MINUTES OF DISCUSSIONS
PREPARATORY SURVEY II (BASIC DESIGN)
ON THE PROJECT
FOR URGENT REHABILITATION OF WATER SUPPLY SYSTEM
INTHE CAPITAL CITY OF PODGORICA IN MONTENEGRO
(EXPLANATION ON DRAFT REPORT)

In may 2009, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Basic Design Study Team on the Project for Urgent rehabilitation of the Water Supply System in the Capital City of Podgorica in Montenegro (hereinafter referred to as "the Project") to Montenegro 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 Montenegro on the components of the draft report, JICA sent to Montenegro the Draft Report Explanation Team (hereinafter referred to as "the Team"), which is headed by YAMADA Ken, Deputy Resident Representative, JICA Balkan Office, from 6th October to 12th October, 2009.

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

Podgorica, 9th October, 2009

Mr. Yamada Ken
Leader, Deputy Resident Representative
Balkan Office
Japan International Cooperation Agency
Japan

Mr. Mladen Brajovic
Director
Podgorica Water and Sewerage Corporation
(PWS)
Montenegro

Mr. Pavle Radulovic
City manager
Capital City of Podgorica
Montenegro

ATTACHMENT

1. Components of the Draft Report

The Government of Montenegro 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 Montenegrin side understands the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Montenegro as explained by the Team and described in Annex-4 and Annex-5 of the Minutes of Discussions signed by both parties on 21st May, 2008.

3. Schedule of the Study

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

4. Other Relevant Issues

4-1. Undertaking of the Montenegrin Side

The Team requested to the Government of Montenegro to abide the following undertakings of the Montenegrin side in additional to major undertakings described in Annex-5 of the Minutes of discussions signed by both parties on 21st May, 2009. The Montenegrin side agreed to it.

4-2. Project Cost Estimation

The team explained to the Montenegrin side the project cost estimation as described in Annex-2. The Team and Montenegrin 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 Montenegro understood that the Project cost estimation attached as Annex-2 is not final and is subject to change.

4-3. Countermeasure of Vibration for Pump

Both parties agreed that;

(1) According to the vibration criteria, the firm which will be selected in the Project (hereinafter to be referred as the firm) makes the vibration analysis study. As the result of the study, if the firm requests PWS to strength rigidity of the building in

order to keep the vibration of the upper floor below the said vibration criteria, PWS shall implement it based on the plan made by the firm.

(2) In addition of (1), as the result of the dynamic flow simulation analysis in the pump suction pit made by the firm, if the firm requests PWS to modify the internals in it such as deletion of the internal wall near A2 pump, etc., PWS shall implement it.

4-4. Improvement of Water Leakage

The team requested PWS to proceed with reduction of water leakage rate as planned because capability of water supply rate against water demand rate is expected to be lack in future.

4-5 Eligible Counties for Procurement

Both parties agreed that the eligible countries for procurement are Japan, Serbia and countries belonging to Organization for Economic Cooperation and Development (OECD). As for pump/motor, the products of Japanese manufacturers made by their own overseas factories or their subsidiary factories holding stocks over 51% are accepted. These factories are located in Indonesia, Viet Num, China, Brazil, etc. Meanwhile as for monitoring system, the products of the manufacturers in OECD countries made by their own overseas factories or their subsidiary factories holding stocks over 51% are accepted. These factories are located in China, India, Malaysia, Thailand, etc.

ANNEX-1: Components of the Project

ANNEX-1: Components of the Project

Items	Qty	Procurement	Installation
1. Mareza new pump station			
(1) New pump/motor and fitting			
-Pump/Motor	4	Japan	Japan/Montenegro*[1]
-Fitting	1set		
(2) Countermeasure for pump vibration prevention (if necessary)			
-For pump/motor	1set	Japan	Japan
-For pump suction pit	1set	-	Montenegro
(3) Pump control system and field instrument			
-SCADA PC	3	Japan	Japan/Montenegro*[2]
-22 inch monitor (TFT monitor)	2		
-50 inch monitor (LCD monitor)	1		
-PLC (programmable logic controller)	1		
-UPS (uninterrupted power supply)	1		
-Control desk, server rack	1set		
-I/O Panel	1		
-Water level meter for pump suction pit	2		
-Battery	1set		
-Battery charger	1		
2. Monitoring system			
(1) Monitoring system			
-SQL server	2	Japan/Montenegro*[3]	Japan*[4]
-SCADA server	1		Japan*[4]
-Communication server	1		Japan*[4]
-SCADA HMI	2		Japan*[4]
-Fire wall	4		Japan*[4]/Montenegro*[4]
-22 inch monitor (TFT monitor)	2		Japan*[4]
-50 inch monitor (LCD monitor)	2		Japan*[4]
-RGB switch	2		Japan*[4]
-Layer 2 switch	1		Japan*[4]
-Laser printer	1		Japan*[4]
-GPRS router	38		Montenegro*[4]
-UPS	42		Japan*[4]/Montenegro*[4]
-Touch panel	8		Montenegro*[4]
-PLC	41		Montenegro*[4]
-Server rack	1		Japan*[4]
-Control desk	1		Japan*[4]
-Interface panel	41		Montenegro*[4]
(2) Field instrument			
-Pressure instrument	36	Japan/Montenegro*[5]	Montenegro
-Flow meter	25		
-Flow meter (Portable)	1		
-Residual chlorine analyzer	7		
-Water level meter	13		
(3) Telecommunication system		Montenegro	Montenegro

Note: *[1] Montenegro carries out dismantling work for cable and pumps/motors
*[2] Montenegro carries out dismantling work for pump control panel and cables connected to the panel
*[3] Montenegro carries out procurement work for power cable, control cable and kiosk for interface panel.
*[4] Japan carries out installation work in the main control center and Montenegro carries out all the remaining installation work.
*[5] Montenegro carries out procurement work for cables and piping materials to mount the field instruments, and Montenegrin side is responsible for construction of concrete pit.

TECHNICAL NOTES
ON
THE PREPARATORY SURVEY 2 (BASIC DESIGN)
ON
THE PROJECT FOR URGENT REHABILITATION OF WATER SUPPLY SYSTEM
IN
THE CAPITAL CITY OF PODGORICA IN MONTENEGRO

Based on the Minutes of Discussions (hereinafter referred to as "M/D") on the Preparatory survey 2 (Basic Design) on the Project for Urgent Rehabilitation of Water Supply System in the Capital City of Podgorica (hereinafter referred to as "the Project") signed on 20th May 2009 between the Preparatory Survey Team (hereinafter referred to as "the Team") of Japan International Cooperation Agency (hereinafter referred to as "JICA") and Podgorica Waterworks and Sewerage (hereinafter referred to as "PWS"), of the Municipal Government of the Capital City of Podogrica, the consultant members of the Team had a series of discussions and conducted field surveys from 21st May 2009 to 16th June 2009.

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

Podogorica, 17th June 2009

Okaga Toshifumi
Chief Consultant,
Preparatory Survey Team,
Japan International Cooperation Agency
Japan

Mladen Brajovic
Director,
Podgorica Waterworks and Sewerage,
the Capital City of Podogrica

Filip Makrid
Technical Director,
Podgorica Waterworks and Sewerage,
the Capital City of Podogrica

ATTACHMENT

Both parties agreed upon and confirmed the following items.

1. Work Demarcation between Japan and Montenegro

Basically the work demarcation between Japan side and Montenegro side is summarized as below;

Work Item	Japan Side	Montenegro Side	Remarks
1. Pump/Motor for Mareza new PS			
(1) Procurement for new pump/motor and fittings	○	X	
(2) Release of power cable from existing motor	X	○	
(3) Dismantle of existing pump/motor	X	○	
(4) Installation for new pump/motor	○	X	
(5) Connection of existing power cable to new motor	○	X	
(6) Commissioning work for new pump/motor	○	○	
2. Prevention of vibration (if necessary)			
(1) Vibration isolation facilities	○	X	
(2) Modification work for pump reservoir	X	○	
3. Pump operation system for Mareza new PS			For detail, please refer to "Pump and Electrical System for Mareza New PS" attached separately.
(1) Procurement for equipment including battery and battery charger	○	X	
(2) Dismantle of existing operation panel	X	○	
(3) Installation of new pump operation system	○	X	
4. Monitoring system			For detail, please refer to "Monitoring System on Water Supply for PWS" attached separately.
(1) Procurement	○	○	
(2) Installation	○ (MCC only)	○	

2 Water demand and required pump

2.1 Water demand in the target year (2012)

The target year means the year when this project is expected to complete.

2.1.1 Unit demand of other usage (l/c.d)

The social survey has been carried out and the quantity used by each household was surveyed by hearing. The result of survey for the unit domestic water consumption is 273 l/c.d. (refer to " The social survey" for detail)

In addition to the domestic water, the water to be used by industries, small business and public offices are the part of water demand.

The unit quantity (in terms of l/c.d) of those users is estimated on the basis of the data compiled by PWS as the form of annual report.

Table 2-1 Unit demand of other usage unit (1000 m^3/year))

Year	2004	2005	2006	2007	2008
Small Buisiness	286	355	382	457	560
Public office	1726	1630	1747	1636	1381
Industry	2476	2181	2209	2181	2162
Total (a)	4488	4166	4338	4274	4103
Population (b)	170876	172626	174401	176569	178335
(a)/(b): Unit demand (l/c.d)	72	66	68	66	63

source : Record of PWS

The total demand of other usage is to be 336 l/c.d (273 + 63 =336 l/c.d)

2.1.2 Domestic water demand

(1) Population in the target year (2012)

From the statistic data in the past 5 years, the population in the target year will be projected as is shown in Table 2-2.

Table 2-2 Statistic data and projected population unit (n)

	Statisticd Data					Target year
Year	2003	2004	2005	2006	2007	2012
Podgorica	168736	170876	172626	174401	176569	185557
Population growth		1.30%	1.00%	1.00%	1.20%	1.00%

Data source: Statistical Year Book in 2008, Statistical Office

The population shown in the table is the resident population. It is estimated that non resident population is 29,600.

(2) Domestic water demand in the target year.

On the basis of unit demand, projected population and rate of population served the total water

demand and water to be supplied can be calculated.

Table 2-3 The water demand in 2012

				Water demand			
	Popu-lation	Unit demand	Rate of service	Daily average	Daily max	Hourly peak	
	(n)	(l/c.d)	(%)	m^3/d	m^3/d	m^3/d	l/sec
Resident	185,575	336	92	57,364			
Non-resident	29,600	60		1,776			
Total	215,175			59,140	73,925	99,798	
				Water to be supplied			
				103,754	129,692	175,084	2,026

note : Percentage of water loss is 43% (average of these 5 years)
: Unit demand of non-resident population is considered to be 60 l/c.d.
: Daily max./Daily average =1.25, Hourly peak/Daily max. =1.35

2.2 Existing pump capacity

The maximum operation capacity of the existing pump is shown in the following table. The total maximum capacity is 1,878L/c・d.

Table 2-4 Intake and Transmission Pump Facility (Podgorica city)

No.	Name of Pump Station	Pump No.	Pump specification and motor					ADC**
			Type	Capacity (l/sec.)	Head (m)	Output (kW)	Electric power (kV)	l/sec.
1	Mareza 1(Old)	P3	HS	100	110	182	10/0.4	375
		P4	HS	75	100	132		
		P5	HS	(75)*	100	132		
		P6	VS	200	100	315		
2	Mareza 2(New)	P1	VS	320	90	400	10/6	700
		P2	VS	320				
		P3	VS	320				
		P4	VS	320				
3	Zagoric	P1	VS	100	100	132	10/0.4	360
		P2	VS	100	100	132		
		P3	SMP	50	50	55		
		P4	SMP	50	90	55		
4	Cemovsko polije	P1	SMP	60	80	55	10/0.4	360
		P2	SMP	45	80	51		
		P3	SMP	60	80	75		
		P4	SMP	105	80	110		
		P5	SMP	105	80	110		
5	Milje	P1	SMP	40	100	51	10/0.4	70
		P2	SMP	20	100	30		
		P3	SMP	10	100	22		
6	Tuzi 1							
	Tuzi 2							
	Tuzi 3	P1	SMP	13	80	18	10/0.4	13
7	Dinosa		SMP	25	110	53	10/0.4	0
Total								1,878

Remarks: HS:Horizontal shaft, VS:Vertical shaft, SMP: Submersible pump
* for Danilovgrade
** ADC : Actual delivery capacity(max)

2.3 Required pump capacity

According to table 2-3 and 2-4, the required pump in target year (2012) is shown in table 2-5.

Table 2-5 Water demand and required pump capacity

Water demand	Existing pump capacity	imbalance	Additional pump capacity in Mareza II	Required pump capacity
l/sec	l/sec	l/sec	l/sec	l/sec
2,026	1,878	148	350	2,228

It is required in Mareza II pump station that additional one pumps and therefore, altogether three have to be operated. With one pump as stand by, the number of pumps has to be four in the target year (2012).

2.4 Specification of pump

The specification of each pump is shown below;

-Head: 90 m

-Flow rate: 320 l/s

-Number of pumps: 4 sets (One stand-by pump)

3. The Vibration of the Pump

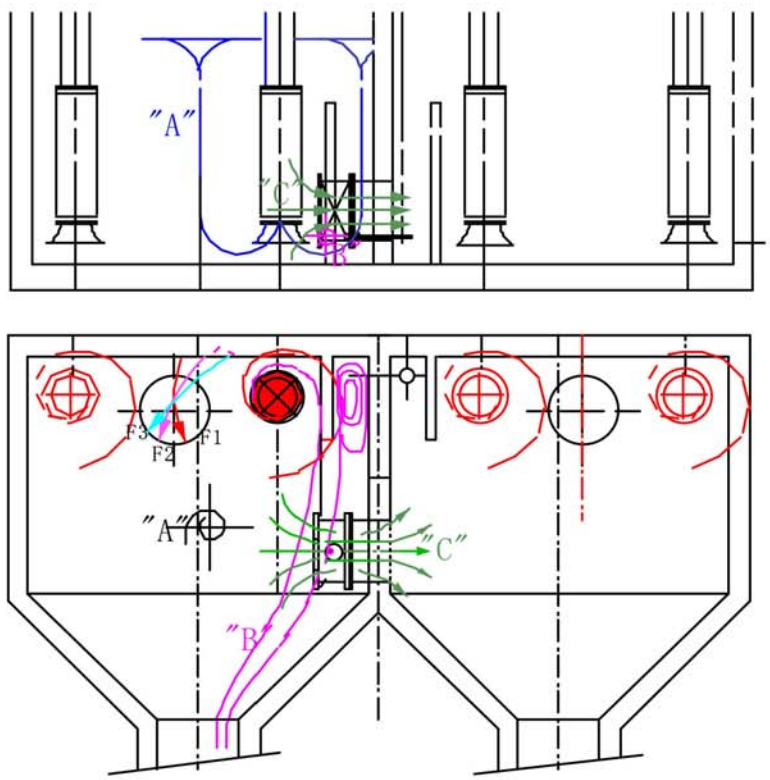
1 Objective of the survey

The objective of the survey is to make sure the causes of vibration, and to determine the guide line of new design, replacing with the new Pump System at Mareza Pump Station.(New)
The causes of the present vibration at Mareza Pump Station and the guide line to prevent the mechanical and flow induced vibration are summarize as shown Table 3-1.

Table 3-1 The Vibration Situation of The Mareza Pump Station

	Cause	Mechanism of Vibration	Reason & Improvement	Proposal of Countermeasure
a	Mechanical Vibration			
	*Imbalance force of the pump-motor system as the rotational machine. (Especially, Motor)	*Aging of the Motor-Pump mechanical -facilities.	*To repeate repair	*Replacement
b	Resonance and Beet Phenomenon			
	*Resonance between the Floor structure and Mechanical Vibration	*Coincidence the natural frequency of the floor structure with the fundamental frequency of the pump-motor system	*The change of the performance of Pump-Motor System according to decrepitude	*Installation in consideration of the vibration isolation design
	*The difference of revolution of each rotor induce the beet phenomenon	*Beet phenomenon induced by the slightly different revoluti of each rotor.	*Vibration of Floor and Motor are emphasized over the measurement value by the beet phenomenon.	*Vibration Isolation support *Dynamic vibration reducer etc.
c	Flow induced Vibration			
	Cause of vibration in Z-direction as the axial direction on A2-Pump only			
			*Improvement of the three flows combination.	*Arrangement of flow pattern
	*The turbulence and deviation of suction flow	*The flow at suction port has the influences of three flows	*Improvement of the influence of the structures	in the reservoir
	*Nonuniform flow at suction	as shown in Fig.1 ;	in the reservoir into suction flow	*Improvement of the structure
		*One is the stream from the surface of water to the suction	*Improvement of the suction efficiency under the present	shapes in the reservoir
		port as shown by "A"	condition, considering the swirl flow in the reservoir.	
		*Second is the stream from the water pipe line as shown		
		by "B".		
		*Third is the stream though the pipe between two reservoirs		
		as shown by "C".		
		*These flow combination make the turbulence and deviation		
		flow, and generate the fluctuation of suction load in axial direction.		

Flow Pattern in the water reservoir
Cause of Vibration in Z-direction (Axial-direction) of A2-PUMP



4. Pump and Electrical Operation System for Mareza New Pump Station

4.1 Outline of Pump and Electrical Operation System

1) Pump and Electrical Operation shall be redundant system so that operation can be continuously performed if one system fails.
2) The System has functions for monitoring of main pumps, the related equipments and electrical incoming and distribution system and operating main pumps and electrical system.
3) All the necessary input and output signal shall be brought from/to the equipments to be supplied by Japan side and existing pumping facilities and electrical switchgears.
4) Montenegrin language shall be used for monitoring and operation on the screen.
5) Installation and wiring work shall be implemented by Japan side.
6) For the system configuration, please refer to the attached sheet.

4.2 Equipment to be supplied by Japan side

7) Water level meter for pump reservoir
   - 2 sets of water level transmitter and power distributor
8) Temperature converter
   - 3 sets of RTD converters for motor winding
   - 2 sets of RTD converters for motor bearing
   - 1 set of RTD converter for pump bearing

9) Monitoring and operation system
   - 2 sets of SCADA Server
   - 1 set of SCADA HMI
   - 2 sets of 19" monitor
   - 1 set of 50" monitor
   - 2 sets of PLC
   - 1 set of UPS
   - 1 lot of isolator
   - 1 set of monitor table and chair
   - 1 set of I/O panel

4.3 Expected I/O points for monitoring and operation

No.	Equipment	Input		Output	
		Digital	Analog	Digital	Analog
1.	Pump Discharge Flow		1		
2.	Pump Discharge Pressure		1		
3.	Pump Suction Water Level	4	2		
4.	Pump Bearing temperature	8	4		
5.	Main Pump Motor Temperature	40	20		
6.	Air Chamber system	6	4		
7.	Chlorine system	4	2	2	
8.	10kV Electrical System	40	10	8	
9.	Transformer	10			
10.	6kV Electrical System	40	20	16	
11.	DC Battery System		3	2	

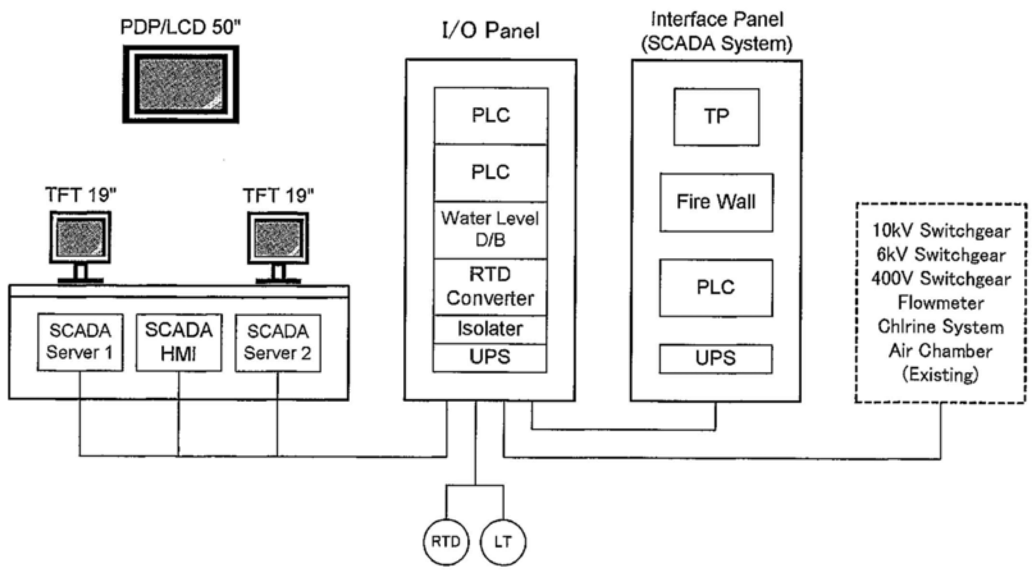
4.4 Remarks

(1) The battery and battery charger (135 Ah, lead type) for this system shall be supplied by Japan side separately.

(2) The instruments and transmitters for the air chambers and air compressor shall be supplied and installed by the Podgorica Water and Sewerage Corporation (hereinafter referred as "PWS") after rehabilitation of the air chambers and air compressor. Then the control cables to the I/O panel shall be laid and connected by the Corporation.

(3) The existing I/O control cable shall be replaced with the new one by Japan side, but the existing power cable for motors of pumps shall be used for the new motors.

System Configuration for Pump and Electrical Operation in Mareza New Pump Station



5. District Meter Area (DMA)

5.1 Flow meters and chlorine analyzers for DMA

For the measurement of flow rate for DMA, Japanese side shall procure interface panels, flow meters and pressure transmitters on the pipelines shown in the Appendix. The number of this equipment is listed in the table 5-1. For the measurement of residual chlorine and pressure, Japanese side shall procure interface panels, chlorine analyzers and pressure transmitters. The number of this equipment is listed in the table 5-2.

Table 5-1 Number of interfaces panels, flow meters and pressure transmitters

DMA	Flow meter	Interface panel	Flow meter	Pressure transmitter
DMA-1	Dia. 250mm AC x 1	1	1	1
DMA-2	Dia. 200mm PEHD x 1	1	1	1
	Dia. 200mm AC x 1	1	1	1
	Dia. 300mm PEHD x 1	1	(Existing)	1
	Dia. 300mm AC x 1	1	(Existing)	1
DMA-3	Dia. 200mm AC x 1	1	1	1
	Dia. 200mm AC x 1	1	1	1
DMA-4	Dia. 350mm AC x 1	1	1	1
	Dia. 250mm AC x 1	1	1	1
DMA-5	Dia. 200mm AC x 1	1	1	1
DMA-6	Dia. 300mm PEHD x 2	2	(Existing)	2
	Dia. 400mm AC x 1	1	1	1
	Dia. 300mm AC x 1	1	1	1
	Dia. 315mm PEHD x 1	1	1	1
	Dia. 300mm AC x 1	1	1	1
DMA-7	Dia. 300mm AC x 1	1	1	1
	Dia. 400mm AC x 1	1	1	1
DMA-8	Dia. 200mm AC x 1	1	1	1
	Dia. 300mm AC x 1	1	1	1
	Dia. 150mm AC x 1	1	1	1
DMA-9	Dia. 250mm AC x 1	1	1	1
DMA-10	Dia. 300mm x 1	1	1	1
	Dia. 200mm x 1	1	1	1
DMA-11	Dia. 250mm PEHD x 1	1	1	1
DMA-12	Dia. 300mm PEHD x 1	1	1	1
DMA-13	Dia. 450mm PEHD x 1	1	(Existing)	1
DMA-14	Dia. 250mm PEHD x 2	2	(Existing)	2
Total	-	**29**	**22**	**29**

Table 5-2 Number of interface panels, chlorine analyzers and pressure transmitters

DMA	Diameter and Materials	Interface panel	Chlorine analyzer	Pressure transmitter
DMA-1	Dia. 110mm PEHD	1	1	1
DMA-3	Dia. 150mm AC	1	1	1
DMA-4	Dia. 80mm PEHD	1	1	1
DMA-11	Dia. 160mm PEHD	1	1	1
DMA-12	Dia. 25mm PEHD	1	1	1
DMA-13	Dia. 450mm PEHD	1	1	1

Other	Dia. 110mm PEHD	1	1	1
Total		**7**	**7**	**7**

5.2 Closing valves for DMA

In order to establish DMA, Japanese side shall procure the closing valves and PWS shall install them for DMA as shown below.

Table 5-3 Number of closing valves

DMA	Valve
DMA-2	Dia. 300mm AC x 1 (Existing)
DMA-6	Dia. 300mm AC x 1 (Existing) Dia. 160mm AC x 1 (Existing)
DMA-7	Dia. 80mm AC x 1
DMA-10	Dia. 150mm AC x 1
Total	**2 valves (Except for DMA-2 and 6)**

5.3 Portable ultrasonic flow meters

In order to check whether the position of flow meter is suitable for measurement or not, Japanese side shall procure one (1) portable ultrasonic flow meter.

6 Monitoring System on Water Supply for Podgorica Water and Sewerage Corporation

6.1 This monitoring system aims at monitoring electrical power, ampere, voltage, water level of pump pits and wells, residual chlorine contents, operation status of pumps, motor coil temperature, pump and motor bearing temperature, pump discharge flow rate, pump discharge pressure, etc at the following pump stations;

1) Mareza New Pump Station
2) Mareza Old Pump Station
3) Zagoric Pump Station
4) Cemovsko Polje Pump Station
5) Miljes Pump Station
6) Dinosa Pump Station
7) Vuksanlekici Pump Station

In addition, it aims at monitoring flow rate, pressure and residual chlorine contents at the piping network areas (DMA).

The Main Control Center (MCC) located in the head office of the Corporation can monitor all pump stations and DMAs. Meanwhile each pump station can monitor his pump station only through a touch panel.

The items to be monitored are shown in **"I/O Lists"** attached hereto.

6.2 For SCADA system to be used for this monitoring system, please refer to **"SCADA System Configuration"** attached hereto.

6.3 The following telecommunication system shall be used for this SCADA system;

Location of Telecommunication	Telecommunication System
1. Between MCC and Mareza New PS	MIPNet*(Optical Fiber Network)
2. Between MCC and Mareza Old PS	MIPNet*(Optical Fiber Network)
3. Between MCC and Zagoric PS	MIPNet*(Optical Fiber Network)
4. Between MCC and Cemovsko Polje PS	GPRS Network + MIPNet*(Optical Fiber Network)
5. Between MCC and Miljes PS	GPRS Network + MIPNet*(Optical Fiber Network)
6. Between MCC and Dinosa PS	GPRS Network + MIPNet*(Optical Fiber Network)
7. Between MCC and Vukusanlekici PS	GPRS Network + MIPNet*(Optical Fiber Network)
8. Between MCC and Piping Network Areas	GPRS Network + MIPNet*(Optical Fiber Network)

*MIPNet means Montenegrin IP Network.

6.4 This GPRS Network and MIPNet is MPLS muliti-service network of T-Com (private telecommunication company). Accordingly Podgorica Water and Sewerage Corporation (hereafter referred as "PWS") shall make contract with T-Com on telecommunication service for this SCADA system.

6.5 T-Com shall supply and install the telecommunication devices including media converters for this SCADA system.

6.6 For the equipment to be supplied by Japan side, please refer to **"Equipment List for SCADA System"** attached hereto.

6.7 The equipment for SCADA system located in MCC shall be installed by Japan side. But the equipment for SCADA system located other than MCC shall be installed by Montenegro side. For the detailed work demarcation between Japan side and Montenegro side, please refer to **"Work Demarcation for SCADA System between Japan and Montenegro"** (hereinafter referred as "Work Demarcation") attached hereto.

6.8 The Montenegro side shall lay and connect all the I/O control cables, power supply cables, earthing cables and RGB cable as shown in the Work Demarcation.

6.9 The Montenegro side shall install pressure transmitters, flowmeters, and residual chlorine analyzers on the pipe of piping area networks as shown in the Work Demarcation.

6.10 The Montenegro side shall procured and installed kiosks for the interface panels of piping

network areas (DMA) in order to avoid theft of CPRS antenna and direct sunshine as shown in the Work Demarcation.

6.11 UPS shall have back-up time for 2 hours when electrical power fails.

6.12 Type of flow meter shall be of ultrasonic as far as possible.

6.13 Type of residual chlorine analyzer shall be of non-reagent.

7. Technical Assistance

7.1 On-the-Job-Training program for operation and maintenance of the following equipment to be procured in the Project shall be prepared for PWS staffs before commencement of start-up operation.

(1) Pump/Motor
(2) Hardware and software for pump operation system
(3) Hardware and software for monitoring system
(4) Flow meter
(5) Chlorine analyzer

7.2 The soft component for the optimum water distribution control by use of data collected by the monitoring system will not be required by PWS.

8 Cut-off of water supply

According to the result of socio-condition survey, cut-off of water supply is observed in Podgorica. The total population of areas with cut-off of water supply is approximately 24,000. This is because control of water distribution is not made adequately. These areas are shown below.