

TECHNICAL NOTES  
ON  
THE BASIC DESIGN STUDY  
ON  
THE PROJECT FOR IMPROVEMENT OF WATER SUPPLY FACILITIES  
AT  
DARKHAN CITY  
IN  
MONGOLIA

Based on the Minutes of Discussions (hereinafter referred to as "M/D") on the Basic Design Study on the Project for Improvement of Water Supply Facilities at Darkhan City in Mongolia (hereinafter referred to as "the Project") signed on May 28, 2008 between the Basic Design Study Team (hereinafter referred to as "the Team") of Japan International Cooperation Agency (hereinafter referred to as "JICA") and Ministry of Construction and Urban Development (hereinafter referred to as "MCUD"), of the Government of Mongolia, the consultant members of the Team (hereinafter referred to as "TEC") had a series of discussions and conducted field surveys from May 29 to June 19, 2008.


As a result of the discussions and the surveys, both sides confirmed the technical conditions described as per the attached.

Darkhan, June 19, 2008



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Soichiro Yumoto  
Chief Consultant,  
JICA Basic Design Study Team for  
the Project for Improvement of Water  
Supply Facilities at Darkhan City  
in Mongolia



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Sodnombaljir Elbegbayan  
Director,  
Water Supply and Sewerage System Co. of  
Darkhan City,  
Mongolia

## ATTACHMENT

Both parties agreed upon and confirmed the following items.

### 1. Population Frame and Water Demand

Population frame of the Darkhan city is set as tabulated below based on the forecast prepared by the Water Supply and Sewerage System Co. of Darkhan City (hereinafter referred to as "WSSSCD").

Table 1 Population Frame of Darkhan City (2007 - 2015)

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Apartment Area	49,867	51,739	54,547	62,336	64,725	66,287	59,830	72,535	73,709
Ger Area	24,659	24,828	25,084	25,461	26,135	26,615	27,156	28,534	29,402
Total Population	74,526	76,568	79,631	87,798	90,860	92,902	96,986	101,070	103,111

The water demand of 2011 is set as stated below, and the average daily demand and the maximum daily demand for the Darkhan city are calculated to be 21,194 m<sup>3</sup>/day and 36,030 m<sup>3</sup>/day, respectively.

a. Total Population:	90,860
Apartment Area:	64,725
Ger Area:	26,135
b. Unit Consumption	
Apartment Area (l/day/capita):	170
Ger Area (l/day/capita):	25
c. Annual Consumption (1,000m <sup>3</sup> ):	4,255
Apartment Area (1,000m <sup>3</sup> ):	4,016
Ger Area (1,000m <sup>3</sup> ):	238
d. Daily Consumption (m <sup>3</sup> ):	21,194
e. Unaccounted Water (%):	45
f. Daily Demand (m <sup>3</sup> /day):	21,194
g. Max. Daily Demand (m <sup>3</sup> /day):	36,030
h. Industrial Water Demand (m <sup>3</sup> /day):	2,877
i. Total Demand (m <sup>3</sup> /day):	24,071

### 2. Control and Monitoring Systems of the 1st and 2nd Stations

The minimum level of control and monitoring system consisting of the essential functions required for the proper operation of the pumping units in the 1st and 2nd Stations shall be applied as illustrated in Fig. 1 and Fig. 2.

### 3. Facilities to be Replaced in the 1st Station

The number of pump unit to be replaced shall be determined in the study in Japan, and the replaced parts of pumping system shall be as indicated in Fig. 3 and Fig. 4. The fittings of each system shall be furnished with the electric heating ware to prevent from freezing during the winter season. The WSSSCD requested to apply the pumping units with the type and capacity same as those being used at present considering the easiness in operation and maintenance by





the WSSSCD staff. The transformer and the control panel shall also be replaced.

Since the electric supply line from No. 7 and No. 8 of 6,000V was found to be unusable, WSSSCD shall fix it before the commencement of the project implementation.

The following items shall be considered in the renovation plan of the existing pump house.

- a. Entrance door
- b. Window and window frame
- c. Pipe insulator and heater
- d. Room heater
- e. Internal lighting fixture

#### 4. Facilities to be Replaced in the 2nd Station

The WSSSCD requested that three (3) pumping units would be replaced under the Project in order to allocate one (1) bay reserved for the further increase of pumping capacity of the station in future as indicated in Fig. 5. As for the electric supply facilities, only the parts necessary for the replacement of the pumping units shall be considered. The pump panels for three (3) pumping units to be replaced shall be newly installed in the room used as a meeting room at present. The present operation room shall be used as it is, and the operation and monitoring panels shall be installed in the same room.

The new chlorination equipment shall be installed in the chlorination room of the house beside the pump house. The room behind the chlorine room shall be used for the storage of chlorine cylinders. The injection shall be made into the regulation reservoirs located behind the pump house.

#### 5. Use of Storage House in the 2nd Station

The water hammer effect shall be analyzed in the course of the study in Japan, and if any countermeasures are required as a result, the storage house which is not used at present shall be utilized for installing the surge tank to prevent mal effect of the water hammer to occur at the sudden stop of pumping equipment.

#### 6. Water Kiosks and Distribution Networks in Ger Areas

The locations of water kiosks are tentatively determined as indicated in Fig. 6 and Fig. 7 as the result of a series of discussions with chief of bags and leaders of beneficiaries as well as the staff of WSSSCD. The routes of the distribution pipelines are tentatively determined as shown in the figure with the alternative route. The distribution network analysis shall be carried out in the course of the study in Japan, and the pipeline routes and the kiosk locations shall be definitely determined. The house of the existing No. 32 water kiosk which was constructed about two (2) years ago shall be used though the other kiosk houses shall be newly constructed.

As for the kiosk which is located in the elevated hill in the No. 6 bag, it is found to be difficult to convey the water from the main distribution pipe with its pressure. The WSSSCD strongly requests to apply a booster pump for conveying the water to the said kiosk. The applicability of

this pump, therefore, shall be studied in the course of the study in Japan. The automatic operation system of booster pump shall not be applied, and only a simple method with manual operation shall be considered for the easiness in operation by the present kiosk staff.

#### 7. Water Flow Meters to be Installed for Monitoring

Five (5) flow meters shall be installed; three (3) meters at the outlet from the reservoirs on the three (3) distribution mains, and two (2) meters at the beginning of the raw water transmission.

#### 8. Water Meters to be Procured

The WSSSCD requested to increase the number of water meters to be procured to meet the number of meter planned to be installed in 2011 and 2012, and the TEC will convey this request to JICA.

Table 2 Installation Plan of House Water Meter

Year (20**)	05	06	07	08	09	10	11	12	13	14	15
No. of Meter to be Installed	16	79	505	800	1,200	1,400	1,500	1,600	1,800	2,000	2,200
Comm. No. of Meter	16	95	600	1,400	2,600	4,000	5,500	7,100	8,900	10,900	13,100

#### 9. Water Quality Analysis Equipment to be Procured

The following items of equipment shall be procured as the water quality analysis equipment.

- a. Drying oven 1 no.
- b. Incubator 1 no.
- c. Absorption spectrophotometer 1 no.

#### 10. Track Crane and Mobile Welding Machine

Since 1978 the track crane has been used for about 30 years, and various troubles occur due to oldness. The crane is considered an essential equipment in the operation and maintenance works of the pumping units of the 1st station as well as those of the distribution networks. The welding machine has also used long time, and the remarkable deterioration was found. Therefore, those operation and maintenance equipment is also required to be replaced as soon as possible.

#### 11. Technical Assistance

Though the operation and monitoring system shall be planned on the basis of minimum level to meet to the present manners of operation of the 2nd station considering the skills and technical know-how of the present operation staff, it is requested by WSSSCD to provide some extent of technical assistance for the operation of the 2nd station. In addition, it is requested provide technical assistance for the operation of booster pump in the elevated kiosk also. A short training course consisting of lectures and on-the-job training shall be proposed.



**Operation of 1st Station**

1. Manual Operation from 1st Station Pump Panel or
2. Manual Operation from 2nd Station Monitoring Panel

**Operation of 2nd Station**

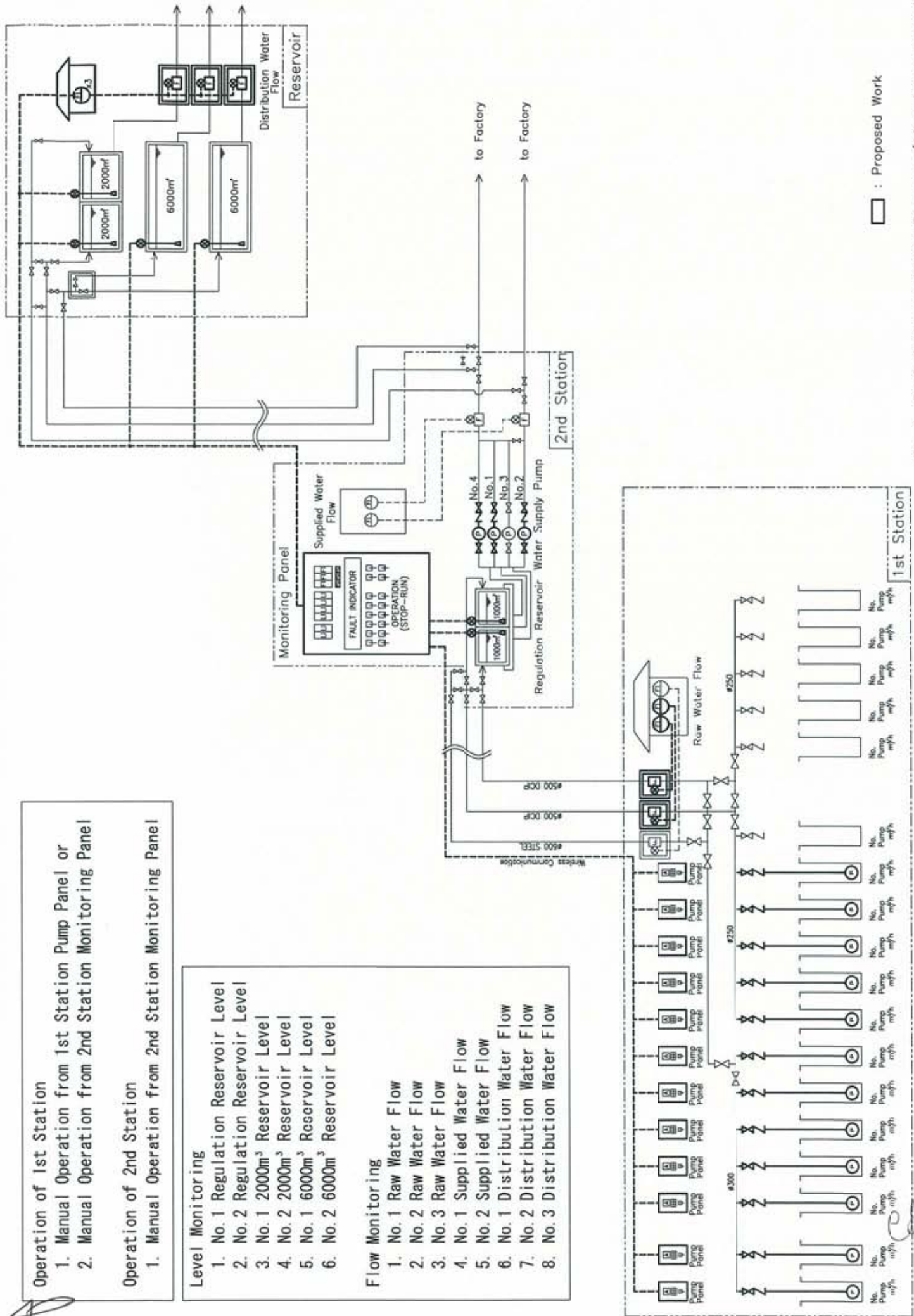
1. Manual Operation from 2nd Station Monitoring Panel

**Level Monitoring**

1. No. 1 Regulation Reservoir Level
2. No. 2 Regulation Reservoir Level
3. No. 1 2000m<sup>3</sup> Reservoir Level
4. No. 2 2000m<sup>3</sup> Reservoir Level
5. No. 1 6000m<sup>3</sup> Reservoir Level
6. No. 2 6000m<sup>3</sup> Reservoir Level

**Flow Monitoring**

1. No. 1 Raw Water Flow
2. No. 2 Raw Water Flow
3. No. 3 Raw Water Flow
4. No. 1 Supplied Water Flow
5. No. 2 Supplied Water Flow
6. No. 1 Distribution Water Flow
7. No. 2 Distribution Water Flow
8. No. 3 Distribution Water Flow



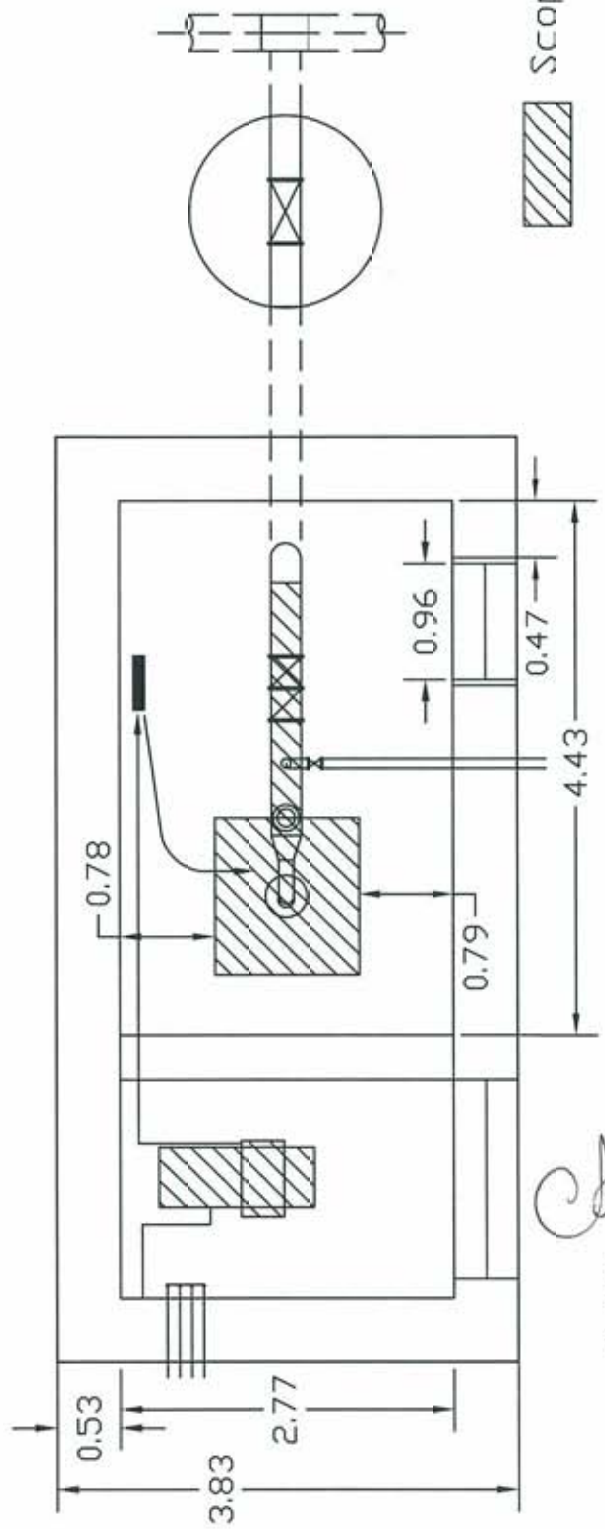
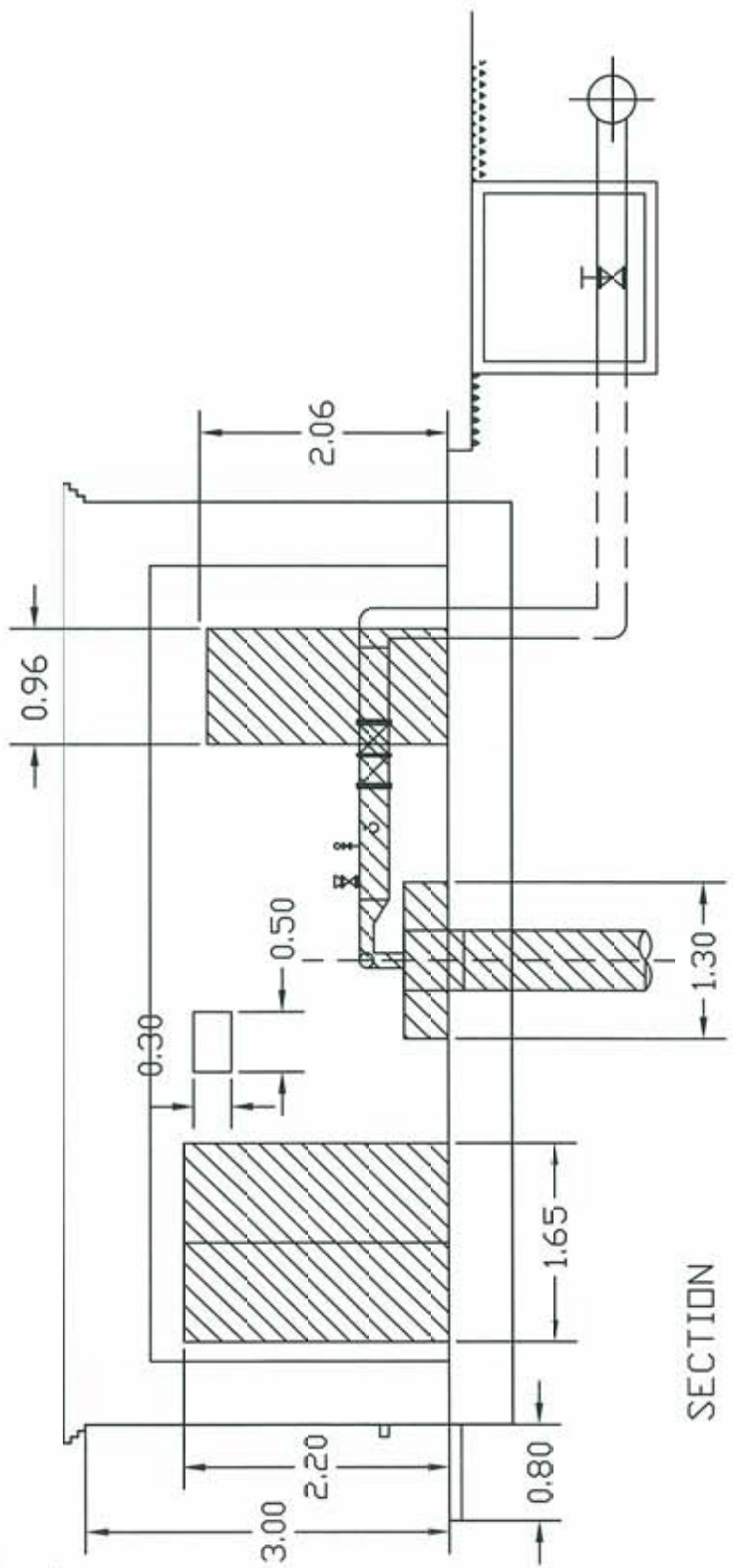
□ : Proposed Work

Fig 1. Draft instrumentation Diagram (After Improvement)

No.1 Well ON	No.2 Well ON	No.3 Well ON	No.4 Well ON	No.5 Well ON	No.6 Well ON	No.7 Well ON	No.8 Well ON	No.9 Well ON	No.10 Well ON	No.11 Well ON	No.12 Well ON	Spare	Spare	Spare	Spare	Spare	Spare
No.1 Well OFF	No.2 Well OFF	No.3 Well OFF	No.4 Well OFF	No.5 Well OFF	No.6 Well OFF	No.7 Well OFF	No.8 Well OFF	No.9 Well OFF	No.10 Well OFF	No.11 Well OFF	No.12 Well OFF	Spare	Spare	Spare	Spare	Spare	Spare
No.1 Well FAULT	No.2 Well FAULT	No.3 Well FAULT	No.4 Well FAULT	No.5 Well FAULT	No.6 Well FAULT	No.7 Well FAULT	No.8 Well FAULT	No.9 Well FAULT	No.10 Well FAULT	No.11 Well FAULT	No.12 Well FAULT	Spare	Spare	Spare	Spare	Spare	Spare
No.1 Wireless Communication Equipment FAULT	No.2 Wireless Communication Equipment FAULT	No.3 Wireless Communication Equipment FAULT	No.4 Wireless Communication Equipment FAULT	No.5 Wireless Communication Equipment FAULT	No.6 Wireless Communication Equipment FAULT	No.7 Wireless Communication Equipment FAULT	No.8 Wireless Communication Equipment FAULT	No.9 Wireless Communication Equipment FAULT	No.10 Wireless Communication Equipment FAULT	No.11 Wireless Communication Equipment FAULT	No.12 Wireless Communication Equipment FAULT	Spare	Spare	Spare	Spare	Spare	Spare

No.1 Water Supply Pump ON	No.2 Water Supply Pump ON	No.3 Water Supply Pump ON	No.4 Water Supply Pump ON	No.1 Outlet Valve OPEN	No.2 Outlet Valve OPEN	No.3 Outlet Valve OPEN	No.4 Outlet Valve OPEN	Chlorination Equipment ON	No.1 2000m <sup>3</sup> Reservoir HH	No.2 2000m <sup>3</sup> Reservoir HH	No.1 6000m <sup>3</sup> Reservoir HH	No.2 6000m <sup>3</sup> Reservoir HH
No.1 Water Supply Pump OFF	No.2 Water Supply Pump OFF	No.3 Water Supply Pump OFF	No.4 Water Supply Pump OFF	No.1 Outlet Valve CLOSE	No.2 Outlet Valve CLOSE	No.3 Outlet Valve CLOSE	No.4 Outlet Valve CLOSE	Chlorination Equipment OFF	No.1 2000m <sup>3</sup> Reservoir LL	No.2 2000m <sup>3</sup> Reservoir LL	No.1 6000m <sup>3</sup> Reservoir LL	No.2 6000m <sup>3</sup> Reservoir LL
No.1 Water Supply Pump FAULT	No.2 Water Supply Pump FAULT	No.3 Water Supply Pump FAULT	No.4 Water Supply Pump FAULT	No.1 Outlet Valve FAULT	No.2 Outlet Valve FAULT	No.3 Outlet Valve FAULT	No.4 Outlet Valve FAULT	Chlorination Equipment FAULT	No.1 Regulation Reservoir HH	No.2 Regulation Reservoir HH	Spare	Spare
Spare	Spare	Spare	Spare	Spare	Spare	Spare	Spare	Spare	No.1 Regulation Reservoir LL	No.2 Regulation Reservoir LL	Spare	Spare

Fig 2. Detail of Fault Indicator (Draft)




 Scope of Replacement Work

Fig 3. Pump House No1-11



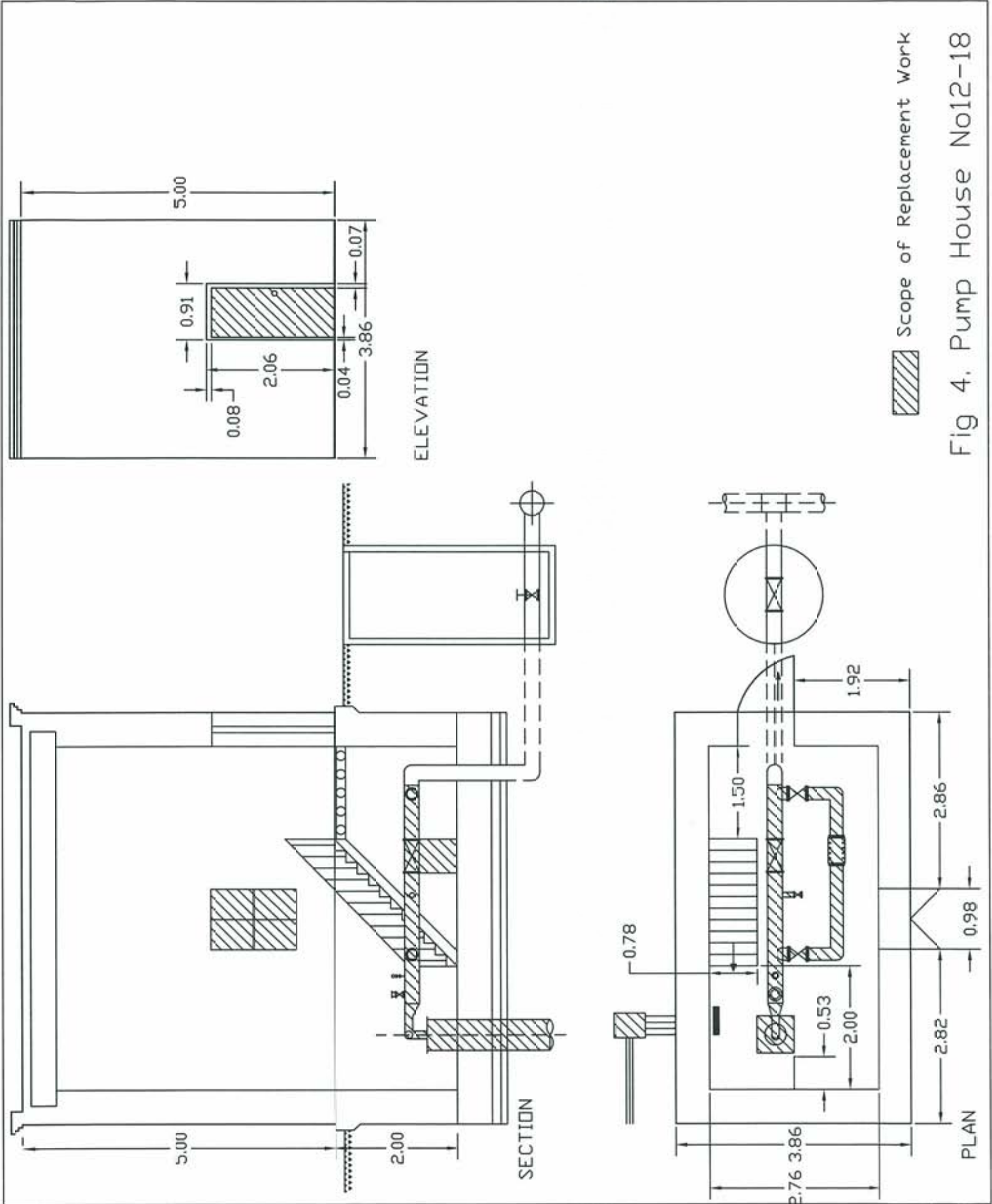


Fig 4. Pump House No12-18

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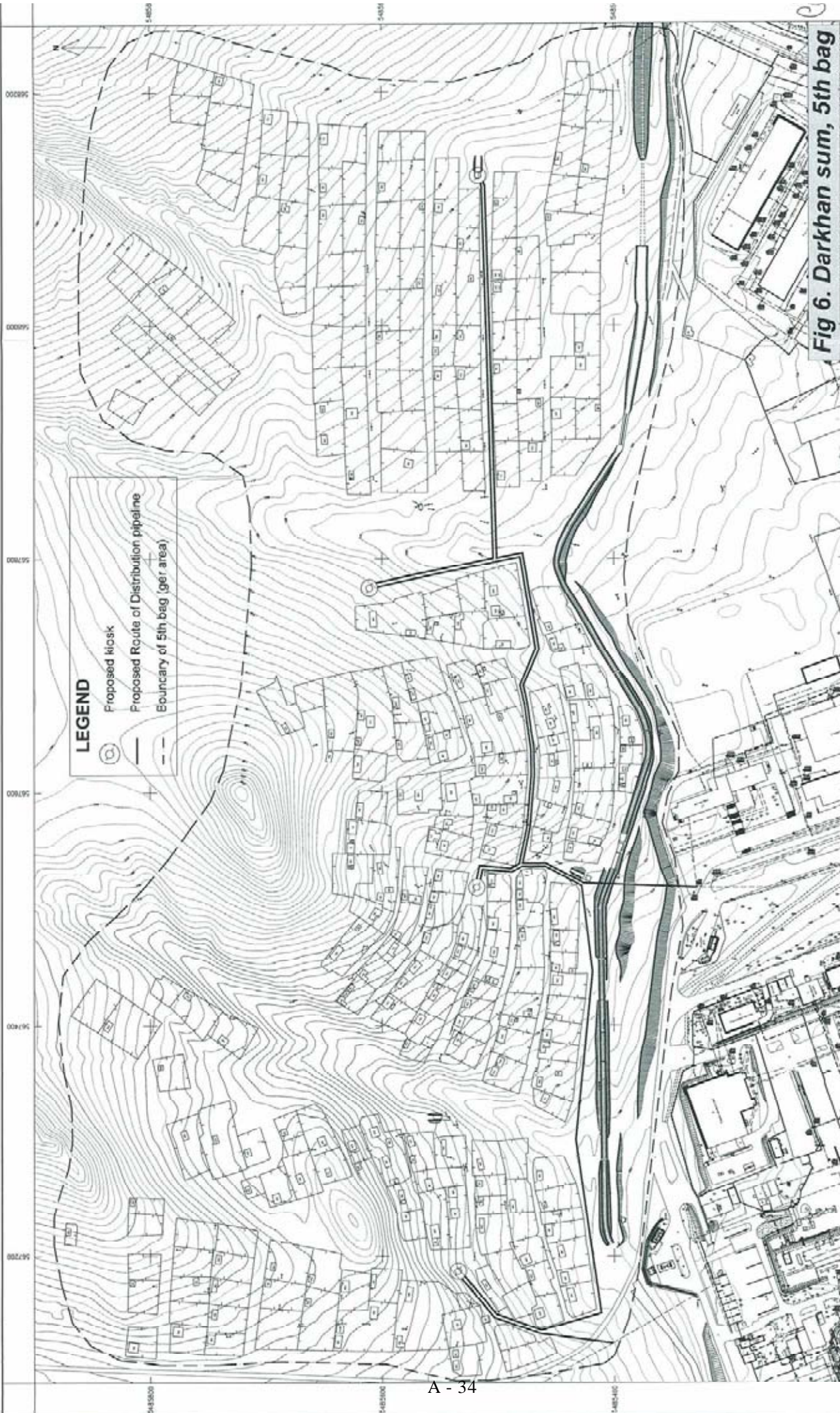


Fig 6. Darkhan sum, 5th bag

SCALE 1 : 3000  
 1 centimeter equals 30 metres  
 height interval 1 m  
 Height system: Baltic Sea

Prepared by MonMap Engineering Co. Ltd  
 For Tokyo Engineering Consultants Co. Ltd  
 June, 2008





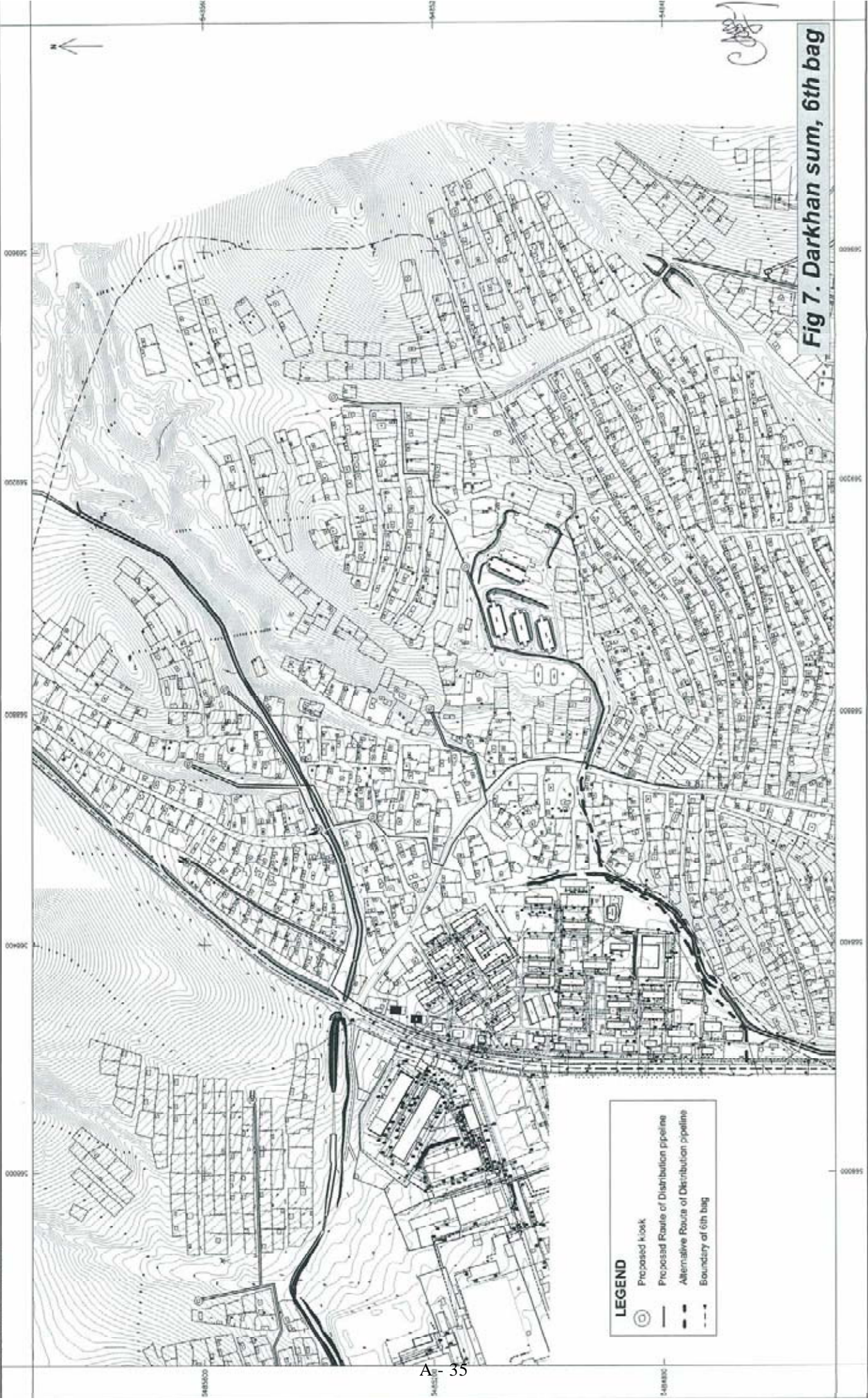


Fig 7. Darkhan sum, 6th bag

**SCALE 1 : 6000**  
 1 centimeter equals 60 meters  
 height interval 1 m  
 Height system: Baltic Sea

Prepared by Mo-Mao Engineering Co., Ltd  
 For Tokyo Engineering Consultants Co., Ltd  
 June, 2008





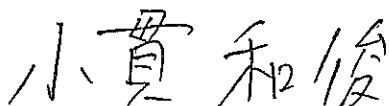
**MINUTES OF DISCUSSIONS**  
**ON THE BASIC DESIGN STUDY**  
**ON THE PROJECT FOR IMPROVEMENT OF WATER SUPPLY FACILITIES**  
**AT DARKHAN CITY IN MONGOLIA**  
**(EXPLANATION ON DRAFT REPORT)**

In May 2008, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Basic Design Study Team on the Project for Improvement of Water Supply Facilities at Darkhan City in Mongolia ( hereinafter referred to as "the Project" ) to Mongolia and through discussion, field survey, and technical examination of the results in Japan, JICA prepared a draft report of the study.

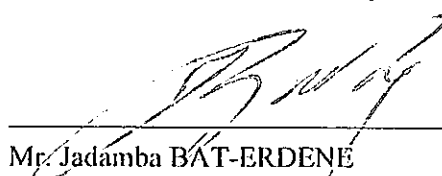
In order to explain and to consult with the Government of Mongolia on the components of the draft report, JICA sent to Mongolia the Draft Report Explanation Team (hereinafter referred to as "the Team" ), which is headed by Mr. Kazutoshi ONUKI, Deputy Resident Representative, JICA Mongolia Office, from September 19th to 28th, 2008.

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

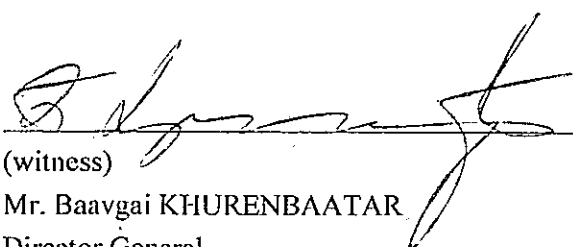
Ulaanbaatar, 26th September 2008




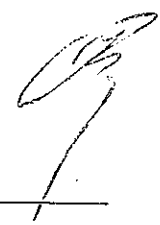
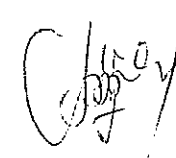
Mr. Kazutoshi ONUKI  
Leader,  
Deputy Resident Representative  
Mongolia office  
Japan International Cooperation Agency  
Mongolia

  
Mr. Jadamba BAT-ERDENE  
State Secretary,  
Ministry of Roads, Transport, Construction and  
Urban Development  
Mongolia

(witness)

  
Mr. Baavgai KHURENBAATAR  
Director General,  
Department of Policy and Coordination  
for Loans and Aid  
Ministry of Finance  
Mongolia

  
Mr. Sodnombaljir ELBEGBAYAN  
Director,  
Water Supply and Sewerage System Co.  
of Darkhan City  
Mongolia

## ATTACHMENT

### 1. Components of the Draft Report

The Government of Mongolia agreed and accepted in principle the components of the Draft Basic Design Study Report explained by the Team. The components of the project are shown in Annex-1.

### 2. Japan's Grant Aid scheme

The Mongolian side understands the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Mongolia as explained by the Team and described in Annex-4 and Annex-5 of the Minutes of Discussions signed by both parties on May 28<sup>th</sup> 2008.

### 3. Schedule of the Study

JICA will complete the final report in accordance with the confirmed item and send it to the Government of Mongolia by January 2009.

### 4. Other relevant issues

#### 4-1. Undertakings of the Mongolian side

The Team requested to the Government of Mongolia to abide the following undertakings of the Mongolian side in addition to major undertakings described in Annex-4 and Annex-5 of the Minutes of Discussions signed by both parties on 28<sup>th</sup> May 2008. The Mongolian side agreed to it.

The provisions shown in Annex-2 (2) of the human resources and the expenses for the engineers and technical staff, and the lands and spaces belonging to the Water Supply and Sewerage System Co. of Darkhan city (hereinafter referred to as WSSSC-Darkhan) .

#### 4-2. Project Cost estimation

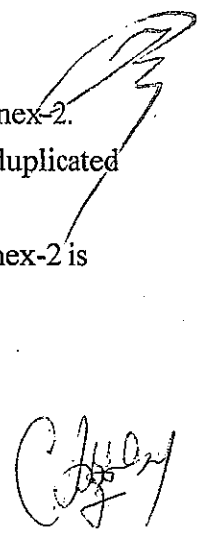
The team explained to the Mongolian side the Project cost estimation as described in Annex-2. The team and the Mongolian side agreed that the Project cost estimation should never be duplicated or released to any outside parties before signing of all the Contract(s) for the Project.

The government of Mongolia understood that the Project cost estimation attached as Annex-2 is not final and is subject to change.

ANNEX-1 : Components of the project

ANNEX-2 : Project Cost Estimation

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ANNEX-1 : Components of the project

(1) Contents of the Facilities and Equipment

components		number of items
1st station	Replacement of Intake Pump (160 m <sup>3</sup> /hr)	10nos
	Operation Control System (Manual Remote Control)	1set
	Portable Water Level Gauge	2nos
	Discharge Meter	2nos
2nd station	Replacement of Transmission Pump (640 m <sup>3</sup> / hr)	3nos
	Automatic Operation Control System (Manual Remote Control)	1set
	Discharge Meter	3nos
Chlorination System		1set
Water Supply System for Ger Area	Kiosk House	12nos
	Distribution Pipeline	φ150 x 7,326 m
Operation and Maintenance Equipment	Truck Crane	1no
	Welding Machine (Truck mounted type)	1no
	Water Quality Analysis Equipment (Spectrophotometer, Incubator, Dryer)	1set
	Water Meter	1,500nos

(2) Technical Assistance (Soft Component)

Activity item	Contents
Intake and Transmission Pumps	Compiling operation manual (Mongolian)
	Seminar/Workshop : Basic operation conforming to the manual, Demand responsive operation on water quantity
	Operation OJT : Confirmation of check-up points and operation procedures, Operation practice, Daily operation record / management report , Efficient operation optimizing electric utility rate
Chlorination Facilities	Seminar/Workshop : Basics of chlorine disinfection, Basic operation, Injection rate control, Safety control
	Operation OJT : Operation practice, Emergency response for accident/troubles, Daily operation record with injection data
Relay Pump in Kiosk	Seminar/Workshop : Knowledge of pumping works, Basic pump operation
	Operation OJT : Precaution/Notices on pump operation, Operation practice with proper procedures, Daily operation record / management report

