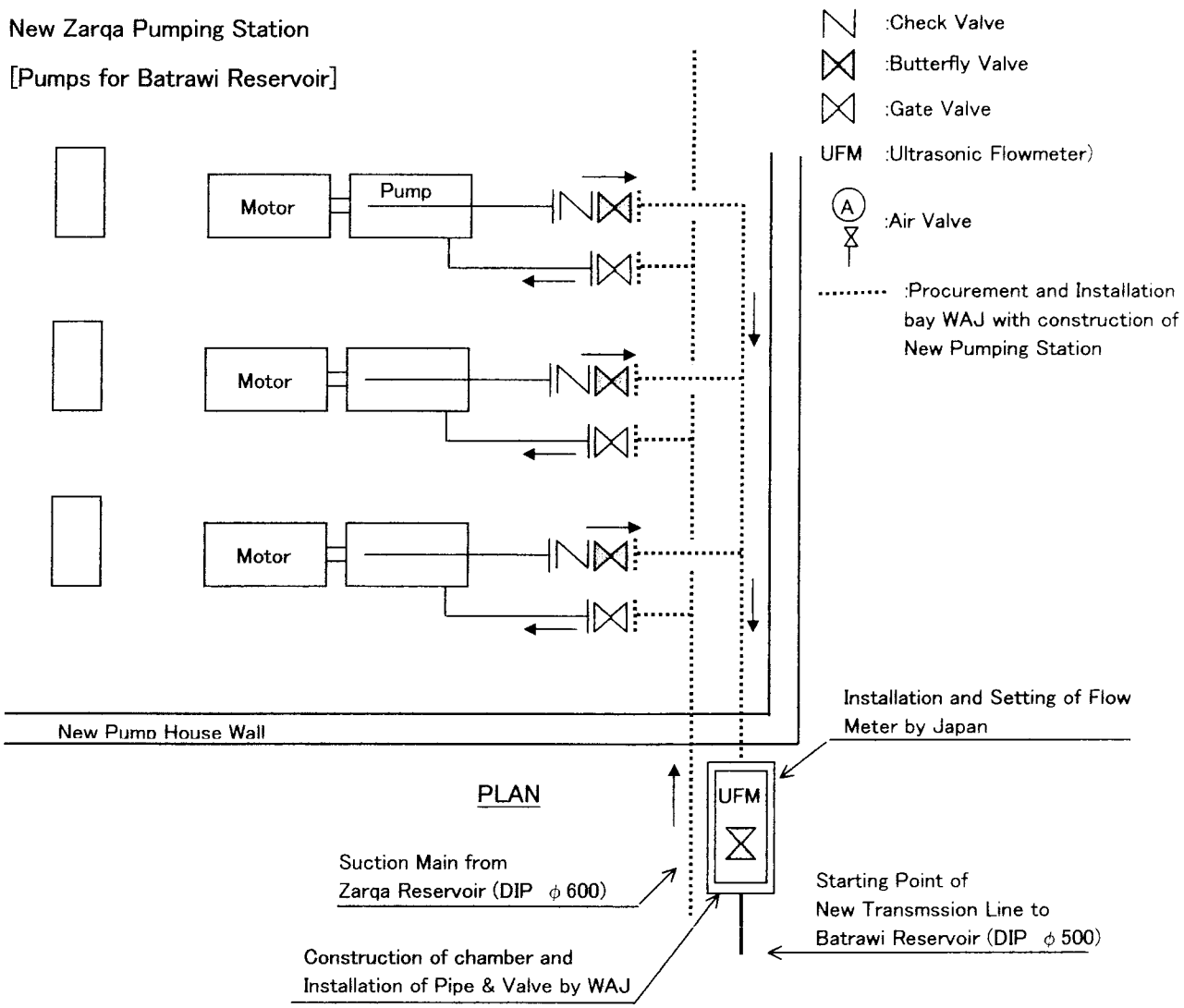
2. Hallabat Pumping Station

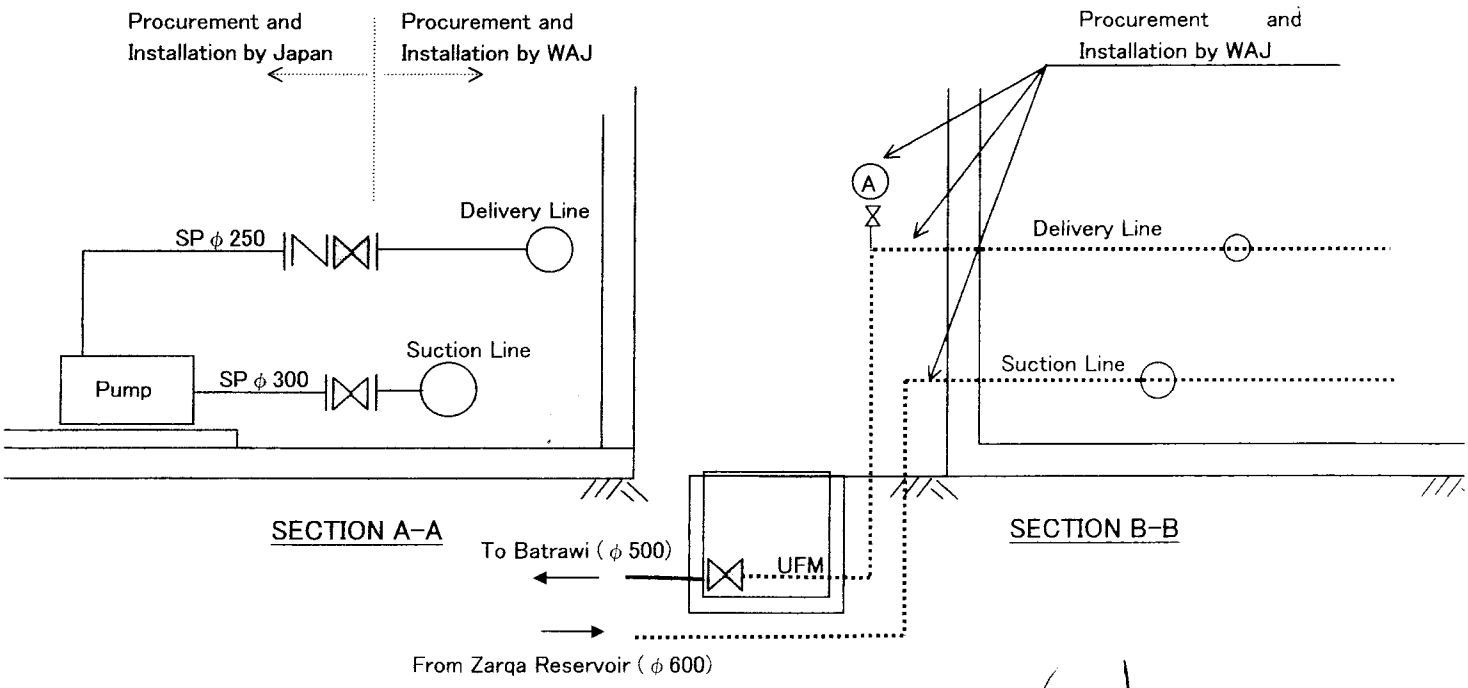
[Pumps for Khaw Reservoir]



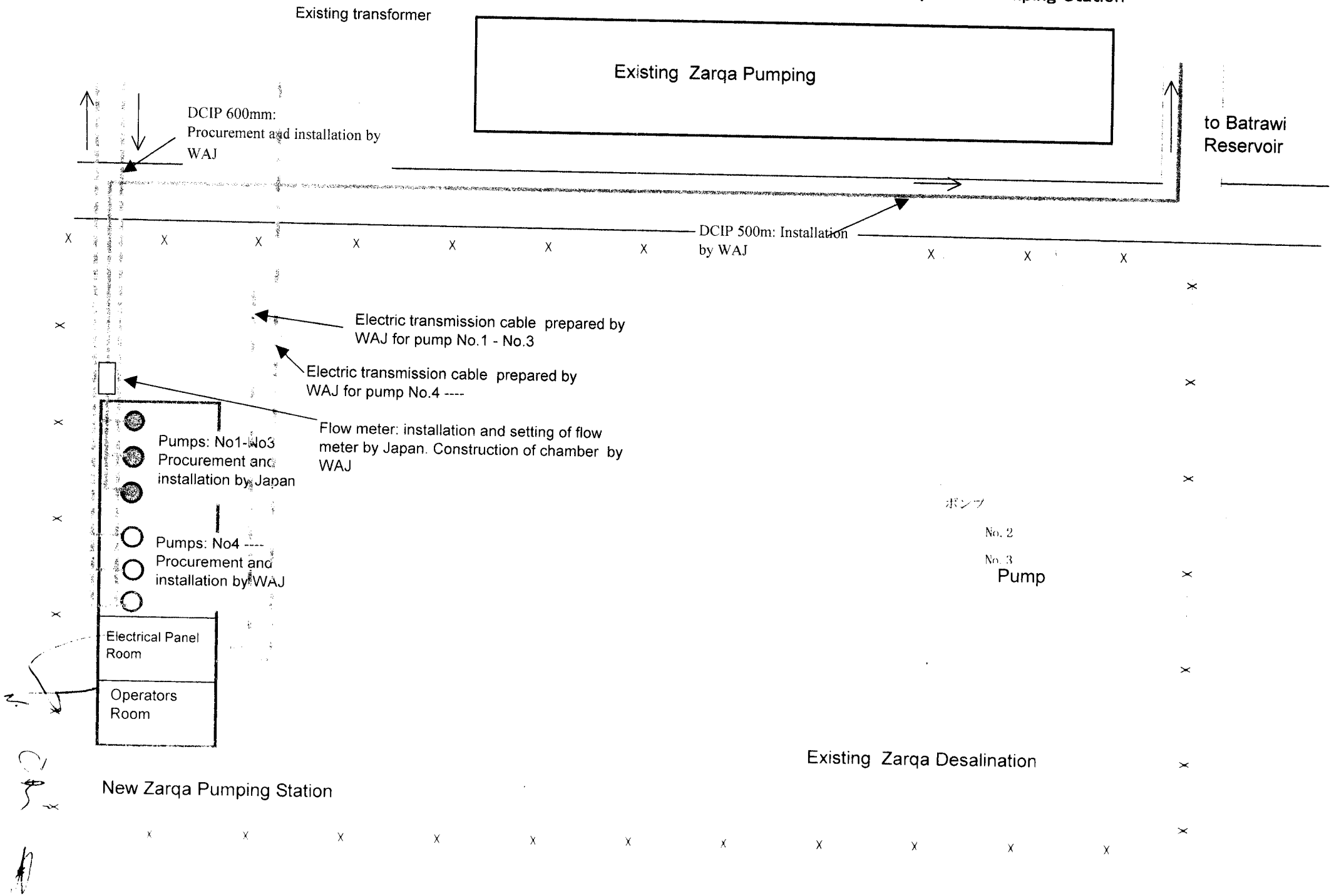
3. New Zarqa Pumping Station

[Pumps for Batrawi Reservoir]





Layout of Piping and Wiring Works, Zarqa New Pumping Station



سلطة المياه
نموذج طلب التزام مالي
عطاء اشغال

التاريخ

الجهة الطالبة: [illegible] المياه

المحافظة / اللواء: الزرقاء

اسم العطاء: تمديد وتركيب خط بطول ٢,٢ كم وقطر ٥٠٠ م من محطة الزرقاء الجديدة وحتى خزان البتراوي .

هدف العطاء: تحسين التزويد المائي لمحافظة الزرقاء / تحويل الخطوط الناقلة للمحافظات الوسط

موجز لوصف العمل: تمديد خط قطر ٥٠٠ م لطول ٢,٢ كم من محطة الزرقاء وحتى خزان البتراوي

اولا :- تحديد مدى جاهزية كل من :

مرحلة العطاء	الدراسات	وثائق العطاء	الطرح	الاحاله	تاريخ بداية التنفيذ
تاريخ الجاهزيه المتوقع	جاهزه	جاهزه	١/٣/٢٠١١	١/٤/٢٠١١	١/٧/٢٠١١

كلفة العطاء المتوقعة	نصف مليون دينار (١٠٠٪)	مدة التنفيذ المتوقعة	٤ شهور

الهدف الاستراتيجي	الهدف رقم (١): رفع الكفاءة وتطوير القدرة المؤسسية	الهدف رقم (٢): رفع مستوي خدمات المياه ✓	الهدف رقم (٣): رفع مستوي خدمات الصرف الصحي
رقم و اسم البرنامج	٨٠٠١ الاداره والخدمات المسانده	٨٠٠٢ المياه ✓	٨٠٠٥ الصرف الصحي

ثانيا :- موازنة التمويل والتدفق النقدي

البيان	تفاصيل العطاء				
	ذاتي	قرض	منحه	المجموع	ملاحظات
قيمة العطاء المتوقعه				0	
مطلوب ٢٠٠٩	—			0	
مطلوب ٢٠١٠	—			0	
مطلوب ٢٠١١	٥٠٠,٠٠٠			0	سيتم تزويد
نسبة التمول ٪	١٠٠٪	ذاتي		0%	خطوط الركاب
اسم الجهه المموله	ذاتي				من المنحة اليابانية

ثالثا :- التدفق النقدي للعطاء خلال عام ٢٠٠٩

مطلوب ٢٠٠٩	الربع الاول	الربع الثاني	الربع الثالث	الربع الرابع	الاجمالي
ذاتي	--	-	—	—	0
قرض	-	-	-	—	0
منحه	-	—	—	—	0
الاجمالي	0	0	0	0	0

ملاحظـــة: في حال وجود عطاء اشراف على العطاء اعلاه يتم الاشاره لذلك وتعبئة نموذج اخر لعطاء الاشراف وبخلاف ذلك بيان الدائره المشرفه من سلطة المياه .

معد البيانات التقديرية: م. [illegible]

مدير الوحدة الادارية

توقيع مساعد الامين العام المختص ....

نموذج طلب التزام مالي
عطاء اشغال

التاريخ ١٢/٧/٢٠٠٩

جهة ... ... المياه

محافظة/لواء: الزرقاء

اسم العطاء: إنشاء محطة ضخ جديدة للزرقاء

هدف العطاء: تحسين التزويد المائي لمحافظة الزرقاء وتحسين الوضع التشغيلي .

موجز لوصف العمل: إنشاء محطة ضخ (٩ مضخات) بموقع محطة تحلية الزرقاء وتمديد خطوط قطر ٦٠٠ مم بطول ٥٠٠ متر داخلية وخطوط قطر ٦٠٠ مم خارجية بطول ٥٠٠ متر .

أولا : تحديد مدى جاهزية كل من :

مرحلة العطاء	الدراسات	وثائق العطاء	الطرح	الاحاله	تاريخ بداية التنفيذ
تاريخ الجاهزيه المتوقع	جاهزة	جاهزة	١/٩/٢٠٠٩	١/١١/٢٠٠٩	١/١٢/٢٠٠٩

كلفة العطاء المتوقعة	٤٠٠٠٠٠ دينار (أربعمائة ألف دينار أردني)	مدة التنفيذ المتوقعة	١٢ شهر

الهدف الاستراتيجي	الهدف رقم (١): رفع الكفاءة وتطوير القدرة المؤسسية	الهدف رقم (٢): رفع مستوي خدمات المياه ✓	الهدف رقم (٣): رفع مستوي خدمات الصرف الصحي
رقم و اسم البرنامج	٨٠٠١ الاداره والخدمات المسانده	٨٠٠٢ الميـــــــاه ✓	٨٠٠٥ الصرف الصحي

ثانيا : موازنة التمويل والتدفق النقدي

تفاصيل العطاء

البيان	ذاتي	قرض	منحه	المجموع	ملاحظـات
قيمة العطاء المتوقعه	٤٠٠٠٠٠			0	
مطلوب ٢٠٠٩	١٦٠٠٠٠			0	
مطلوب ٢٠١٠	٢٤٠٠٠٠			0	
مطلوب ٢٠١١	—			0	
نسبة التمول ٪	١٠٠٪			0%	
اسم الجهه المموله					

ثالثا : التدفق النقدي للعطاء خلال عام ٢٠٠٩

مطلوب ٢٠٠٩	الربع الاول	الربع الثاني	الربع الثالث	الربع الرابع	الاجمالي
ذاتي	—	—	—	١٦٠٠٠٠	0
قرض					0
منحه					0
الاجمالي	0	0	0	0	0

ملاحظـــــة: في حال وجود عطاء اشراف على العطاء اعلاه يتم الاشاره لذلك وتعبئة نموذج اخر لعطاء الاشراف وبخلاف ذلك بيان الدائره المشرفه من سلطة المياه .

معد البيانات التقديرية — مدير الوحدة الادارية — توقيع مساعد الامين العام المختص ....

Appendix 5. Soft Component Plan

(1) Background to planning the Soft Component

Improvement of the water transmission pipelines, reservoirs and main water distribution networks is in progress with the implementation of the two phases of the Grant Aid Project of Japan, “The Project for Improvement of the Water Supply System for the Zarqa District,” based on the master plan for improvement of the water supply system in Zarqa District drafted by JICA. The implementation of the project is expected to improve efficiency of water distribution and thus reduce energy consumption for water distribution.

In this Project, the pumping facilities at the existing main water transmission pumping stations (Azraq, Hallabat and Zarqa Pumping Stations) will be replaced to improve water transmission efficiency and reduce energy consumption for water transmission. Implementation of this Project will create synergy with the above-mentioned Grant Aid Project and enable more stable water distribution in Zarqa District and reduced operation and maintenance costs.

Full-time operators and mechanical and electrical maintenance technicians are assigned to each pumping station in Zarqa Governorate. However, the existence of many problems in the operation and maintenance of the pumping facilities not only impedes efficient operation of the facilities, but also causes frequent breakdowns and premature deterioration of the facilities. Therefore, the effectiveness of implementation of the Project is likely to be compromised because of lack of appropriate operation and maintenance even after the replacement of the pumping facilities.

Under such circumstances, establishment of the effectiveness of Project implementation will require not only procurement of equipment for water transmission, but also provision of technical assistance in the form of Operation and Maintenance Technical Guidance and Soft Component, both in theory and in practice, to develop the capacity to operate and maintain the improved pumping facilities for water transmission appropriately and to improve energy efficiency in water transmission system.

The following are the problems found in the operation and maintenance of the pumping facilities:

1) Operation management-related problems

・Operators do not have correct knowledge of pump operation, including procedures and timing of starting and shutdown of pumps.

2) Maintenance-related problems

・Repairs are not implemented promptly even when an abnormality or damage to the equipment has been detected.
・Because of inadequate daily inspection, damage is not repaired while still minor.
・Except for regular application of oil and grease to the sliding parts of the rotating machinery such as pumps and motors, no preventive maintenance work is carried out.

・The only entries in the Operation and Maintenance Records are the daily discharge and operation hours. Because of the lack of records concerning maintenance/inspection and replacement of equipment, it is impossible to know the time of occurrence and type of damage or abnormality.

3) Safety management-related problems

・Understanding of safety management is poor and technology for accident prevention and crisis management is lacking.
・Experience in medium voltage power receiving is lacking.

4) Problems related to management organization and training in management

・As the number of engineers and technicians for maintenance is not sufficient, employment of additional personnel is required. As a medium voltage power receiving system is to be introduced, someone to be in charge of handling medium voltage electric equipment will have to be appointed.
・There is no systematic operation/maintenance manual and operation and maintenance depend solely on the experience of the operators and technicians.
・No systematic technical training is provided to engineers, technicians and operators. Although ad hoc training is provided at the Vocational Training Centre (VTC) and Central Workshop (CWS), the content is either conceptual or fragmental.
・Only limited operation records are kept (ID numbers of operated pumps, pump discharge, discharge pressure, water level in reservoirs and amount of chlorine input) and such records are not sorted, analyzed or used.

5) Problems in managing the water transmission system

・Each pumping station is operated either for fixed hours or according to the water level in the reservoir to which the station supplies water. An operation system that takes into consideration water distribution in the entire water transmission and distribution system has not been adopted.
・The diagnosis of the operational condition of the pump facility based on water transmission efficiency, efficiency of electricity consumption and pump efficiency has not considered.
・Pump operation and procurement of equipment are implemented without consideration for reduction in energy consumption.

The measure of Operation and Maintenance Technical Guidance of pumping facilities provided by the contractor will be taken for the problems 1), 2), 3) and 4) at immediately after installation of the equipments at each pumping station. For the problem of 5), the measure of Soft Component provided by the Consultant will be taken. These technical assistances shall be acted in cooperation between the contractor and the consultant.

(2) Objective of the Soft Component

Appropriate operational management of the water transmission system will make water transmission efficient and stable by enabling water transmission in accordance with demand for water distribution (demand at distribution reservoirs). It will reduce energy use in water transmission system by enabling efficient operational management.

Diagnosis of the operational condition by collecting and analyzing the operation records on pumping discharge, voltage and current and electricity consumption of pump facilities will contribute to efficient pump operation and reduction in energy consumption.

(3) Effects of the Soft Component

The engineers who are engaged in operation of water supply system at Zarqa Office will be able to carry out comprehensive water transmission management and operation of the pumping facilities with conscious of energy efficiency. Also, they will be able to do maintenance management based on the efficiency of pumping facility.

(4) Means of verification of achievement of the effects

Goals will be set for each training subject. The instructor in each subject will evaluate the degree of understanding of the transferred technology in the final confirmation. In the final confirmation, each trainee will carry out the work independently and the instructor will evaluate his/her performance.

Table 1 Goals of the Soft Component

Training subject	Goals
Operational management technology of pumping water transmission system	To prepare a pump operation plan in accordance with the water transmission and distribution plan To analyze the operation management records and evaluate the efficiency of pump operation To finalize the management manual of pumping water transmission system

(5) Soft Component activities (Input Plan)

The recipients of the Soft Component will be the Director of the Water Directorate, who supervises operation of the water transmission systems, the head and staff members (engineers and technicians) of the Pump Section.

Table 2 Content of the technical assistance

Details of assistance	Activity	Recipients
Operational management technology of pumping water transmission system	Training in drafting of an efficient water transmission plan Training in drafting of a pumping station operation plan Management by procurement contractor	Water directorate managers at Zarqa Office (Director of Water Directorate: 1, Head of Pump Section: 1, mechanical facility engineer: 1, electrical facility engineer: 1) Azraq (senior manager: 1), Technician: 6

Table 3 Activities and number of working days of the Soft Component

Activity	Details of activity	Number of days
Work in Japan	Drafting of lecture and practice plans and preparation of manual and reference materials for the lecture and practice plan	5
Field activity 3: (For system managers)	1) Water transmission system operation technology Theory of water transmission by pump, operation and maintenance record, analysis of the record, diagnosis of operation condition, practice of preparation of report 2) Diagnosis technology of efficiency of pumping facilities: evaluation of operational efficiency, unit electricity consumption per pumping discharge, electricity consumption of pump 3) Practice at Azraq, Hallabat and Zarqa pumping stations	3
	Preparation of Final Report on Soft Component, advice on management and finalization of the manuals	2
	Report to WAJ	1

(6) Resources required for implementation of the Soft Component

The consultant, who is familiar with the concept of the water supply system, to provide technical assistance both in preparation and in implementation of the operational plans for the pumping stations. Personnel to be dispatched for the Soft Component is a Japanese engineer of operational management of pumping water transmission system.

(7) Implementation schedule of the Soft Component

The contractor will implement commissioning and Operation and Maintenance Technical Guidance of pumping facilities at Azraq, Hallabat and Zarqa pumping station immediately after installation of the equipments.

The consultant will provide technical assistance under the Soft Component after completion of all technical guidance provided by the contractor and at the time when new pumping facilities replaced in the Project became in the operational condition.

Because WAJ is the implementation organization of this Project, the Soft Component will be implemented after discussion on the implementation methods and content with WAJ and in the presence of WAJ training personnel.

Table 4　Implementation plan of Soft Component.

Working Items	Implementation Body	Days	Year 2011			Year 2012						
			Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July
Installation of Pump			Azraq Pumping Station			Hallabat Pumping Station		Hallabat Pumping Station				
Construction of Zarqa－Batrawi water transmission pipeline						Zarqa Pumping Station						
1. Operation and Maintenance Technical Guidance of Pumping Facilities									Legend Work in Japan Work in Jordan			
Preparation of various manuals for the lecture and practice	Contractor	10		10								
Meeting with WAJ, Preparation of Guidance	Contractor	1			1							
Overall system management theory	Contractor	2			2							
Training in operation management technology	Contractor	7×4			7	7		7	7			
Training in safety management technology	Contractor	1			1							
Training in Maintenance technology (Inspection and maintenance)	Contractor	7×4			7	7		7	7			
Maintenance technology (Repair)	Contractor	7							7			
Finalization of Operation & Maintenance Manual, recording form	Contractor	2×4			2	2		2	2			
Supervision of the Guidance	Consultant	20, 16, 16, 23			20	16		16	23			
2. Soft Component												
Preparation of manual for the lecture and practice	**Consultant**	5						5				
Training in water transmission system operation technology	**Consultant**	3							3			
Preparation of Final Report on Soft Component	**Consultant**	2							2			
Report to WAJ	**Consultant**	1							1			

(8)　Outputs of the Soft Component

The table below shows the outputs of the Soft Component activities. These outputs will be compiled into the Soft Component Report to be submitted to WAJ. The outputs will be written in English

- Pumping Water Transmission System Management Manual
- Reference materials for the lecture and practice
- Completion report of soft component

(9)　Responsibilities of the recipient country

In order to enhance and sustain the effects of the Soft Component activities and to facilitate the activities, the Jordanian side should take responsibility for the following:

- Appointment of a counterpart for the Soft Component
- Monitoring and follow-up for sustainable operation and maintenance of the facilities after implementation of the Soft Component

Appendix 6. Relevant Data

6-1 Hydraulic Calculation of Transmission Pipeline

6-2 Index of Programme Effects

6-1 Hydraulic Calculation of Transmission Pipeline

Azraq-Khaw Transmission Pipeline

New Station G.L. 552.50 m

Design Flow: 1,700 m^3/h Reservoir L.W.L. 563.00 m

Coefficient of Roughness: 125 Pumping Head: 360.00 m

Sta.	Invert Level or G.L (m)	Parcial Dist. (m)	Accum. Dist. (m)	Flow (L/s)	Hydraulic Grade	Friction Head Loss (m)	Hydraulic Grade Line (m)	Dynamic Head (m)	Internal Dia. (mm)	Velocity (m/s)	Water Hammer (m)	Remark
Tank	563.00	0.00	0.00				923.00					LWL=563m
Pump	553.00	250.00	250.00	472	0.00470	1.17539	921.82	368.82	587	1.744	221.29	G.L.+0.5m, Pipeline 250m
Road	562.50	270.00	520.00	472	0.00470	1.26942	920.56	358.06	587	1.744	214.83	Internal Pipeline 270m
149	562.05	86.70	606.70	472	0.00470	0.40763	920.15	358.10	587	1.744	214.86	Air Valve No.1
151	561.67	35.56	642.26	472	0.00470	0.16719	919.98	358.31	587	1.744	214.99	
155	558.04	207.32	849.58	472	0.00470	0.97473	919.01	360.97	587	1.744	216.58	
158	553.48	179.28	1028.86	472	0.00470	0.84290	918.16	364.68	587	1.744	218.81	
161	554.82	166.56	1195.42	472	0.00470	0.78309	917.38	362.56	587	1.744	217.54	
163	557.54	154.10	1349.52	472	0.00470	0.72451	916.66	359.12	587	1.744	215.47	Air Valve No.2
166	553.01	90.74	1440.26	472	0.00470	0.42662	916.23	363.22	587	1.744	217.93	
172	553.63	347.01	1787.27	472	0.00470	1.63149	914.60	360.97	587	1.744	216.58	Air Valve No.3
175	556.42	172.07	1959.34	472	0.00470	0.80900	913.79	357.37	587	1.744	214.42	
178	554.58	118.00	2077.34	472	0.00470	0.55479	913.23	358.65	587	1.744	215.19	
179	554.67	81.00	2158.34	472	0.00470	0.38083	912.85	358.18	587	1.744	214.91	Air Valve No.4
180	554.35	40.00	2198.34	472	0.00470	0.18806	912.66	358.31	587	1.744	214.99	
182	548.74	117.01	2315.35	472	0.00470	0.55013	912.11	363.37	587	1.744	218.02	NP40
185	548.11	126.17	2441.52	472	0.00470	0.59320	911.52	363.41	587	1.744	218.05	
186	548.89	48.73	2490.25	472	0.00470	0.22911	911.29	362.40	587	1.744	217.44	
190	558.75	154.03	2644.28	472	0.00470	0.72418	910.57	351.82	587	1.744	211.09	
191	559.13	85.78	2730.06	472	0.00470	0.40330	910.16	351.03	587	1.744	210.62	Air Valve No.5
196	553.27	299.29	3029.35	472	0.00470	1.40713	908.76	355.49	587	1.744	213.29	
201	557.46	282.44	3311.79	472	0.00470	1.32791	907.43	349.97	587	1.744	209.98	Air Valve No.6
247	538.32	2536.59	5848.38	472	0.00470	11.92596	895.50	357.18	587	1.744	214.31	
279	555.10	2834.34	8682.72	472	0.00470	13.32586	882.18	327.08	587	1.744	196.25	Air Valve No.7
308	581.18	1906.55	10589.27	472	0.00470	8.96378	873.21	292.03	587	1.744	175.22	
310	590.28	180.79	10770.06	472	0.00470	0.85000	872.36	282.08	587	1.744	169.25	
311	599.17	110.42	10880.48	472	0.00470	0.51915	871.84	272.67	587	1.744	163.60	
312	600.29	60.19	10940.67	472	0.00470	0.28299	871.56	271.27	587	1.744	162.76	Air Valve No.8
318	583.00	335.63	11276.30	472	0.00470	1.57799	869.98	286.98	587	1.744	172.19	
321	582.53	165.97	11442.27	472	0.00470	0.78032	869.20	286.67	587	1.744	172.00	
341	592.00	106.00	11548.27	472	0.00470	0.49837	868.70	276.70	587	1.744	166.02	
342	594.82	92.40	11640.67	472	0.00470	0.43443	868.27	273.45	587	1.744	164.07	
345	602.73	71.64	11712.31	472	0.00470	0.33682	867.93	265.20	587	1.744	159.12	
347	605.22	94.43	11806.74	472	0.00470	0.44397	867.49	262.27	587	1.744	157.36	Air Valve No.9
350	597.35	50.53	11857.27	472	0.00470	0.23757	867.25	269.90	587	1.744	161.94	
351	596.63	42.00	11899.27	472	0.00470	0.19747	867.05	270.42	587	1.744	162.25	
365	604.05	1820.42	13719.69	472	0.00470	8.55884	858.50	254.45	587	1.744	152.67	
366	606.73	49.58	13769.27	472	0.00470	0.23310	858.26	251.53	587	1.744	150.92	
371	602.02	202.76	13972.03	472	0.00470	0.95329	857.31	255.29	587	1.744	153.17	No.8-No.10 shall be replaced by WAJ.
380	613.62	422.24	14394.27	472	0.00470	1.98519	855.32	241.70	587	1.744	145.02	
386	617.67	274.99	14669.26	472	0.00470	1.29289	854.03	236.36	587	1.744	141.82	
395	628.54	523.50	15192.76	472	0.00470	2.46127	851.57	223.03	587	1.744	133.82	
398	636.89	151.69	15344.45	472	0.00470	0.71318	850.86	213.97	587	1.744	128.38	
401	658.45	178.23	15522.68	472	0.00470	0.83796	850.02	191.57	587	1.744	114.94	
403	661.11	80.74	15603.42	472	0.00470	0.37961	849.64	188.53	587	1.744	113.12	Air Valve No.10, No.11
406	658.31	151.82	15755.24	472	0.00470	0.71379	848.93	190.62	587	1.744	114.37	
408	651.13	136.74	15891.98	472	0.00470	0.64289	848.28	197.15	587	1.744	118.29	
412	644.70	274.94	16166.92	472	0.00470	1.29265	846.99	202.29	587	1.744	121.37	
416	649.39	231.04	16397.96	472	0.00470	1.08625	845.90	196.51	587	1.744	117.91	Air Valve No.12
417	648.70	38.68	16436.64	472	0.00470	0.18186	845.72	197.02	587	1.744	118.21	
419	643.15	81.25	16517.89	472	0.00470	0.38200	845.34	202.19	587	1.744	121.31	
420	639.60	94.82	16612.71	472	0.00470	0.44580	844.89	205.29	587	1.744	123.18	NP25
436	630.97	859.80	17472.51	472	0.00470	4.04241	840.85	209.88	587	1.744	125.93	
439	633.60	162.16	17634.67	472	0.00470	0.76241	840.09	206.49	587	1.744	123.89	
441	635.50	125.64	17760.31	472	0.00470	0.59071	839.50	204.00	587	1.744	122.40	Air Valve No.13
443	634.70	80.00	17840.31	472	0.00470	0.37613	839.12	204.42	587	1.744	122.65	
445	630.90	181.81	18022.12	472	0.00470	0.85479	838.27	207.37	587	1.744	124.42	
463	626.43	1038.93	19061.05	472	0.00470	4.88461	833.38	206.95	587	1.744	124.17	
464	625.04	47.61	19108.66	472	0.00470	0.22384	833.16	208.12	587	1.744	124.87	
498	611.80	1944.07	21052.73	472	0.00470	9.14019	824.02	212.22	587	1.744	127.33	
505	613.56	391.17	21443.90	472	0.00470	1.83911	822.18	208.62	587	1.744	125.17	Air Valve No.14
510	612.50	319.37	21763.27	472	0.00470	1.50154	820.68	208.18	587	1.744	124.91	
514	613.82	153.00	21916.27	472	0.00470	0.71934	819.96	206.14	587	1.744	123.68	
541	628.07	1700.83	23617.10	472	0.00470	7.99658	811.96	183.89	587	1.744	110.34	Air Valve No.15
547	623.01	387.17	24004.27	472	0.00470	1.82031	810.14	187.13	587	1.744	112.28	
567	628.60	1083.00	25087.27	472	0.00470	5.09180	805.05	176.45	587	1.744	105.87	Air Valve No.16
570	628.18	200.00	25287.27	472	0.00470	0.94031	804.11	175.93	587	1.744	105.56	
580	627.60	490.00	25777.27	472	0.00470	2.30377	801.81	174.21	587	1.744	104.52	
590	622.65	510.00	26287.27	472	0.00470	2.39780	799.41	176.76	587	1.744	106.06	
610	612.90	1097.00	27384.27	472	0.00470	5.15763	794.25	181.35	587	1.744	108.81	
612	612.44	105.72	27489.99	472	0.00470	0.49705	793.75	181.31	587	1.744	108.79	
613	613.13	32.29	27522.28	472	0.00470	0.15181	793.60	180.47	587	1.744	108.28	
615	621.83	81.33	27603.61	472	0.00470	0.38238	793.22	171.39	587	1.744	102.83	
616	621.84	17.56	27621.17	472	0.00470	0.08256	793.14	171.30	587	1.744	102.78	Air Valve No.17
617	621.16	31.10	27652.27	472	0.00470	0.14622	792.99	171.83	587	1.744	103.10	
619	614.76	87.00	27739.27	472	0.00470	0.40904	792.58	177.82	587	1.744	106.69	

Sta.	Invert Level or G.L (m)	Parcial Dist. (m)	Accum. Dist. (m)	Flow (L/s)	Hydraulic Grade	Friction Head Loss (m)	Hydraulic Grade Line (m)	Dynamic Head (m)	Internal Dia. (mm)	Velocity (m/s)	Water Hammer (m)	Remark
621	614.30	131.00	27870.27	472	0.00470	0.61591	791.97	177.67	587	1.744	106.60	
633	622.49	727.94	28598.21	472	0.00470	3.42246	788.54	166.05	587	1.744	99.63	
634	622.60	50.77	28648.98	472	0.00470	0.23870	788.30	165.70	587	1.744	99.42	
640	625.77	375.41	29024.39	472	0.00470	1.76502	786.54	160.77	587	1.744	96.46	
653	635.62	683.25	29707.64	472	0.00470	3.21235	783.33	147.71	587	1.744	88.62	
659	640.01	361.53	30069.17	472	0.00470	1.69976	781.63	141.62	587	1.744	84.97	
664	645.87	301.24	30370.41	472	0.00470	1.41630	780.21	134.34	587	1.744	80.60	
665	646.04	62.07	30432.48	472	0.00470	0.29183	779.92	133.88	587	1.744	80.33	
667	650.49	130.28	30562.76	472	0.00470	0.61252	779.31	128.82	587	1.744	77.29	
669	655.20	118.44	30681.20	472	0.00470	0.55685	778.75	123.55	587	1.744	74.13	
670	655.89	49.33	30730.53	472	0.00470	0.23193	778.52	122.63	587	1.744	73.58	
672	663.08	135.04	30865.57	472	0.00470	0.63490	777.88	114.80	587	1.744	68.88	
673	663.80	45.07	30910.64	472	0.00470	0.21190	777.67	113.87	587	1.744	68.32	Air Valve No.18
675	656.22	109.93	31020.57	472	0.00470	0.51684	777.15	120.93	587	1.744	72.56	
676	662.03	63.85	31084.42	472	0.00470	0.30020	776.85	114.82	587	1.744	68.89	
680	664.64	167.88	31252.30	472	0.00470	0.78930	776.07	111.43	587	1.744	66.86	Air Valve No.19, No.20
681	664.59	14.28	31266.58	472	0.00470	0.06714	776.00	111.41	587	1.744	66.84	
682	661.23	72.04	31338.62	472	0.00470	0.33870	775.66	114.43	587	1.744	68.66	
684	647.38	118.51	31457.13	472	0.00470	0.55718	775.10	127.72	587	1.744	76.63	
687	636.29	199.96	31657.09	472	0.00470	0.94013	774.16	137.87	587	1.744	82.72	
695	625.56	408.07	32065.16	472	0.00470	1.91857	772.24	146.68	587	1.744	88.01	
696	625.58	3.79	32068.95	472	0.00470	0.01782	772.23	146.65	587	1.744	87.99	
697	627.01	53.91	32122.86	472	0.00470	0.25346	771.97	144.96	587	1.744	86.98	
698	633.33	83.83	32206.69	472	0.00470	0.39413	771.58	138.25	587	1.744	82.95	
700	635.95	57.95	32264.64	472	0.00470	0.27246	771.31	135.36	587	1.744	81.21	Air Valve No.21
706	629.15	310.68	32575.32	472	0.00470	1.46068	769.84	140.69	587	1.744	84.42	
710	635.68	246.68	32822.00	472	0.00470	1.15978	768.68	133.00	587	1.744	79.80	Air Valve No.22
712	633.77	110.54	32932.54	472	0.00470	0.51971	768.17	134.40	587	1.744	80.64	
713	633.61	107.30	33039.84	472	0.00470	0.50448	767.66	134.05	587	1.744	80.43	
715	637.04	66.05	33105.89	472	0.00470	0.31054	767.35	130.31	587	1.744	78.19	Air Valve No.23
720	633.77	414.15	33520.04	472	0.00470	1.94716	765.40	131.63	587	1.744	78.98	
725	625.20	18.48	33538.52	472	0.00470	0.08689	765.32	140.12	587	1.744	84.07	
728	634.95	190.47	33728.99	472	0.00470	0.89551	764.42	129.47	587	1.744	77.68	
730	637.90	106.28	33835.27	472	0.00470	0.49968	763.92	126.02	587	1.744	75.61	
735	653.47	287.55	34122.82	472	0.00470	1.35194	762.57	109.10	587	1.744	65.46	
736	654.12	35.98	34158.80	472	0.00470	0.16916	762.40	108.28	587	1.744	64.97	Air Valve No.24
740	648.92	222.54	34381.34	472	0.00470	1.04629	761.35	112.43	587	1.744	67.46	
743	648.73	151.22	34532.56	472	0.00470	0.71097	760.64	111.91	587	1.744	67.15	
746	651.47	128.96	34661.52	472	0.00470	0.60631	760.04	108.57	587	1.744	65.14	Air Valve No.25
751	638.48	314.64	34976.16	472	0.00470	1.47930	758.56	120.08	587	1.744	72.05	
752	637.24	74.71	35050.87	472	0.00470	0.35125	758.21	120.97	587	1.744	72.58	
755	636.74	189.42	35240.29	472	0.00470	0.89057	757.32	120.58	587	1.744	72.35	
757	633.49	104.60	35344.89	472	0.00470	0.49178	756.82	123.33	587	1.744	74.00	NP16
764	631.90	395.30	35740.19	472	0.00470	1.85853	754.96	123.06	587	1.744	73.84	
767	634.25	159.08	35899.27	472	0.00470	0.74793	754.22	119.97	587	1.744	71.98	
772	635.25	378.00	36277.27	472	0.00470	1.77719	752.44	117.19	587	1.744	70.31	
773	636.72	30.00	36307.27	472	0.00470	0.14105	752.30	115.58	587	1.744	69.35	
778	653.12	319.80	36627.07	472	0.00470	1.50356	750.80	97.68	587	1.744	58.61	
782	653.69	257.40	36884.47	472	0.00470	1.21018	749.58	95.89	587	1.744	57.54	
783	653.73	56.80	36941.27	472	0.00470	0.26705	749.32	95.59	587	1.744	57.35	
786	670.23	165.00	37106.27	472	0.00470	0.77576	748.54	78.31	587	1.744	46.99	Air Valve No.26
793	642.66	401.00	37507.27	472	0.00470	1.88533	746.66	104.00	587	1.744	62.40	
794	641.01	70.00	37577.27	472	0.00470	0.32911	746.33	105.32	587	1.744	63.19	
796	642.66	120.00	37697.27	472	0.00470	0.56419	745.76	103.10	587	1.744	61.86	
798	652.54	130.00	37827.27	472	0.00470	0.61120	745.15	92.61	587	1.744	55.57	Air Valve No.27
802	641.80	190.00	38017.27	472	0.00470	0.89330	744.26	102.46	587	1.744	61.48	
808	650.22	360.00	38377.27	472	0.00470	1.69257	742.57	92.35	587	1.744	55.41	Air Valve No.28
813	642.72	188.85	38566.12	472	0.00470	0.88789	741.68	98.96	587	1.744	59.38	
815	641.68	137.57	38703.69	472	0.00470	0.64680	741.03	99.35	587	1.744	59.61	
823	625.71	437.00	39140.69	472	0.00470	2.05459	738.98	113.27	587	1.744	67.96	
847	614.83	1415.58	40556.27	472	0.00470	6.65545	732.32	117.49	587	1.744	70.50	
860	621.92	693.15	41249.42	472	0.00470	3.25890	729.06	107.14	587	1.744	64.29	Air Valve No.29
864	619.42	261.99	41511.41	472	0.00470	1.23177	727.83	108.41	587	1.744	65.05	Air Valve No.30
868	618.10	199.86	41711.27	472	0.00470	0.93966	726.89	108.79	587	1.744	65.27	
872	610.05	248.00	41959.27	472	0.00470	1.16599	725.73	115.68	587	1.744	69.41	
900	605.99	1660.31	43619.58	472	0.00470	7.80607	717.92	111.93	587	1.744	67.16	
922	612.34	1237.63	44857.21	472	0.00470	5.81881	712.10	99.76	587	1.744	59.86	Air Valve No.31
929	609.79	309.89	45167.10	472	0.00470	1.45697	710.64	100.85	587	1.744	60.51	
931	605.17	70.42	45237.52	472	0.00470	0.33108	710.31	105.14	587	1.744	63.09	
940	609.31	551.39	45788.91	472	0.00470	2.59240	707.72	98.41	587	1.744	59.05	
950	611.95	523.42	46312.33	472	0.00470	2.46090	705.26	93.31	587	1.744	55.99	
961	615.54	584.17	46896.50	472	0.00470	2.74652	702.51	86.97	587	1.744	52.18	Air Valve No.32
966	614.11	222.52	47119.02	472	0.00470	1.04619	701.47	87.36	587	1.744	52.41	
987	628.03	1301.61	48420.63	472	0.00470	6.11961	695.35	67.32	587	1.744	45.00	
988	630.09	24.90	48445.53	472	0.00470	0.11707	695.23	65.14	587	1.744	45.00	
992	633.09	215.76	48661.29	472	0.00470	1.01441	694.22	61.13	587	1.744	45.00	Air Valve No.33
995	631.24	134.54	48795.83	472	0.00470	0.63255	693.58	62.34	587	1.744	45.00	
1024	660.00	756.86	49552.69	472	0.00470	3.55843	690.02	30.02	587	1.744	30.02	Air Valve No.34
1026	659.45	913.51	50466.20	472	0.00470	4.29493	685.73	26.28	587	1.744	26.28	
1029	651.54	186.52	50652.72	472	0.00470	0.87694	684.85	33.31	587	1.744	33.31	
1032	648.52	176.46	50829.18	472	0.00470	0.82964	684.02	35.50	587	1.744	35.50	
1044	655.26	633.64	51462.82	472	0.00470	2.97910	681.04	25.78	587	1.744	25.78	
1057	673.27	644.67	52107.49	472	0.00470	3.03096	678.01	4.74	587	1.744	4.74	Air Valve No.35, No.36
1066	648.55	491.25	52598.74	472	0.00470	2.30965	675.70	27.15	587	1.744	27.15	
1067	648.87	38.42	52637.16	472	0.00470	0.18063	675.52	26.65	587	1.744	26.65	

Sta.	Invert Level or G.L (m)	Parcial Dist. (m)	Accum. Dist. (m)	Flow (L/s)	Hydraulic Grade	Friction Head Loss (m)	Hydraulic Grade Line (m)	Dynamic Head (m)	Internal Dia. (mm)	Velocity (m/s)	Water Hammer (m)	Remark
1070	652.93	110.86	52748.02	472	0.00470	0.52122	675.00	22.07	587	1.744	22.07	Air Valve No.37
1074	651.09	206.47	52954.49	472	0.00470	0.97073	674.03	22.94	587	1.744	22.94	
1079	641.93	307.83	53262.32	472	0.00470	1.44729	672.58	30.65	587	1.744	30.65	
1084	638.50	278.39	53540.71	472	0.00470	1.30887	671.27	32.77	587	1.744	32.77	
1086	640.03	105.71	53646.42	472	0.00470	0.49700	670.78	30.75	587	1.744	30.75	Air Valve No.38
1090	635.47	180.85	53827.27	472	0.00470	0.85028	669.93	34.46	587	1.744	34.46	Air Valve No.39
1093	635.30	147.62	53974.89	472	0.00470	0.69405	669.23	33.93	587	1.744	33.93	
1096	632.74	168.10	54142.99	472	0.00470	0.79033	668.44	35.70	587	1.744	35.70	
1098	627.46	54.90	54197.89	472	0.00470	0.25812	668.18	40.72	587	1.744	40.72	Air Valve No.40
1144	598.34	2641.78	56839.67	472	0.00470	12.42052	655.76	57.42	587	1.744	45.00	
1189	585.85	2497.84	59337.51	472	0.00470	11.74378	644.02	58.17	587	1.744	45.00	
1198	586.85	434.31	59771.82	472	0.00470	2.04194	641.98	55.13	587	1.744	45.00	
1219	581.39	1027.40	60799.22	472	0.00470	4.83040	637.15	55.76	587	1.744	45.00	
1229	590.71	503.77	61302.99	472	0.00470	2.36851	634.78	44.07	587	1.744	44.07	Air Valve No.41
1248	580.35	1001.72	62304.71	472	0.00470	4.70966	630.07	49.72	587	1.744	45.00	
1250	583.03	83.75	62388.46	472	0.00470	0.39376	629.68	46.65	587	1.744	45.00	Air Valve No.42
1260	575.44	549.15	62937.61	472	0.00470	2.58187	627.09	51.65	587	1.744	45.00	
1265	576.85	252.50	63190.11	472	0.00470	1.18715	625.91	49.06	587	1.744	45.00	
1267	585.60	141.81	63331.92	472	0.00470	0.66673	625.24	39.64	587	1.744	39.64	Air Valve No.43
1273	573.00	255.35	63587.27	472	0.00470	1.20055	624.04	51.04	587	1.744	45.00	
1281	575.67	209.04	63796.31	472	0.00470	0.98282	623.06	47.39	587	1.744	45.00	
1283	580.46	143.46	63939.77	472	0.00470	0.67449	622.38	41.92	587	1.744	41.92	
Khaw	611.00	317.50	64257.27	472	0.00470	1.49275	620.89	9.89	587	1.744	9.89	
Total						302.11						

Hallabat-Khaw Transmission Pipeline

Total Flow: 1,700 m^3/h Station G.L. 593.20 m

Hallabat Design Flow: 500 m^3/h Reservoir L.W.L. 593.80 m

Coefficient of Roughness: 122 Pumping Head: 135.00 m (By Requested Capacity)

Sta.	Invert Level. (m)	Parcial Dist. (m)	Accum. Dist. (m)	Flow (L/s)	Hydraulic Grade	Friction Head Loss (m)	Hydraulic Grade Line (m)	Dynamic Head (m)	Nominal Dia. (mm)	Velocity (m/s)	Water Hammer (m)	Remark
Tank	593.80	0.00	0.00				728.80					LWL594m
Pump	593.70	50.00	50.00	139	0.00051	0.02562	728.77	135.07	587	0.514	81.04	G.L.+0.5m, Pipeline 50m
1	591.92	50.00	100.00	139	0.00051	0.02562	728.75	136.83	587	0.514	82.10	
2	591.79	75.00	175.00	139	0.00051	0.03842	728.71	136.92	587	0.514	82.15	
3	592.25	25.00	200.00	139	0.00051	0.01281	728.70	136.45	587	0.514	81.87	
4	592.09	25.00	225.00	139	0.00051	0.01281	728.68	136.59	587	0.514	81.96	
5	592.47	75.00	300.00	139	0.00051	0.03842	728.65	136.18	587	0.514	81.71	
6	593.12	25.00	325.00	139	0.00051	0.01281	728.63	135.51	587	0.514	81.31	
7	593.07	100.00	425.00	139	0.00051	0.05123	728.58	135.51	587	0.514	81.31	
8	592.42	150.00	575.00	139	0.00051	0.07685	728.51	136.09	587	0.514	81.65	
9	593.09	225.00	800.00	139	0.00051	0.11527	728.39	135.30	587	0.514	81.18	
10	593.27	50.00	850.00	139	0.00051	0.02562	728.36	135.09	587	0.514	81.06	
11	593.53	25.00	875.00	139	0.00051	0.01281	728.35	134.82	587	0.514	80.89	
12	593.68	25.00	900.00	139	0.00051	0.01281	728.34	134.66	587	0.514	80.80	Connection with Corridor Line
13	594.20	75.00	975.00	472	0.00492	0.36931	727.97	133.77	587	1.745	80.26	
14	593.98	25.00	1000.00	472	0.00492	0.12310	727.85	133.87	587	1.745	80.32	
15	594.73	25.00	1025.00	472	0.00492	0.12310	727.72	132.99	587	1.745	79.80	
16	594.20	25.00	1050.00	472	0.00492	0.12310	727.60	133.40	587	1.745	80.04	
17	594.56	125.00	1175.00	472	0.00492	0.61551	726.98	132.42	587	1.745	79.45	
18	595.51	25.00	1200.00	472	0.00492	0.12310	726.86	131.35	587	1.745	78.81	
19	594.58	25.00	1225.00	472	0.00492	0.12310	726.74	132.16	587	1.745	79.30	
20	594.97	50.00	1275.00	472	0.00492	0.24621	726.49	131.52	587	1.745	78.91	
21	597.19	425.00	1700.00	472	0.00492	2.09275	724.40	127.21	587	1.745	76.33	
22	597.48	25.00	1725.00	472	0.00492	0.12310	724.28	126.80	587	1.745	76.08	
23	597.65	100.00	1825.00	472	0.00492	0.49241	723.78	126.13	587	1.745	75.68	
24	597.54	25.00	1850.00	472	0.00492	0.12310	723.66	126.12	587	1.745	75.67	
25	598.91	275.00	2125.00	472	0.00492	1.35413	722.31	123.40	587	1.745	74.04	
26	598.62	50.00	2175.00	472	0.00492	0.24621	722.06	123.44	587	1.745	74.06	
27	602.47	175.00	2350.00	472	0.00492	0.86172	721.20	118.73	587	1.745	71.24	
28	602.75	25.00	2375.00	472	0.00492	0.12310	721.08	118.33	587	1.745	71.00	
29	603.75	125.00	2500.00	472	0.00492	0.61551	720.46	116.71	587	1.745	70.03	Air Valve No.1
30	604.18	75.00	2575.00	472	0.00492	0.36931	720.09	115.91	587	1.745	69.55	
31	601.86	150.00	2725.00	472	0.00492	0.73862	719.35	117.49	587	1.745	70.50	
32	601.32	50.00	2775.00	472	0.00492	0.24621	719.11	117.79	587	1.745	70.67	
33	601.64	50.00	2825.00	472	0.00492	0.24621	718.86	117.22	587	1.745	70.33	
34	601.47	25.00	2850.00	472	0.00492	0.12310	718.74	117.27	587	1.745	70.36	
35	602.06	75.00	2925.00	472	0.00492	0.36931	718.37	116.31	587	1.745	69.78	
36	602.50	125.00	3050.00	472	0.00492	0.61551	717.75	115.25	587	1.745	69.15	
37	602.83	75.00	3125.00	472	0.00492	0.36931	717.38	114.55	587	1.745	68.73	
38	602.87	25.00	3150.00	472	0.00492	0.12310	717.26	114.39	587	1.745	68.63	
39	603.78	100.00	3250.00	472	0.00492	0.49241	716.77	112.99	587	1.745	67.79	
40	603.80	75.00	3325.00	472	0.00492	0.36931	716.40	112.60	587	1.745	67.56	
41	603.35	125.00	3450.00	472	0.00492	0.61551	715.78	112.43	587	1.745	67.46	
42	602.90	50.00	3500.00	472	0.00492	0.24621	715.54	112.64	587	1.745	67.58	
43	603.33	25.00	3525.00	472	0.00492	0.12310	715.41	112.08	587	1.745	67.25	
44	601.04	25.00	3550.00	472	0.00492	0.12310	715.29	114.25	587	1.745	68.55	
45	600.03	50.00	3600.00	472	0.00492	0.24621	715.04	115.01	587	1.745	69.01	
46	601.07	25.00	3625.00	472	0.00492	0.12310	714.92	113.85	587	1.745	68.31	
47	600.03	25.00	3650.00	472	0.00492	0.12310	714.80	114.77	587	1.745	68.86	
48	600.32	25.00	3675.00	472	0.00492	0.12310	714.67	114.35	587	1.745	68.61	
49	602.60	50.00	3725.00	472	0.00492	0.24621	714.43	111.83	587	1.745	67.10	
50	602.88	50.00	3775.00	472	0.00492	0.24621	714.18	111.30	587	1.745	66.78	
51	603.93	50.00	3825.00	472	0.00492	0.24621	713.94	110.01	587	1.745	66.00	
52	603.88	25.00	3850.00	472	0.00492	0.12310	713.81	109.93	587	1.745	65.96	
53	602.57	75.00	3925.00	472	0.00492	0.36931	713.44	110.87	587	1.745	66.52	
54	606.97	100.00	4025.00	472	0.00492	0.49241	712.95	105.98	587	1.745	63.59	
55	607.05	25.00	4050.00	472	0.00492	0.12310	712.83	105.78	587	1.745	63.47	Air Valve No.2
56	606.09	50.00	4100.00	472	0.00492	0.24621	712.58	106.49	587	1.745	63.90	
57	605.16	25.00	4125.00	472	0.00492	0.12310	712.46	107.30	587	1.745	64.38	
58	604.91	25.00	4150.00	472	0.00492	0.12310	712.34	107.43	587	1.745	64.46	
59	606.28	150.00	4300.00	472	0.00492	0.73862	711.60	105.32	587	1.745	63.19	
60	607.38	50.00	4350.00	472	0.00492	0.24621	711.35	103.97	587	1.745	62.38	
61	605.94	75.00	4425.00	472	0.00492	0.36931	710.98	105.04	587	1.745	63.02	
62	606.23	50.00	4475.00	472	0.00492	0.24621	710.74	104.51	587	1.745	62.70	
63	606.24	50.00	4525.00	472	0.00492	0.24621	710.49	104.25	587	1.745	62.55	
64	606.06	75.00	4600.00	472	0.00492	0.36931	710.12	104.06	587	1.745	62.44	
65	607.04	25.00	4625.00	472	0.00492	0.12310	710.00	102.96	587	1.745	61.77	
66	606.93	75.00	4700.00	472	0.00492	0.36931	709.63	102.70	587	1.745	61.62	
67	608.36	50.00	4750.00	472	0.00492	0.24621	709.38	101.02	587	1.745	60.61	
68	607.80	50.00	4800.00	472	0.00492	0.24621	709.13	101.33	587	1.745	60.80	
69	610.46	100.00	4900.00	472	0.00492	0.49241	708.64	98.18	587	1.745	58.91	
70	611.04	75.00	4975.00	472	0.00492	0.36931	708.27	97.23	587	1.745	58.34	
71	612.64	175.00	5150.00	472	0.00492	0.86172	707.41	94.77	587	1.745	56.86	
72	612.65	25.00	5175.00	472	0.00492	0.12310	707.29	94.64	587	1.745	56.78	
73	615.25	125.00	5300.00	472	0.00492	0.61551	706.67	91.42	587	1.745	54.85	
74	614.59	100.00	5400.00	472	0.00492	0.49241	706.18	91.59	587	1.745	54.95	
75	617.04	150.00	5550.00	472	0.00492	0.73862	705.44	88.40	587	1.745	53.04	
76	616.66	50.00	5600.00	472	0.00492	0.24621	705.20	88.54	587	1.745	53.12	

Sta.	Invert Level. (m)	Parcial Dist. (m)	Accum. Dist. (m)	Flow (L/s)	Hydraulic Grade	Friction Head Loss (m)	Hydraulic Grade Line (m)	Dynamic Head (m)	Nominal Dia. (mm)	Velocity (m/s)	Water Hammer (m)	Remark
77	621.98	150.00	5750.00	472	0.00492	0.73862	704.46	82.48	587	1.745	49.49	Air Valve No.3
78	621.71	25.00	5775.00	472	0.00492	0.12310	704.33	82.62	587	1.745	49.57	
79	621.83	25.00	5800.00	472	0.00492	0.12310	704.21	82.38	587	1.745	49.43	
80	620.16	75.00	5875.00	472	0.00492	0.36931	703.84	83.68	587	1.745	50.21	
81	619.98	75.00	5950.00	472	0.00492	0.36931	703.47	83.49	587	1.745	50.10	
82	622.46	150.00	6100.00	472	0.00492	0.73862	702.73	80.27	587	1.745	48.16	
83	622.85	75.00	6175.00	472	0.00492	0.36931	702.36	79.51	587	1.745	47.71	
84	625.63	125.00	6300.00	472	0.00492	0.61551	701.75	76.12	587	1.745	45.67	
85	627.37	175.00	6475.00	472	0.00492	0.86172	700.89	73.52	587	1.745	45.00	
86	633.59	125.00	6600.00	472	0.00492	0.61551	700.27	66.68	587	1.745	45.00	
87	633.94	25.00	6625.00	472	0.00492	0.12310	700.15	66.21	587	1.745	45.00	Air Valve No.4
88	626.65	150.00	6775.00	472	0.00492	0.73862	699.41	72.76	587	1.745	45.00	
89	626.99	75.00	6850.00	472	0.00492	0.36931	699.04	72.05	587	1.745	45.00	
90	626.65	25.00	6875.00	472	0.00492	0.12310	698.92	72.27	587	1.745	45.00	
91	632.30	225.00	7100.00	472	0.00492	1.10793	697.81	65.51	587	1.745	45.00	
92	632.54	25.00	7125.00	472	0.00492	0.12310	697.69	65.15	587	1.745	45.00	
93	631.08	50.00	7175.00	472	0.00492	0.24621	697.44	66.36	587	1.745	45.00	
94	632.05	100.00	7275.00	472	0.00492	0.49241	696.95	64.90	587	1.745	45.00	
95	634.22	100.00	7375.00	472	0.00492	0.49241	696.46	62.24	587	1.745	45.00	
96	633.77	50.00	7425.00	472	0.00492	0.24621	696.21	62.44	587	1.745	45.00	
97	635.66	75.00	7500.00	472	0.00492	0.36931	695.84	60.18	587	1.745	45.00	
98	637.26	25.00	7525.00	472	0.00492	0.12310	695.72	58.46	587	1.745	45.00	
99	642.82	200.00	7725.00	472	0.00492	0.98482	694.73	51.91	587	1.745	45.00	
100	642.79	25.00	7750.00	472	0.00492	0.12310	694.61	51.82	587	1.745	45.00	
101	641.70	125.00	7875.00	472	0.00492	0.61551	693.99	52.29	587	1.745	45.00	
102	644.05	163.00	8038.00	472	0.00492	0.80263	693.19	49.14	587	1.745	45.00	
103	653.25	350.00	8388.00	472	0.00492	1.72344	691.47	38.22	587	1.745	38.22	
104	653.28	125.00	8513.00	472	0.00492	0.61551	690.85	37.57	587	1.745	37.57	
105	662.65	325.00	8838.00	472	0.00492	1.60034	689.25	26.60	587	1.745	26.60	Air Valve No.5
106	650.59	503.00	9341.00	472	0.00492	2.47683	686.77	36.18	587	1.745	36.18	
107	664.70	497.00	9838.00	472	0.00492	2.44729	684.33	19.63	587	1.745	19.63	
108	672.56	510.00	10348.00	472	0.00492	2.51130	681.82	9.26	587	1.745	9.26	
109	672.40	65.00	10413.00	472	0.00492	0.32007	681.50	9.10	587	1.745	9.10	
110	675.84	50.00	10463.00	472	0.00492	0.24621	681.25	5.41	587	1.745	5.41	
111	675.92	125.00	10588.00	472	0.00492	0.61551	680.63	4.71	587	1.745	4.71	
112	678.48	75.00	10663.00	472	0.00492	0.36931	680.26	1.78	587	1.745	1.78	Air Valve No.6
113	651.74	425.00	11088.00	472	0.00492	2.09275	678.17	26.43	587	1.745	26.43	
114	652.16	75.00	11163.00	472	0.00492	0.36931	677.80	25.64	587	1.745	25.64	
115	655.51	75.00	11238.00	472	0.00492	0.36931	677.43	21.92	587	1.745	21.92	
116	655.63	150.00	11388.00	472	0.00492	0.73862	676.69	21.06	587	1.745	21.06	Air Valve No.7
117	642.88	500.00	11888.00	472	0.00492	2.46206	674.23	31.35	587	1.745	31.35	
118	641.70	150.00	12038.00	472	0.00492	0.73862	673.49	31.79	587	1.745	31.79	
119	644.99	125.00	12163.00	472	0.00492	0.61551	672.88	27.89	587	1.745	27.89	Air Valve No.8
120	637.45	225.00	12388.00	472	0.00492	1.10793	671.77	34.32	587	1.745	34.32	
121	638.28	75.00	12463.00	472	0.00492	0.36931	671.40	33.12	587	1.745	33.12	Air Valve No.9
122	628.72	275.00	12738.00	472	0.00492	1.35413	670.05	41.33	587	1.745	41.33	
123	615.87	1250.00	13988.00	472	0.00492	6.15514	663.89	48.02	587	1.745	45.00	Air Valve No.10
124	603.13	1195.60	15183.60	472	0.00492	5.88727	658.00	54.87	587	1.745	45.00	
125	597.99	801.40	15985.00	472	0.00492	3.94619	654.06	56.07	587	1.745	45.00	
126	599.39	71.00	16056.00	472	0.00492	0.34961	653.71	54.32	587	1.745	45.00	Air Valve No.11
127	597.57	79.00	16135.00	472	0.00492	0.38901	653.32	55.75	587	1.745	45.00	
128	595.93	275.00	16410.00	472	0.00492	1.35413	651.97	56.04	587	1.745	45.00	
129	594.88	75.00	16485.00	472	0.00492	0.36931	651.60	56.72	587	1.745	45.00	
130	594.88	100.00	16585.00	472	0.00492	0.49241	651.10	56.22	587	1.745	45.00	
131	590.20	925.00	17510.00	472	0.00492	4.55481	646.55	56.35	587	1.745	45.00	
132	591.55	75.00	17585.00	472	0.00492	0.36931	646.18	54.63	587	1.745	45.00	Air Valve No.12
133	589.64	75.00	17660.00	472	0.00492	0.36931	645.81	56.17	587	1.745	45.00	
134	588.97	75.00	17735.00	472	0.00492	0.36931	645.44	56.47	587	1.745	45.00	
135	588.83	50.00	17785.00	472	0.00492	0.24621	645.20	56.37	587	1.745	45.00	
136	588.53	25.00	17810.00	472	0.00492	0.12310	645.07	56.54	587	1.745	45.00	
137	588.67	75.00	17885.00	472	0.00492	0.36931	644.70	56.03	587	1.745	45.00	
138	588.89	50.00	17935.00	472	0.00492	0.24621	644.46	55.57	587	1.745	45.00	
139	588.50	25.00	17960.00	472	0.00492	0.12310	644.33	55.83	587	1.745	45.00	
140	589.36	325.00	18285.00	472	0.00492	1.60034	642.73	53.37	587	1.745	45.00	
141	588.80	175.00	18460.00	472	0.00492	0.86172	641.87	53.07	587	1.745	45.00	
142	587.56	45.00	18505.00	472	0.00492	0.22159	641.65	54.09	587	1.745	45.00	
143	588.91	105.00	18610.00	472	0.00492	0.51703	641.13	52.22	587	1.745	45.00	
144	586.19	75.00	18685.00	472	0.00492	0.36931	640.76	54.57	587	1.745	45.00	
145	587.23	75.00	18760.00	472	0.00492	0.36931	640.39	53.16	587	1.745	45.00	
146	587.03	100.00	18860.00	472	0.00492	0.49241	639.90	52.87	587	1.745	45.00	
147	585.80	150.00	19010.00	472	0.00492	0.73862	639.16	53.36	587	1.745	45.00	
148	586.18	25.00	19035.00	472	0.00492	0.12310	639.04	52.86	587	1.745	45.00	
149	586.53	200.00	19235.00	472	0.00492	0.98482	638.06	51.53	587	1.745	45.00	
150	586.40	25.00	19260.00	472	0.00492	0.12310	637.93	51.53	587	1.745	45.00	
151	588.17	100.00	19360.00	472	0.00492	0.49241	637.44	49.27	587	1.745	45.00	
152	587.78	100.00	19460.00	472	0.00492	0.49241	636.95	49.17	587	1.745	45.00	
153	585.57	50.00	19510.00	472	0.00492	0.24621	636.70	51.13	587	1.745	45.00	
154	588.95	100.00	19610.00	472	0.00492	0.49241	636.21	47.26	587	1.745	45.00	
155	588.46	75.00	19685.00	472	0.00492	0.36931	635.84	47.38	587	1.745	45.00	
156	593.21	100.00	19785.00	472	0.00492	0.49241	635.35	42.14	587	1.745	42.14	
157	593.37	25.00	19810.00	472	0.00492	0.12310	635.22	41.85	587	1.745	41.85	Air Valve No.13
158	587.36	375.00	20185.00	472	0.00492	1.84654	633.38	46.02	587	1.745	45.00	
159	586.03	25.00	20210.00	472	0.00492	0.12310	633.25	47.22	587	1.745	45.00	
160	589.61	100.00	20310.00	472	0.00492	0.49241	632.76	43.15	587	1.745	43.15	
161	583.58	275.00	20585.00	472	0.00492	1.35413	631.41	47.83	587	1.745	45.00	

Sta.	Invert Level. (m)	Parcial Dist. (m)	Accum. Dist. (m)	Flow (L/s)	Hydraulic Grade	Friction Head Loss (m)	Hydraulic Grade Line (m)	Dynamic Head (m)	Nominal Dia. (mm)	Velocity (m/s)	Water Hammer (m)	Remark
162	583.16	100.00	20685.00	472	0.00492	0.49241	630.92	47.76	587	1.745	45.00	
163	583.69	25.00	20710.00	472	0.00492	0.12310	630.79	47.10	587	1.745	45.00	
164	582.76	25.00	20735.00	472	0.00492	0.12310	630.67	47.91	587	1.745	45.00	
165	584.18	150.00	20885.00	472	0.00492	0.73862	629.93	45.75	587	1.745	45.00	
166	584.98	25.00	20910.00	472	0.00492	0.12310	629.81	44.83	587	1.745	44.83	
167	584.91	25.00	20935.00	472	0.00492	0.12310	629.68	44.77	587	1.745	44.77	
168	581.24	134.00	21069.00	472	0.00492	0.65983	629.02	47.78	587	1.745	45.00	
169	579.43	291.00	21360.00	472	0.00492	1.43292	627.59	48.16	587	1.745	45.00	
170	578.03	54.00	21414.00	472	0.00492	0.26590	627.33	49.30	587	1.745	45.00	
171	580.27	71.00	21485.00	472	0.00492	0.34961	626.98	46.71	587	1.745	45.00	
172	580.50	75.00	21560.00	472	0.00492	0.36931	626.61	46.11	587	1.745	45.00	
173	579.59	150.00	21710.00	472	0.00492	0.73862	625.87	46.28	587	1.745	45.00	
174	586.41	125.50	21835.50	472	0.00492	0.61798	625.25	38.84	587	1.745	38.84	Air Valve No.14
175	582.27	109.50	21945.00	472	0.00492	0.53919	624.71	42.44	587	1.745	42.44	
176	579.64	64.50	22009.50	472	0.00492	0.31761	624.39	44.75	587	1.745	44.75	
177	581.11	85.50	22095.00	472	0.00492	0.42101	623.97	42.86	587	1.745	42.86	
178	587.77	100.00	22195.00	472	0.00492	0.49241	623.48	35.71	587	1.745	35.71	
179	587.99	25.00	22220.00	472	0.00492	0.12310	623.36	35.37	587	1.745	35.37	
180	587.29	25.00	22245.00	472	0.00492	0.12310	623.23	35.94	587	1.745	35.94	
181	588.75	50.00	22295.00	472	0.00492	0.24621	622.99	34.24	587	1.745	34.24	
182	585.91	200.00	22495.00	472	0.00492	0.98482	622.00	36.09	587	1.745	36.09	
183	593.95	125.00	22620.00	472	0.00492	0.61551	621.39	27.44	587	1.745	27.44	
184	594.54	25.00	22645.00	472	0.00492	0.12310	621.26	26.72	587	1.745	26.72	Air Valve No.15
185	588.29	100.00	22745.00	472	0.00492	0.49241	620.77	32.48	587	1.745	32.48	
Khaw	612.50	79.35	22824.35	472	0.00492	0.39073	620.38	7.88	587	1.745	7.88	Inlet Level=612.5m
Total						108.4						

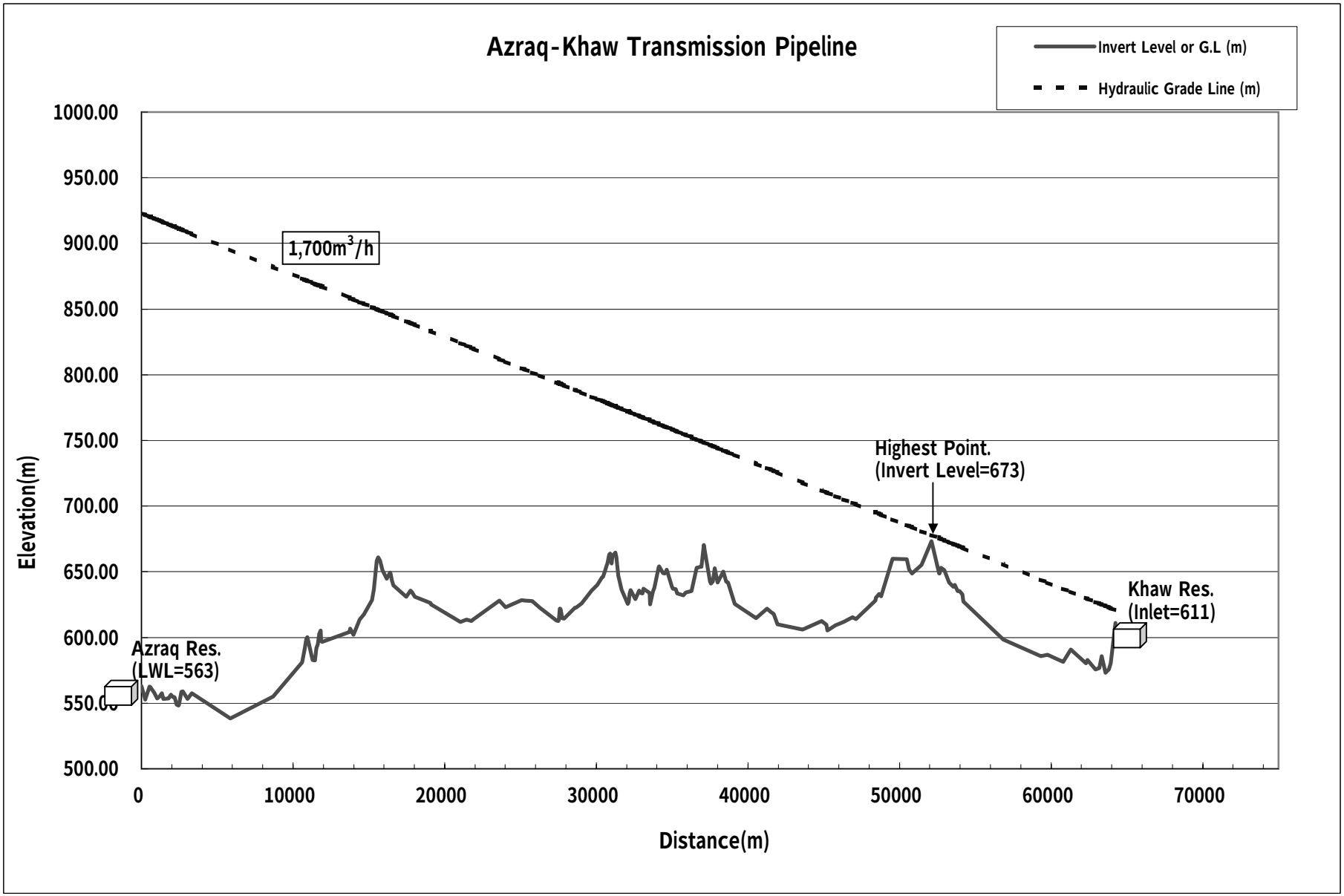
Zarqa Pumping Station - Batrawi Reservoir New Pipeline

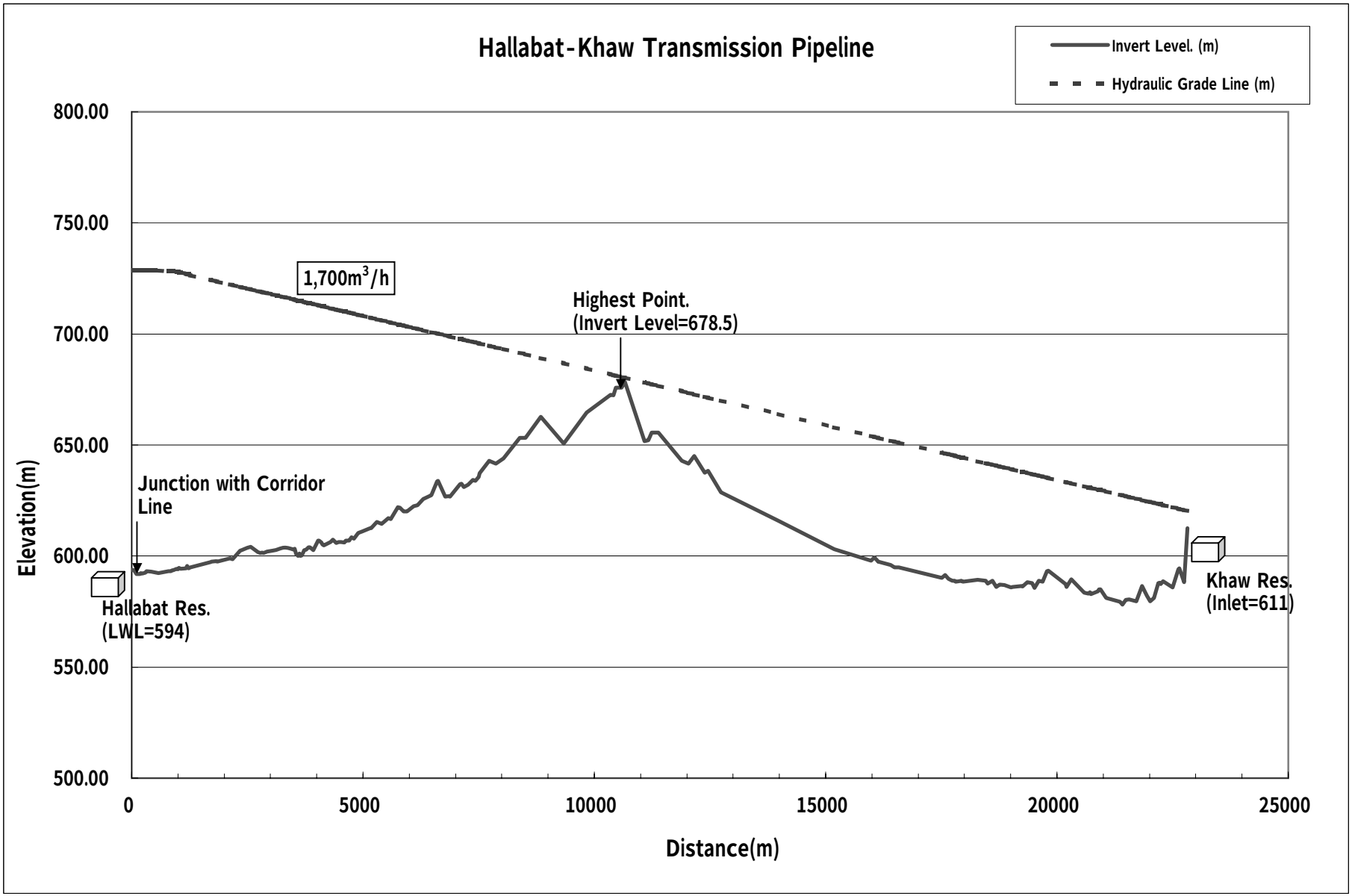
Zarqa Station G.L. 565.00 m Batrawi Tank G.L. 635.20 m

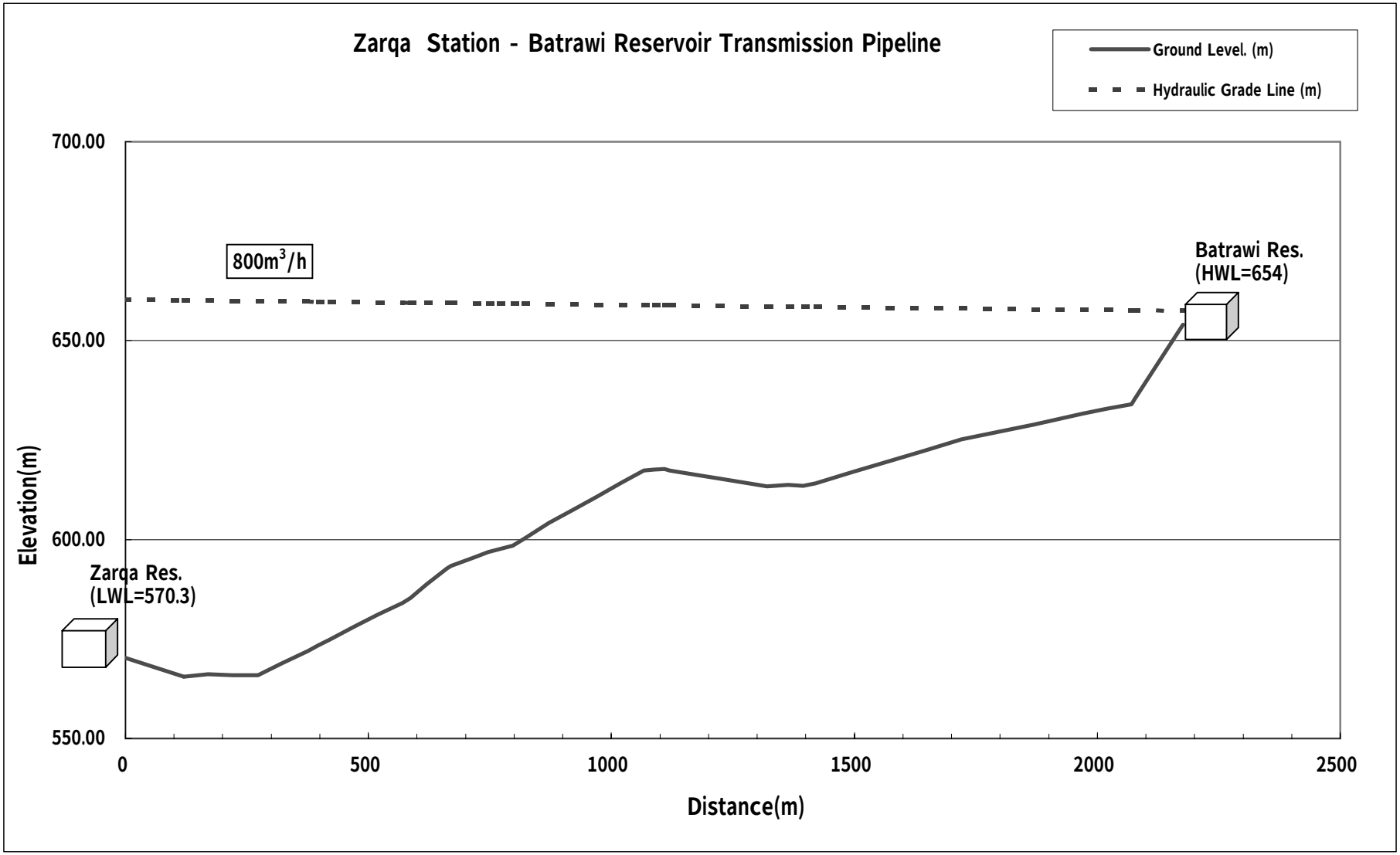
Design Flow: 800 m^3/h Zarqa Reservoir L.W.L. 570.30 m Batrawi Tank HWL 654.00 m

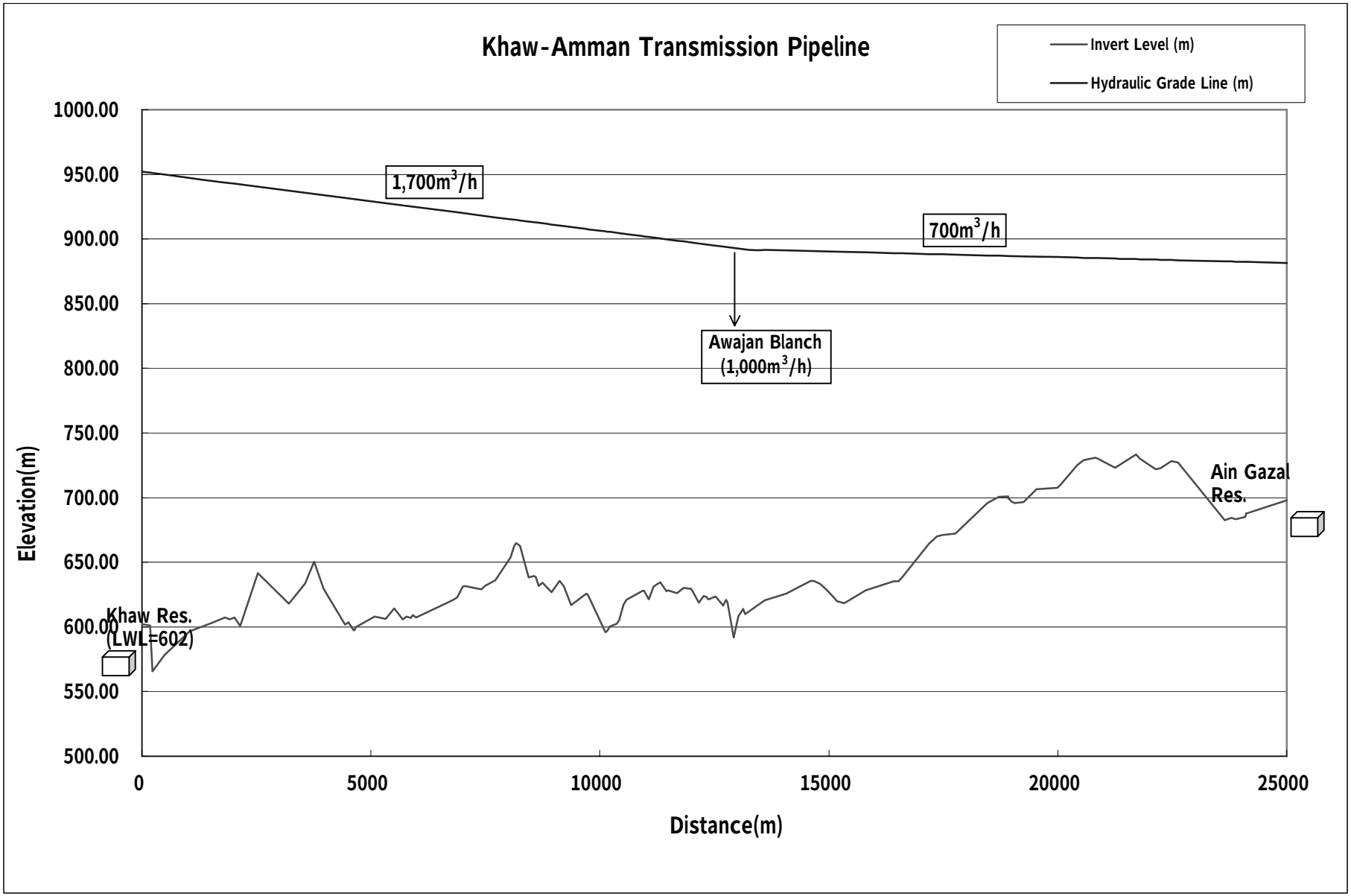
Coefficient of Roughness: 110 Pumping Head: 90.00 m

Sta.	Ground Level. (m)	Parcial Dist. (m)	Accum. Dist. (m)	Flow (L/s)	Hydraulic Grade	Friction Head Loss (m)	Hydraulic Grade Line (m)	Dynamic Head (m)	Nominal Dia. (mm)	Velocity (m/s)	Water Hammer (m)	Remark
Tank	570.30	0.00	0.00				660.30					LWL:570.3m
Pump	565.50	120.00	120.00	222	0.00129	0.15532	660.14	94.64	603	0.777	56.79	G.L.+0.5m, Pipeline 120m
1	566.18	50.00	170.00	222	0.00129	0.06471	660.08	93.90	603	0.777	56.34	
2	565.93	50.00	220.00	222	0.00129	0.06471	660.02	94.09	603	0.777	56.45	
3	565.90	2.59	222.59	222	0.00129	0.00335	660.01	94.11	603	0.777	56.47	
4	565.85	50.33	272.92	222	0.00129	0.06514	659.95	94.10	603	0.777	56.46	
5	568.75	47.08	320.00	222	0.00129	0.06094	659.89	91.14	603	0.777	54.68	
6	572.00	55.27	375.27	222	0.00129	0.07154	659.81	87.81	603	0.777	52.69	
7	573.36	21.00	396.27	222	0.00129	0.02718	659.79	86.43	603	0.777	51.86	
8	574.90	23.73	420.00	222	0.00129	0.03071	659.76	84.86	603	0.777	50.91	
9	578.09	50.00	470.00	222	0.00129	0.06471	659.69	81.60	603	0.777	48.96	
10	581.20	50.00	520.00	222	0.00129	0.06471	659.63	78.43	603	0.777	47.06	
11	584.07	50.00	570.00	222	0.00129	0.06471	659.56	75.49	603	0.777	45.30	
12	585.32	16.17	586.17	222	0.00129	0.02093	659.54	74.22	603	0.777	45.00	
13	588.75	33.83	620.00	222	0.00129	0.04379	659.50	70.75	603	0.777	45.00	
14	592.77	41.57	661.57	222	0.00129	0.05380	659.44	66.67	603	0.777	45.00	
15	593.40	8.43	670.00	222	0.00129	0.01091	659.43	66.03	603	0.777	45.00	
16	595.65	50.00	720.00	222	0.00129	0.06471	659.37	63.72	603	0.777	45.00	
17	596.90	26.32	746.32	222	0.00129	0.03407	659.33	62.43	603	0.777	45.00	
18	597.60	23.68	770.00	222	0.00129	0.03065	659.30	61.70	603	0.777	45.00	
19	598.50	26.66	796.66	222	0.00129	0.03451	659.27	60.77	603	0.777	45.00	
20	600.20	23.34	820.00	222	0.00129	0.03021	659.24	59.04	603	0.777	45.00	
21	604.20	51.25	871.25	222	0.00129	0.06633	659.17	54.97	603	0.777	45.00	
22	607.47	48.75	920.00	222	0.00129	0.06310	659.11	51.64	603	0.777	45.00	
23	610.83	50.00	970.00	222	0.00129	0.06471	659.04	48.21	603	0.777	45.00	
24	614.19	50.00	1020.00	222	0.00129	0.06471	658.98	44.79	603	0.777	44.79	
25	617.35	46.90	1066.90	222	0.00129	0.06070	658.92	41.57	603	0.777	41.57	
26	617.57	22.28	1089.18	222	0.00129	0.02884	658.89	41.32	603	0.777	41.32	
27	617.70	20.55	1109.73	222	0.00129	0.02660	658.86	41.16	603	0.777	41.16	
28	617.40	10.27	1120.00	222	0.00129	0.01329	658.85	41.45	603	0.777	41.45	
29	616.37	50.00	1170.00	222	0.00129	0.06471	658.79	42.42	603	0.777	42.42	
30	615.35	50.00	1220.00	222	0.00129	0.06471	658.72	43.37	603	0.777	43.37	
31	614.36	50.00	1270.00	222	0.00129	0.06471	658.66	44.30	603	0.777	44.30	
32	613.41	50.00	1320.00	222	0.00129	0.06471	658.59	45.18	603	0.777	45.00	
33	613.77	44.25	1364.25	222	0.00129	0.05727	658.53	44.76	603	0.777	44.76	
34	613.51	30.75	1395.00	222	0.00129	0.03980	658.49	44.98	603	0.777	44.98	
35	614.11	25.00	1420.00	222	0.00129	0.03236	658.46	44.35	603	0.777	44.35	
36	615.93	50.00	1470.00	222	0.00129	0.06471	658.40	42.47	603	0.777	42.47	
37	617.80	50.00	1520.00	222	0.00129	0.06471	658.33	40.53	603	0.777	40.53	
38	619.64	50.00	1570.00	222	0.00129	0.06471	658.27	38.63	603	0.777	38.63	
39	621.48	50.00	1620.00	222	0.00129	0.06471	658.20	36.72	603	0.777	36.72	
40	623.33	50.00	1670.00	222	0.00129	0.06471	658.14	34.81	603	0.777	34.81	
41	625.17	50.00	1720.00	222	0.00129	0.06471	658.07	32.90	603	0.777	32.90	
42	626.40	50.00	1770.00	222	0.00129	0.06471	658.01	31.61	603	0.777	31.61	
43	627.70	50.00	1820.00	222	0.00129	0.06471	657.94	30.24	603	0.777	30.24	
44	628.97	50.00	1870.00	222	0.00129	0.06471	657.88	28.91	603	0.777	28.91	
45	630.28	50.00	1920.00	222	0.00129	0.06471	657.81	27.53	603	0.777	27.53	
46	631.59	50.00	1970.00	222	0.00129	0.06471	657.75	26.16	603	0.777	26.16	
47	632.90	50.00	2020.00	222	0.00129	0.06471	657.69	24.79	603	0.777	24.79	
48	634.00	50.85	2070.85	222	0.00129	0.06581	657.62	23.62	603	0.777	23.62	
49	635.20	5.40	2076.25	222	0.00129	0.00699	657.61	22.41	603	0.777	22.41	
Tank	654.00	100.00	2176.25	222	0.00129	0.12943	657.48	3.48	603	0.777	3.48	Tank HWL 654
Total						2.8						


Azraq-Khaw Transmission Pipeline
Invert Level or G.L (m)
Hydraulic Grade Line (m)
1000.00
950.00
900.00
850.00
800.00
750.00
700.00
650.00
600.00
550.00
500.00
Elevation(m)
1,700m3/h
Highest Point.
(Invert Level=673)
Khaw Res.
(Inlet=611)
Azraq Res.
(LWL=563)
0
10000
20000
30000
40000
50000
60000
70000
Distance(m)


Hallabat-Khaw Transmission Pipeline
Invert Level. (m)
Hydraulic Grade Line (m)
800.00
750.00
700.00
650.00
600.00
550.00
500.00
Elevation(m)
1,700m³/h
Highest Point.
(Invert Level=678.5)
Junction with Corridor
Line
Hallabat Res.
(LWL=594)
Khaw Res.
(Inlet=611)
0
5000
10000
15000
20000
25000
Distance(m)


Zarqa Station - Batrawi Reservoir Transmission Pipeline
Ground Level. (m)
Hydraulic Grade Line (m)
700.00
650.00
600.00
550.00
800m3/h
Batrawi Res.
(HWL=654)
Zarqa Res.
(LWL=570.3)
Elevation(m)
0
500
1000
1500
2000
2500
Distance(m)


Khaw-Amman Transmission Pipeline
Invert Level (m)
Hydraulic Grade Line (m)
1000.00
950.00
900.00
850.00
800.00
750.00
700.00
650.00
600.00
550.00
500.00
Elevation(m)
1,700m3/h
700m3/h
Awajan Blanch
(1,000m3/h)
Khaw Res.
(LWL=602)
Ain Gazal
Res.
0
5000
10000
15000
20000
25000
Distance(m)

6-2 Index of Program Effects

1.Acquisition of Baseline Data

(1) Efficiency of pumps

Pump efficiency (η_p) is expressed as the ratio of available energy provided to the water by the pump (water power, Pw) to the power provided externally to the pump shaft (shaft power, P) per time unit.

Pump efficiency (η_p) = P_W / P × 100 (%),
where:
Water power (P_W) = 0.163 × γ × Q × H (kW)
P: Shaft power of pump (kW)
Q: Discharge (m^3/m)
H: Total head (m) and
γ: Density of liquid (in the case of water: 1)

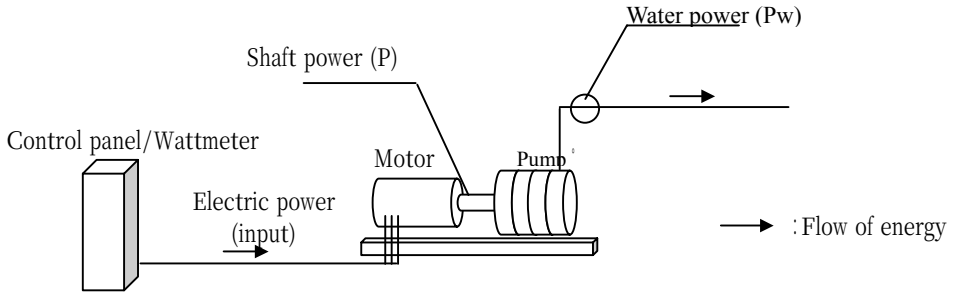


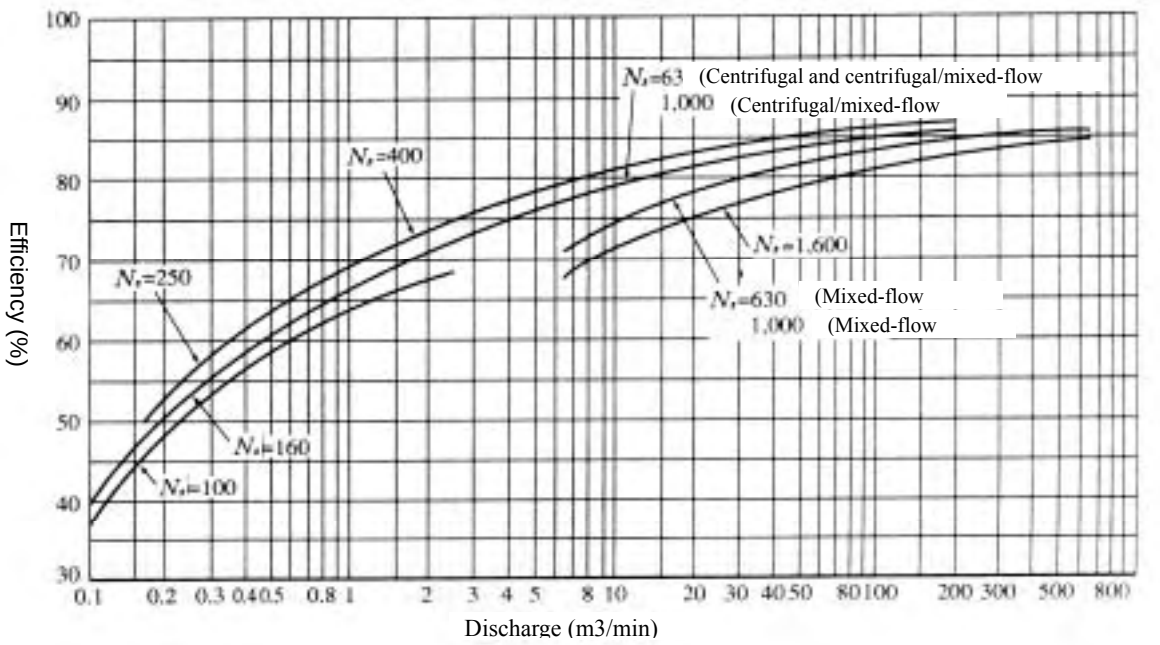
Figure 1.1 Schematic diagram of pump power transmission

The waterpower of an operating pump can be calculated by measuring the discharge (Q) and total head (H). The maximum efficiency of the pump varies depending on the specific speed (Ns), capacity and type/model. Table 1.1 shows the efficiency to be achieved by pumps specified in the Japanese Industrial Standards. Figure 1.2 shows the reference values for the maximum efficiency of various types of pumps.

Table 1.1 Specified values of pump efficiency (for dual suction centrifugal pumps)

Discharge (m^3/min)	2	3	4	5	6	8	10	15	20	30	40	50	60	70
Efficiency A (%)	67	70	71	72	73	74	75	76	77	78	78.5	79	79.5	80
Efficiency B (%)	57	59	60	61	61.5	62.5	63	64	65	66	66.5	67	67.5	68

Efficiency A: Maximum efficiency of pump
Efficiency B: Efficiency of pump at specified discharge



Source: Manual for Pumps for Water Works (1992 Japan Water Works

Figure 1.2 Relationship between discharge and efficiency of pump

(2) Output and power factor of motor

Motor output can be calculated by the following equation:

Output of motor (P) = $\sqrt{3} \times V \times I \times \cos\theta$
where

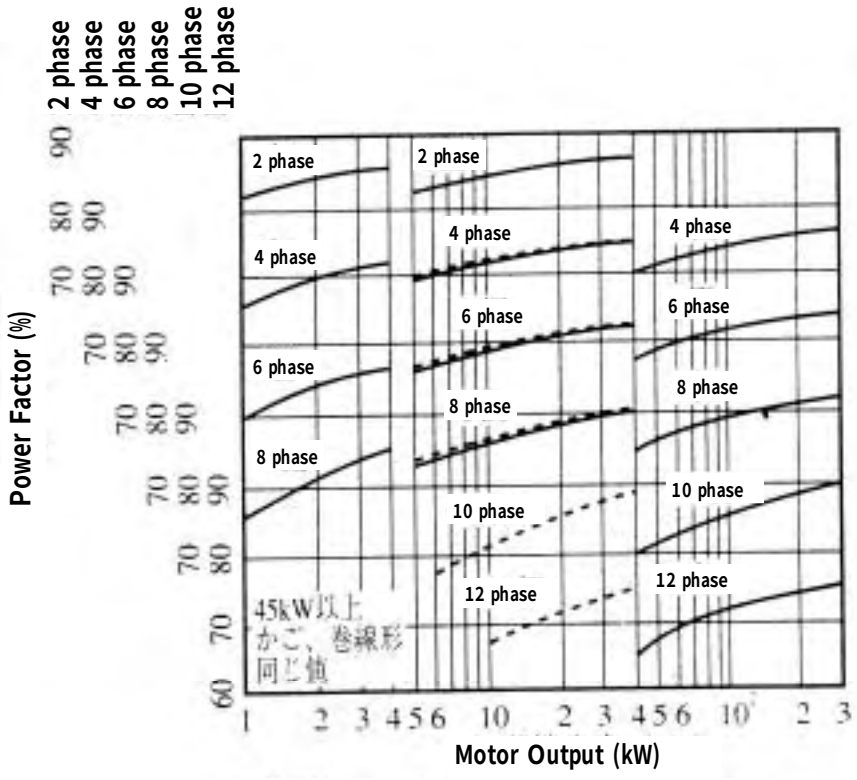
V:	Voltage (V)
I:	Line current (A) and
cosθ:	Power factor = 0.70 – 0.90

The power factor is determined by active power (kW) and reactive power (kvar). In the case of an induction motor, the power source also supplies reactive power.

In general, the power factor decreases as the number of poles increases or output decreases with the same number of poles. As in the case of efficiency, the power factor decreases as the load decreases.

In this survey, the actual output of each motor at the pumping stations concerned was calculated by the power factor given on the rating plate and the measured voltage and current. As each pump is directly linked to a motor, the actual output of the motor is considered equivalent to the power provided to the pump shaft. The efficiency of the pump was calculated by the shaft power thus obtained.

Figure 3 shows examples of the relationship between the output and the power factor of three-phase induction motors operated at full load.



Source: Manual for Pumps for Water Works (1992 Japan Water Works Association)

Figure 1.3 Examples of the relationship between output and power factor of three-phase induction motors

(3) Expected Program effects

Replacement of the pumping facilities in this Program will improve the efficiency of the pumps, which in turn means increased efficiency of the conversion of "power provided to the motors (electricity consumption: kWh)" to "energy to transmit water (water power: P_w)". The improved efficiency in this Program is expected to produce the following effects.

1) Reduction in electricity consumption as a result of the replacement of the pumps
2) Improvement in basic unit electricity consumption (consumed electricity (kWh) / pump discharge (m^3))

(4) Acquisition of baseline data

The actual electricity consumed by the operating pumps and the discharge during operation were measured at the pumping stations included in the request and used in the analysis to obtain the baseline data.

Table 1.2 Baseline data of the pumping stations included in the request

[Azraq Pumping Station]

Measurement	① Discharge Q (m^3/h)	② Total head H (m)	③ Current I (A)	④ Voltage V (V)	⑤ Water power P_w (kW)	⑥ Power factor of motor cosθ	⑦ Output of motor P (kW)	⑧ Efficiency (%)	⑨ Basic unit electricity consumption for water transmission (kWh/m^3)	Remarks
1st: Old PS	1,115	260	1525	644	787	0.87	1,480	53%	1.33	Pumps Nos. 4 & 6, Old PS
1st: New PS	372	260	686	382	262	0.93	422	62%	1.14	Pump No.3, New PS
Subtotal	1,486				1,050		1,902			
2nd: Old PS	1,113	259	1532	641	784	0.87	1480	53%	1.33	Pumps Nos. 4 & 6, Old PS
2nd: New PS	371	259	722	380	261	0.93	442	59%	1.19	Pump No.3, New PS
Subtotal	1,484				1,045		1,922			
Average								57%	1.25	

Note: ① Discharge (m^3/h): The total discharge from two pumps in the old pumping station and one pump in the new pumping station were measured with an ultrasonic flow meter installed on the pipe on the discharge side. For the calculation, the total discharge was divided into discharge from the old and the new stations, respectively, using the measurements made by GTZ as reference.

② Total head (m): Measured with a pressure data logger installed on the pipe on the discharge side

③ Current (A): The effective value of the current was measured with an AC clamp meter.

④ Voltage (V): Readings on the voltage meters on the power distribution panel of the pumps

⑤ Water power (kW): Water power = 0.163 × density of water (1.0) × ① Discharge (converted to m^3/m) × ② Total head

⑥ Power factor of motor: Given on the rating plates of the pumps

⑦ Output of motor (kW): √3 × ④ Voltage V × ③ Current A × ⑥ Power factor of pump

⑧ Efficiency (%): ⑤ Water power (kW) ÷ ⑦ Output of motor (kW)

⑨ Basic unit electricity consumption for water transmission: ⑦ Output of motor kW ÷ ① Discharge m^3/h

[Hallabat Pumping Station]

Measurement	① Discharge Q (m^3/h)	② Total head H (m)	③ Current I (A)	④ Voltage V (V)	⑤ Water power P_w (kW)	⑥ Power factor of motor cosθ	⑦ Output of motor P (kW)	⑧ Efficiency (%)	⑨ Basic unit electricity consumption for water transmission (kWh/m^3)	Remarks
1st	460	133	445	408	166	0.90	283	59	0.62	
2nd	460	133	443	408	166	0.90	282	59	0.61	
3rd	460	120	448	408	150	0.90	285	53	0.62	
Average								57	0.62	

Note ① Discharge (m^3/h): Deduced from the measurements made by GTZ because the measurements by the ultrasonic flow meter were unstable

②–⑨: Same as above

2. Carbon dioxide (CO_2) emissions

At the existing pumping stations, the control panels for the pumping facilities are not equipped with wattmeters exclusively for the pumps. Thus, the readings on the existing wattmeters include electricity consumed by equipment other than the pumps and it is impossible to know precisely the amount of electricity consumed by the pumps alone.

Therefore, a (three‐phase/three-wire) wattmeter will be installed for each pump on the control panels for the pumping facilities to be procured in this Program to facilitate monitoring of electricity consumption.

(6) Effects as measures against climate change

Carbon dioxide (CO_2) emissions will be the index for achievement of the effects of this Program. At Azraq, Hallabat and Zarqa Pumping Stations, where the existing pumping facilities are to be replaced, "the amount of reduction in CO_2 emissions calculated from the amount of reduction in electricity consumption resulting from the replacement of the pumping facilities" will be obtained.

Table 2.1 Index of the effects of the Program

Baseline data of index	Details of baseline data
Baseline emissions	CO_2 emissions if the Program is not implemented → Emissions calculated from the electricity consumption under continued operation of the existing pumping facilities
Program emissions	CO_2 emissions after the Program has been implemented → Emissions calculated from the electricity consumption after the operational efficiency of the pumps has been improved

Reduction in water losses will be converted to CO_2 emission reduction using electricity consumption per unit discharge.

CO_2 emission (kg-CO_2) = Electricity consumption (kWh) × emission coefficient (kg-CO_2 / kWh)

The emission coefficient obtained as a result of the following research will be adopted in this Programme.

Excerpt from JICA Project Research Progress Report, "Project Study on Quantification of Greenhouse Gases (GHGs) Reduction Effectiveness" December 2008

Emission coefficient in Jordan = 0.62 kg-CO_2 / kWh