No.

BASIC DESIGN STUDY REPORT
ON
THE PROJECT
FOR
IMPROVEMENT OF WATER SUPPLY SYSTEM
IN
BELGRADE
IN
SERBIA AND MONTENEGRO

March 2005

JAPAN INTERNATIONAL COOPERATION AGENCY
GRANT AID MANAGEMENT DEPARTMENT

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PREFACE

In response to a request from the Government of Serbia and Montenegro, the Government of Japan decided to conduct a basic design study on the Project for Improvement of Water Supply System in Belgrade and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Serbia and Montenegro a study team from July 14 to August 12, 2004 in the field survey.

The team held discussions with the official concerned of the Government of Serbia and Montenegro, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Serbia and Montenegro in order to discuss a draft basic design, and as this result, the present report was finalized.

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

I wish to express my sincere appreciation to the officials concerned of the Government of Serbia and Montenegro for their close cooperation extended to the teams.

March 2005

Seiji KOJIMA
Vice President
Japan International Cooperation Agency

March 2005

Letter of Transmittal

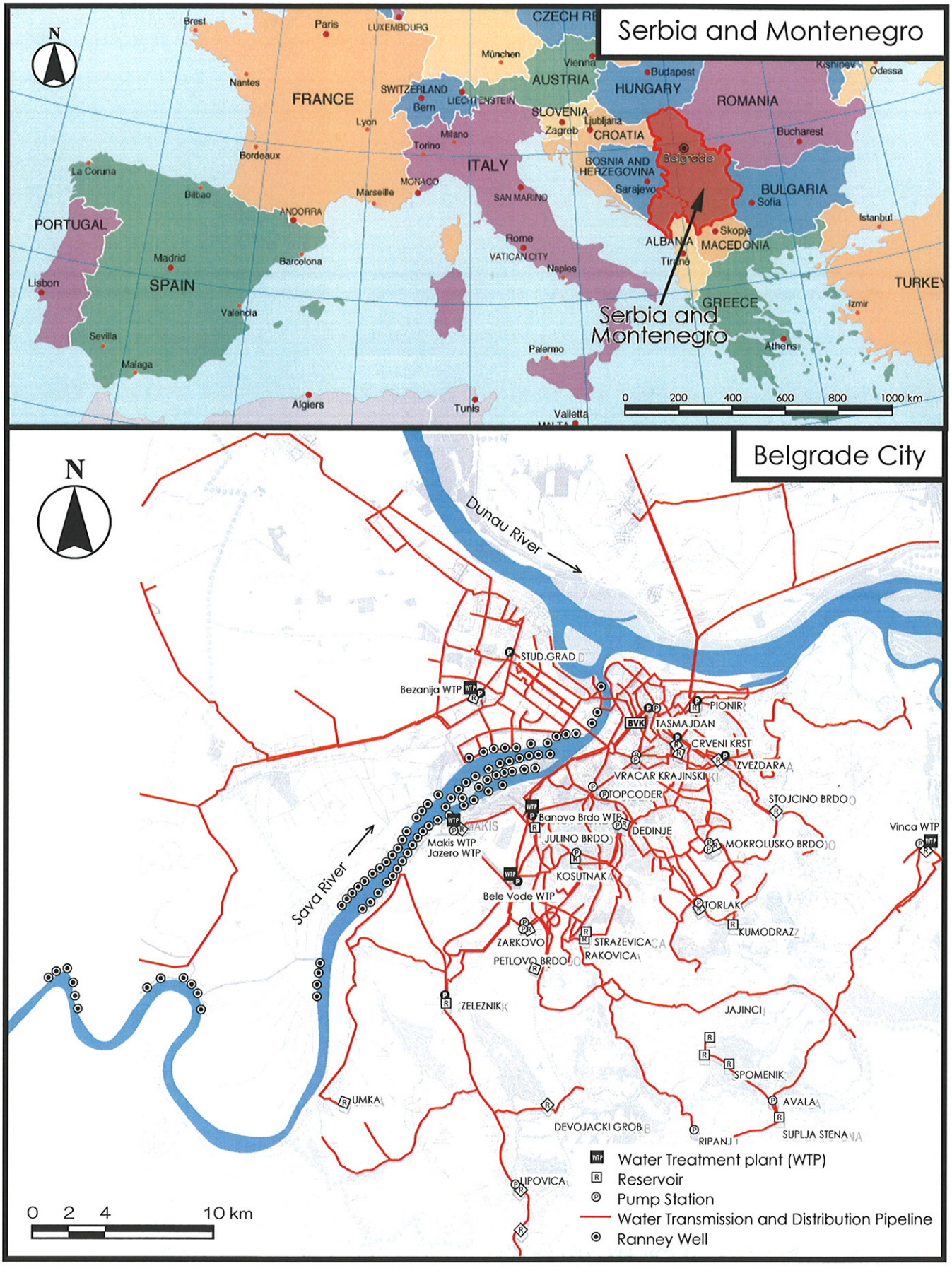
We are pleased to submit to you the basic design study report on the Project for Improvement of Water Supply System in Belgrade in Serbia and Montenegro.

This study was conducted by Pacific Consultants International, under a contract to JICA, during the period from July, 2004 to March, 2005. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Serbia and Montenegro and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Toshifumi Okaga
Project Manager,
Basic design study team on
The Project for Improvement of Water Supply System in Belgrade
Pacific Consultants International



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Abbreviations / Acronyms

AFD	Agency Francaise de Development
BVK	Beogradski Vodovod i Kanalizacija
CSD	Servien Dinar
DBFO	Design, Built, Full Operation
DNS	Domain Name Server
EAR	European Agency for Reconstruction
EBRD	European Bank for Reconstruction and Development
EIA	Environment Impact Assessment
EID	European Investment Bank
EUR	Euro
GPRS	General Packet Radio Service
HMI	Human Machine Interface
IEC	International Electrotechnical Commission
JICA	Japan International Cooperation Agency
KfW	Kreditanstalt fur Wiederraufbau
LCC	Local Control Center
L/c/d	Litter/capita/day
L/s	Litter/second
MCC	Main Control Center
NATO	North Atlantic Treaty Organization
OJT	On the Job Training
PDM	Project Design Matrix
PLC	Programmable Logic Controller
PPP	Public Private Partnership
PS (PC)	Pump Station
rpm	revolutions per minute
SCADA	Supervisory Control and Data Acquisition
SHDSL	Single Pair High-Bit Rate Digital Subscriber Line
SQL	Structured Query Layer
TFT	Thin Film Transistor
UPS	Uninterrupted Power Supply

Exchange Rates (Feb. 2004 - Jun. 2004)

EUR 1.00 = JPY 134.62

CSD 1.00 = JPY 2.06

SUMMARY

Summary

Serbia and Montenegro established in 2003 is located in southeastern Europe in the heart of the Balkan Peninsula. Serbia is considerably larger (88,000km^2) than Montenegro (area 14,000km^2) covering 85% of the total land area. Serbia and Montenegro is bounded by the Adriatic Sea and by seven countries: Albania, Bosnia and Herzegovina, Croatia, Hungary, Romania, Bulgaria, and FYR Macedonia. Forest and woodland cover 17% of the country's area and 40% is arable land. Current population of Serbia and Montenegro is to be 10.65million, about 9.99million reside in Serbia and 0.66millon in Montenegro.

Belgrade, study area of the Project, is capital of Serbia and Montenegro. The population of Belgrade is 1,570,000 persons (Census in 2002). The Belgrade Water Works and Sewage (Beogradski Vodovod I Kanalizacija：hereinafter referred to as BVK) is in charge of the water supply and sewage services for the City. According to the data obtained from BVK, the population of water supply service is 1,319,188 persons, the ratio of served population is 84%, the water demand (daily average in 2004) is approx.646,000 m^3/d and the daily maximum water demand is estimated to be 775,000 m^3/d.

Nevertheless, the capacity of existing facilities is insufficient for the demand capacity due to the reasons such as decrease of intake water capacity, breakdown caused by superannuated equipments, etc. Furthermore, since there are many facilities for the water supply system, the operation of each facility is so complicated that the information from each facility cannot be grasped and therefore timely operation cannot be realized, which results in the areas suffering from perpetual water shortage.

In addition, since enough investment for the facilities of water quality analysis has not been carried into effect smoothly so far, a number of main analytical equipments used in Central Laboratory for Water Quality in Makis WTP are out of order or inadequate for required analytical precision. Therefore, it has been difficult to accomplish properly the works of water quality control.

Under the circumstances, Belgrade city formulated "Prospective Development Program for Water Supply System for Belgrade" (hereinafter referred to as development program). The objective of the development program is "supply of safe drinking water to satisfy the demand volume". The development program includes the implementation plans for "complete operation and maintenance of water supply facilities" and "grasp for actual situation of facility operation and water distribution". In order to execute these implementation plans, BVK formulated the urgent improvement plan in 2001. The table below shows the main contents of improvement plan and implementation status.

Urgent Improvement Plan & Implementation Status

No.	Improvement Plan	Implementation Status
①	**Increase of water production capacity**: To meet the maximum water volume per day by increase of 2,000 L/s.	Expansion project for Makis II WTP by EBRD fund. To be completed in 2007.
②	**Stable groundwater intake**: To decrease the pump troubles for stable water intake. To increase intake volume of 385L/s by pump renewal.	Renewal of submersible pump, installation of frequency converter equipment and introduction of a part of SCADA system by US-Aid and own finance.
③	**Increase of water distribution capacity**: To supply sufficient water by increase of distribution water volume.	Request for distribution pump sets to Japan (Scope of the Project)
④	**Systemizing and unification of SCADA system**: To grasp the operation status of all facilities. To operate intake pump effectively at real-time. To confirm suitable water distribution and water quality.	Request for introduction of SCADA system to Japan (Scope of the Project)
⑤	**Improvement of non-revenue water**: To increase the volume of revenue water and strengthen the financial affairs (Improvement target is from 33% to 28%)	Under the implementation process by KfW and be completed in2005. This plan will be continued by the assistance for renewal of pipe materials, etc. from the own funds and other donors.
⑥	**Supply of safe drinking water**: To satisfy the safe drinking water standard. To secure stable water quality and preserve water quality of water resource.	Request for the renewal of water quality analysis equipment to Japan (Scope of the Project)

Through the execution of the urgent improvement plan, it would be possible to dissolve the perpetual water shortage and, at the same time, to supply safe drinking water. However, due to the lack of budget from the city side, ③ the increase of distribution capacity, ④ the monitoring and control system and ⑥ the supply of safe drinking water have not been realized yet.

Under the situation mentioned above and as the result of "Study of Project Formation for Collecting Basic Information in Federal Republic of Yugoslavia" executed by the Government of Japan in 2001, the urgent improvement plan was recognized as one of the most urgent and highest priority project.

In April 2004, JICA dispatched a preparatory study team for the improvement of water supply in Belgrade which executed the studies to confirm superior plans, scope of cooperation, executing organization, etc. and also to grasp the activities of other donors.

As the result of the study mentioned above, it was confirmed that ③ increase of water distribution capacity, ④ systemizing and unification of monitoring & control for facilities and ⑥ renewal of water quality analysis equipment were not yet realized but it has been also confirmed that BVK has the executing organization with technical ability for installation of required equipments and its operation and maintenance.

According to the confirmation in the preparatory study, the Government of Japan decided to conduct Basic Design Study and JICA dispatched the study team in July 2004. The scope of the Project includes the items requested by Serbia and Montenegro such as procurement of distribution pump sets

for renewal, introduction of SCADA system and renewal of water quality analysis equipment. After the return to Japan, the team analyzed data and prepared a draft of basic design report. In December 2004, the team explained the draft report to BVK and discussed with them, and as the result, this basic design report has been made finally.

For the rehabilitation of the existing pumps and the increase of pump capacity, the distribution pumps in 7 pump stations shall be renewed. The scope of the Project shall include the design, manufacture, test, packing and transportation. The detail of implementation plan is as follows:

Procurement list for distribution pump set

Pump Station	Qty of pump set	Ancillary equipment for pump station	
		Equipment	Quantity
PS-1a Bele Vode	3	Frequency inverter	8
PS-1b Bele Vode	4	Soft starter	16
PS-18 Trasmajan	4	Local control panel	7
PS-19 Bezanija	3	Flap gate valve	23
PS-23 Studentski Grad	5	Pressure transmitter	75
PS-17 Zvezdara	3		
PS-20 Zeleznik	2		
Total	24		

Since the existing facility is individually operated, monitored and controlled by each site and Belgrade Water Supply System consists of many facilities, adequate operation of the entire system is difficult. The SCADA system has the functions of monitoring, control and data acquisition. Through the introduction of this system, it will be possible to control collectively and in unification the water pressure, water volume, water quality and operation status of each facility, and concurrently, possible to direct at the real-time the operation of each facility, and therefore, possible to distribute the treated water adequately and to resolve the areas of the water shortage.

In the Project, as the first step for the introduction of SCADA system, the scope of cooperation will be limited to the collective and unified monitoring of all the facilities and the remote control of the intake facility. On the final step, based on the first step, BVK will do every effort by themselves in order to make it possible for all the facilities to be operated by remote control connecting with the collective and unified monitoring (a complete SCADA system).

The remote control of intake facility to be implemented by the Project is a system that can monitor the data of 99 intake pumps collectively from the water treatment plants and, at the same time, can control remotely the stop and start of any intake pumps in accordance with the operation status in the water treatment plants.

Concerning the automatic control of water intake in the relation between 2 water treatment plants and 99 intake pumps, when the treated water level of the reservoir in a water treatment plant reaches to the high or low point, its intake pump stops or starts by the automatic remote control from the water treatment plant. It is also possible to recover automatically after the restoration of power failure.

The central control room in a water treatment plant can monitor the items of centralized monitoring such as trouble indicators, running and stop, discharge flow of pump, discharge pressure of pump, residual chlorine and power consumption of electric motor. It is possible to monitor on the display and accumulate the data from intake facility, distribution pump station, reservoir and pressure transmitter and also possible to send all the data to distribution pump station, water treatment plant and central control room by fixed line or radio transmission. These data can be accumulated in the central control room. For the data analysis, accumulated data can be indicated in forms or trend charts based on the running conditions and intake volume by day, month and year.

By the unified monitoring system at the central control room, it will be possible to direct adequately the pump operation. Consequently, the distribution pump can be controlled under the proper management through the introduction of unified monitoring system. Thus, there will be no empty reservoirs nor overflow. It will be also possible to control the number of pump in operation according to the water level or the discharge pressure of distribution pump and therefore possible to supply water with stable pressure to the service areas. The accumulated data will be arranged for the preparation of forms and trend graphs on the daily, monthly or yearly basis, which will be used for the remote control to be executed as the next step. Furthermore, it will be possible to know immediately the troubles occurred in the intake facilities and distribution pump stations and therefore possible to take action for restoration at once.

The name and quantity of equipments to be procured for the SCADA system are shown in the table below.

SCADA System

SCADA equipment	Main function	Location										
		Center control room (Deligradska)	Local control (Bezanija)	Local control (Banovo Brdo)	Local control (Makis)	Local control (Bele Bode)	Relay station (Kneza Milosa)	Relay station (Kosutnjak)	Pump station (27 Sites)	Intake pump (99 Sites)	Reservoir (20 Sites)	Total quantity
WEB Server	WEB distribution of data stored	1										1
SQL Server	Store of data collected in central control room	2	1	1	1							5
Master SCADA	Aggregate monitory and data collection in center control room	1										1
Local SCADA	Data collection and distribution at local					1			14			15
DN Server	Control of domain and IP address	1	1	1								3
Monitor/HMI	Graphic monitory of Local data	2	1	1	1	1			14			20
50" Display	Center display	4										4
Printer	Printing	1	1	1	1	1			14			19
UPS	Uninterrupted power supply	1	1	1	1	1			14			19
GPRS Server	Data collection of GPR system	1	1	1	1							4
GPRS Modem	Radio transmission	1	1	1	1	1			27	97	20	149
SHDSL Router	Transmission and receive of fixed line	1	1	3	1	2	11		13			32
PLC	Data collection and transmission at local								24	50	20	94
Touch Panel	Data import and monitory								24			24
TN Server	Alarm Detector of communication line			1								1

In order to secure the safe water sources and drinking water standard, the superannuated equipments for water quality analysis are to be renewed. The equipments to be procured are shown below.

Equipment	Qty
Equipment for Chemical Analysis	
Atomic Absorption Spectrometer	1
Total organic Carbon Analyzer	1
UV-VIS Spectrometer	1
Equipment for Microbiological Analysis	
Autoclave	1
Glassware Washer w/ Drying Sys.	1
Equipment for Chemical Analysis for Sewage	
Atomic Absorption Spectrometer	1

The project is composed of two phases. Phase 1, providing SCADA system, takes 20 months, Phase 2 for pumps and laboratory equipment takes 17.5 months.

The estimated cost required for the implementation of the Project as the grant aid cooperation is ¥ 1,243 million (total project cost of Japan side ¥ 1,177 million and total project cost of Serbia and Montenegro side ¥ 66 million). The estimated project cost does not mean the maximum aid amount to be mentioned in the Exchange of Notes.

The executing agency of the Project is BVK. The department of operation and maintenance in BVK will be in charge of the operation and maintenance of the distribution pumps. The scale of pumps to be procured under the Project is slightly larger than the existing pumps but the operation and maintenance can be carried out as routine as usual because the type, etc. of pumps are not different.

The department of IT will be in charge of the operation and maintenance of the equipments for monitoring and control. The department of IT was established in 2001 in order to introduce the monitoring and control system and already has the experience of operation and maintenance for the equipments introduced as the test cases previously. The equipments procured under the Project will include the software to be constructed by the Japan side. By the cooperative works together with Japanese engineers through the installation and adjustment works and by the technology transfer to the staff of BVK to be realized through OJT executed by the Japanese contractors, the staff of BVK, who has already high level of ability, will be capable enough to master the system procured under the Project.

Based on the financial report of BVK, 2,533 million CSD was spent for the operation and maintenance works in 2003. Annual cost for operation and maintenance after the Project is estimated at 2,541 million CSD. The increment is only 8 million CSD, which corresponds to 0.3% of the current cost.

The water supply system will be improved with the equipments to be procured under the Project, which will realize to supply safe drinking water for 24 hours for 100,000 residents in the areas

suffering from perpetual water shortage and for 300,000 residents in the areas suffering from seasonal water shortage in the summer season.

The objective of the Project are in accordance with the superior plan "Supply of safe drinking water to satisfy the demand volume". The Project will respond to the basic human needs of the residents, who wish the comfortable and sustainable living environment, by solving the problem of water shortage in the service areas.

Since the Project will contribute to the improvement of public health environment for a great number of residents, it is adequately reasonable for Japan to execute the grant aid cooperation to the main part of the Project. Concerning the equipments to be procured under the Project, BVK has already established the department of IT and completed the preparatory steps. Therefore, it is possible to operate and maintain these equipments by the fund and staff of Serbia and Montenegro side together with the technical guidance from Japan side. However, in order to implement the Project smoothly and effectively, it is indispensable to strengthen the organizations for the operation and maintenance after the delivery of the equipments and to enhance the environment protection. Accordingly, it is expected that Serbia and Montenegro side will positively tackle with the followings:

- In order to secure the source of the intake for the water supply system, it is indispensable to tackle with the environmental improvement.
- Serbia and Montenegro side shall acquire the contents of technology that should be succeeded and developed in the organizations in charge.
- The Project marks the first step of the SCADA system. In the future, based on this step, it is necessary for BVK to expand the system for the complete construction of SCADA.
- From the financial strengthening of BVK, it is essential to reallocate the surplus personnel when the SCADA system is introduced.

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CHAPTER 1
BACKGROUND OF THE PROJECT

CHAPTER 1 BACKGROUND OF THE PROJECT

As the result of "Study of Project Formation for Collecting Basic Information in Federal Republic of Yugoslavia" executed by JICA in 2001, in order to unify the monitoring system connecting between the intake facilities, distribution pumps and other facilities, the grant aid for equipments of Supervisory Control and Data Acquisition (SCADA) system and water quality analysis was requested.

Since 2 years and a half had passed after the above mentioned request had been made, in April 2004, JICA dispatched a preliminary study team which executed the studies to confirm superior plans, scope of cooperation, executing organization, etc. and also to grasp the activities of other donors. As the result of the study mentioned above, the following points were confirmed:

- Superannuation of groundwater intake facilities and distribution pumps.
- There are areas suffering from perpetual water shortage due to the problem of distribution method caused by inadequate communication between each facility.
- Water shortage in summer season
- As the executing agency, BVK has the technology and organization, which can carry out without any problems the installation, operation and maintenance of the equipments (excluding the measurement equipments) requested for the Project.

In the study for basic design executed in 2004, four (4) contents of request were confirmed as follows:

- Improvement of groundwater intake facility (49 submersible pumps and other accessories for pump station)
- Improvement of distribution pump facility (28 distribution pumps and other accessories for pump station)
- Construction of SCADA system (construction of monitoring network between intake facility, water treatment plant, distribution pump station, distribution reservoir and center control room)
- Procurement of equipments for water quality analysis (renewal of equipments and materials in the central laboratory for water quality)

Although there is the order of priority for the requested items, it is confirmed that all of the items are essential. The contents of the necessity are as follows:

- The improvement of intake facility was the priority subject in the request letter issued in 2001. Therefore, BVK has been making every effort to improve the situation for stable water intake by investing with first priority the funds from self-finance and other donors. Consequently, as the original targets, the improvement in the renewal of pumps, introducing revolution control, etc. has

now been realized up to a certain level by the leadership of BVK. Therefore, it is considered that the priority is low.

- The decrease of water supply volume is caused by lowered capability due to the superannuation of distribution pumps and by the insufficient distribution capacity to newly expanded service area, which bring about the areas of seasonal water shortage in summer time. However, since the required capacity of pump is large and therefore the price is expensive, the city budget cannot afford it timely. Thus, the request has been submitted.
- Because there are many facilities for the water supply system, the operation of each facility is separated and so complicated that the communication between each facility cannot be controlled at real-time, which results in the areas suffering from perpetual water shortage. Under the circumstances mentioned above, BVK organized the special team for 3 years ago and commenced the study for introducing the monitoring and control system. It has been difficult for BVK to procure actually the new equipments due to the lack of budget. However, BVK has completed it as a preparatory stage in accordance with the technical advice from a computer maker for development of software. The SCADA system in the requested items will be a timely assistance in order to dissolve promptly the unbalance of water distribution.
- Although the existing equipments for water quality analysis are superannuated, these equipments are still used even under the difficulty to procure their parts owing to very old models and budgetary limitation. There is a problem in the accuracy of analytical data with frequent measurement errors shown by these equipments. Since the country has the objective of meeting the EU standards for environment, etc., BVK also aims at the improvement of accuracy for the data. It is confirmed that BVK envisages the roles of the water quality center to function as the center not only for the water supply and sewage services but also for the environmental protection in the future.

CHAPTER 2
CONTENTS OF THE PROJECT

CHAPTER 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

(1) Higher Ranked Plan and Project Purpose

The Government of the Republic of Serbia formulated in 1995 "Master Water Plan for the Republic of Serbia" in order to continue and further develop the integrated national water management including the water resource development. The master plan describes the securing and preservation of water resource and the water demand in the future. Considering this national plan as the superior one, the Belgrade city formulated "Prospective Development Program for Water Supply System for Belgrade".

The objective of the development program is "supply of safe drinking water to satisfy the demand volume" and the program includes the implementation plans for "complete operation and maintenance of water supply facilities" and "grasp for actual situation of facility operation and water distribution". In this development program, BVK formulated the development plans (Urgent Improvement Plan) mentioned below. Table 2-1 shows its main Urgent Improvement Plan and implementation status.

Table 2-1 Urgent Improvement Plan & Implementation Status

No.	Urgent Improvement Plan	Implementation Status
1	**Increase of water production capacity**: To meet the maximum daily water capacity by increase of 2,000 L/s.	Expansion project for Makis II WTP by EBRD fund. To be completed in 2007.
2	**Stable groundwater intake**: To decrease the pump troubles for stable water intake. To increase intake volume of 385L/s by pump renewal.	Under the implementation by US-Aid and the own fund at present. Cleaning well screens, renewal of submersible pump, installation of frequency converter equipment and introduction of a part of SCADA system.
3	**Increase of water distribution capacity**: To increase distribution water capacity by renewal of superannuated and efficiency lowering pumps.	Request for distribution pump sets to Japan
4	**Systemizing and unification of monitoring and control of facilities**: To grasp the operation status of all facilities. To operate intake pump effectively at real-time. To confirm suitable water distribution.	Request for introduction of SCADA system to Japan
5	**Improvement of non-revenue water**: To increase the volume of revenue water and strengthen the financial affairs (Improvement target is from 33 % to 28 %)	Under the implementation by KfW and be completed in2005. This plan will be continued by the assistance for renewal of pipe materials, etc. from the own funds and other donors.

No.	Urgent Improvement Plan	Implementation Status
6	**Supply of safe drinking water:** To satisfy the safe drinking water standard. To secure stable water quality and manage water quality of water resource.	Request for the renewal of water quality analysis equipment to Japan

Through the execution of the improvement plan, it is possible to dissolve the perpetual water shortage (about 150,000 persons suffering from seasonal water shortage in summer and about 100,000 persons suffering from perpetual water shortage) and, at the same time, to supply safe drinking water. However, due to the lack of budget of the city side, the increase of distribution capacity, the monitoring and control system and the supply of safe drinking water are not yet realized presently.

The items not implemented at present are of the Requested Japanese Assistance (Project). If renewal of distribution pumps, introduction of SCADA system and renewal of water quality analysis equipment are implemented, the objective of urgent improvement plan is achieved in combination with the plan being implemented currently.

(2) Basic Concept of the Project

In order to achieve the project purposes, the following works shall be implemented under this Project;

① Renewal of water distribution pumps
② Construction of SCADA (Supervisory Control and Data Acquisition) system
③ Renewal of water quality analysis equipments
④ Dispatch of engineers and technical instructors to construct SCADA system

By the implementation of the Project, the effective water balance will be maintained under the present volume of water intake and it is expected that the balanced distribution of water volume and the stable supply of safe drinking water will be possible. The effects of the Project, the project purpose and the overall goal are summarized in the PDM form (Table 2-2).

Table 2-2 Project Design Matrix (PDM)

Narrative Summary	Indicator	Means of Verification	Important Assumption
Overall Goal Sufficient volume of safe drinking water is supplied in Belgrade city	① Supply volume (L/capita/day) ② Number of households served for 24-hours	① Performance record ② Operation & maintenance record for water facilities	• BVK makes effort to improve water supply management works continuously.
Project Purpose 1. It becomes possible to operate and maintain water supply facilities adequately due to control/supervision of water supply and distribution. 2. Water supply is improved in the area of water shortage.	① Operation status for water facilities ② Maintenance status for water facilities ③ Water supply amount	① Operation record ② Repair & renewal record for water facilities ③ Metering record	• The projects of other donors are implemented as per plan. (KfW: Water leakage improvement project, AFD: Water treatment plant expansion project, etc.
Output 1. Water distribution pumps are renewed in Belgrade city. 2. Monitoring network for each facility is constructed. 3. The items specified for water quality are analyzed.	① Water distribution volume ② Operation status for water facilities ③ Items of water quality analysis	① Operation record ② Operation record ③ Result of water quality analysis	• Operation and maintenance for water supply facilities is carried out successfully by use of SCADA system
Activity 1. Renewal of 24 water distribution pumps 2. Construction of monitoring network system 3. Renewal of water quality analysis equipment in central laboratory	**Input** *Japan side* <Equipment/Materials> Water distribution pump, SCADA system equipment, water quality analysis equipment <Human Resource> Engineer, Technical instructor <Project Cost> Equipment and materials cost	*Serbia and Montenegro Side* <Equipment/Materials> Installation materials <Human Resources> Engineer, Technician, Labor <Project Cost> Installation material cost, installation work cost, operation/maintenance cost	• Works to be done by the recipient country are implemented as per plan. **Precondition** • E/N is concluded.

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

(1) Basic Policy

BVK has requested to Japan side the procurement of the following equipments in order to improve the existing water supply facilities;

① Water intake facilities (submersible pumps, frequency inverters)
② Water distribution pump stations (pumps, frequency inverters, soft starters)
③ Monitoring & control system (SCADA system)
④ Water quality management (water quality analysis equipment)

The items mentioned above were requested to the Government of Japan by BVK in 2001. The most serious problems of BVK are the perpetual water shortage in some areas of the city and seasonal water shortage during summer. As the above four items are to be improved urgently, these items are incorporated into the said improvement plan. Accordingly, these items are prerequisite to achieve the project purposes.

However, as three years have passed since BVK had asked the Requested Japanese Assistance, BVK has already commenced to implement the improvement plan. BVK also commenced renewal of the well pumps to the extent of the available own fund. Meanwhile, as for other works requested by BVK, it is required to pick up and select the works to be done under the Requested Japan Assistance by grasping the urgent improvement Plan. The work items selected are considered as the scope of the Project under the Requested Japanese Assistance and furthermore it is required to examine whether these works meet the guidance of the Japanese Grand Aid Scheme. Then the equipment to be procured under the Requested Japanese Assistance shall be decided.

When the additional equipment is procured and installed to improve the existing facilities, there exists in a case that, as the additional equipment cannot be adjusted and tested together with the existing equipment before deliver, the efficiency of the facilities cannot be guaranteed. For example, it comes under where a frequency inverter is provided for the existing water distribution pump. In this case, the additional equipment requested by BVK is excluded from the Requested Japanese Assistance.

Also BVK has much experience for the installation work of the water distribution pumps requested by BVK, it is excluded from the Requested Japanese Assistance. When the national regulation, rule and practice are applied for the equipment requested by BVK, it is considered to be difficult that Japan side comprehends these regulation, rule and practice within the limited time, and make a design for the equipment so as to meet those. Therefore, this equipment is to be implemented by BVK. For example, the telecommunication system comes under it.

The SCADA system in the final stage is designed so as to be able to monitor and control all of the water supply facilities. Under this Project, as the first step, the SCADA system is designed mainly for monitoring and takes priority over monitoring for water flow rate and pressure.

It is to be designed so that the SCADA system can be expanded easily in future taking compatibility into consideration.

(2) Consideration for Natural Conditions

The Belgrade city has the topography from 100m to 300m heights above the sea level. The water service areas are divided into 4 zones according to the topographic condition. Therefore, the head of water distribution pump should be decided after confirming its topography.

(3) Consideration for Local Conditions, Local Contractors and Local Materials

All the authorization and/or permit required for the telecommunication system for the SCADA system shall be obtained by Serbia and Montenegro side. The telecommunication system shall be constructed by Serbia and Montenegro. The interface between the SCADA system by Japan side and the telecommunication system by Serbia and Montenegro side shall be studied sufficiently by the both parties so as not to have any inconvenience to the data transmission.

(4) Capability of BVK for Operation and Maintenance

BVK has the capability for maintenance works including overhaul for pumps/motors, electrical equipments such as control cubicle and etc. Accordingly, BVK can keep the equipments fully maintained. Furthermore, BVK has the experience of operation and maintenance work for the monitoring system implemented partly by BVK, but it is essential that the training shall be implemented for both hardware and software of the SCADA system by Japan side under the Project. It is considered so that the technical transfer could be done for BVK personnel in the stage of commissioning and trial operation of SCADA system, and a contract for services after sales could be concluded between BVK and the contractor to support BVK'S maintenance works of SCADA system.

(5) Grade and Standard for Equipment and Facility

Considering the procurement from the third countries, the specification for pumps/motors and electrical equipments shall comply with the international standards and/or codes such as ISO, IEC, etc. The specification for the SCADA system shall be prepared taking into consideration the expansion of input/output points and data memory, addition of function on water distribution pumps remote operation, water management system and interface with other subsystem in future.

(6) Procurement Method, Installation Method and Implementation Schedule

The implementation schedule of the Project is composed of Phase 1 and Phase 2. The equipment to be procured on each Phase is shown as follows.

Phase 1: SCADA System
Phase 2: Pumps, Laboratory Equipment

It is recognized that SCADA System should be procured on Phase 1, taking into account following reasons.

1) One of main causes of current problems is absence of monitoring system for entire water supply system.
2) It shall be more effectual to provide pumps after establishment of monitoring system, in respect of ensuring appropriate operation of pumps.
3) SCADA system is expected to contribute to realization of the project effects more than pumps without SCADA system.

The most critical items of the implementation schedule are of manufacture, installation and commissioning work for hardware and software of the SCADA system. The implementation schedule for the telecommunication system and wiring connection to PLC by Serbia and Montenegro side shall meet it of the SCADA system by Japan side.

2-2-2 Basic Plan

(1) Overall Plan

As BVK has already implemented a part of items requested to Japan in year 2001, BVK offered the priority list to Japan side. The priority list is shown in Table 2-3 below.

Table 2-3 Priority List

No.	Name of Equipment	Req'd Q'ty	Priority				Remarks
			1	2	3	4	
1. Well Equipment (97 wells)							
1-1	Aggregate (Pump & Motor)	49		49			
1-2	Frequency Inverter	8		8			
1-3	Measuring equipment	8		8			
1-4	Valves	100		100			
1-5	Flaps	100					-100
1-6	Control Cubicle	50		49			-1
1-7	Terminal Equipment hw + sw	50	49				-1
1-8	Telecommunication equipment (GPRS modem)	97	97				
2. Pump Station Equipment (26 PS)							
2-1	Aggregate (Pump & Motor)	28	25	3			
2-2	Frequency Inverter	53	25	3			-25
2-3	Transformer	14					-14
2-4	Control Cubicle	44	24	4			-16
2-5	Flaps	65	23	18	19	5	

No.	Name of Equipment	Req'd Q'ty	Priority				Remarks
			1	2	3	4	
2-6	Measuring equipment	75	75				
2-7	Terminal Equipment hw + sw	23	48				+25
2-8	Telecommunication equipment (GPRS modem)	24	27				+3
2-9	Local SCADA (SCADA Server)	14	14				
2-10	Monitor/SCADA HMI	0	14				+14
2-11	Printer	0	14				+14
2-12	UPS	0	14				+14
2-13	Touch panel	0	24				+24
3. Measuring Point Equipment (28 points)							
3-1	Chlorine measurement	28		28			
3-2	Cubicle	28		28			
3-3	Terminal Equipment hw + sw	28		28			
3-4	Telecommunication equipment (GPRS modem)	28		28			
4. Reservoir Equipment							
4-1	Chlorine measurement	20	20				
4-2	Terminal Equipment hw + sw	20	20				
4-3	Telecommunication equipment (GPRS modem)	20	20				
4-4	Cubicle	0	20				+20
5. Telecommunication Network							
5-1	IP Data network						
5-1-1	Optical cable link 31.1km	1					-1
5-1-2	Active components						
5-1-2-1	SHDSL Layer 3 router	30	32				+2
5-1-2-2	Layer 3 switch	4	4				
5-1-2-3	Layer 2 switch	12	22				+10
5-1-2-4	Media converter	0	14				+14
5-2	Wireless data transmission network	8					-8
6. Local Control Center Bezanija							
6-1	Domain Controller server (sw + hw)	1	1				
6-2	SQL Server (sw + hw)	1	1				
6-3	GPRS server	0	1				+1
6-4	Monitor/SCADA HMI	0	1				+1
6-5	Printer	0	1				+1
6-6	UPS	0	1				+1
7. Local Control Center Banovo Brdo							
7-1	SQL Server (sw + hw)	1	1				
7-2	Telecommunication Network Server (sw + hw)	1	1				
7-3	Domain Controller server (sw + hw)	1	1				
7-4	GPRS server	0	1				+1
7-5	Monitor/SCADA HMI	0	1				+1
7-6	Printer	0	1				+1
7-7	UPS	0	1				+1
7A. Local Control Center Bele Bode							
7A-1	SCADA Server(sw + hw)	0	1				+1
7A-2	Telecommunication equipment (GPRS modem)	0	1				+1
7A-3	Monitor/HMI SCADA	0	1				+1

No.	Name of Equipment	Req'd Q'ty	Priority				Remarks
			1	2	3	4	
7A-4	Printer	0	1				+1
7A-5	UPS	0	1				+1
7B. Local Control Center Makis							
7B-1	SQL Server (sw + hw)	0	1				+1
7B-2	GPRS server	0	1				+1
7B-3	Monitor/SCADA HMI	0	1				+1
7B-4	Printer	0	1				+1
7B-5	UPS	0	1				+1
8. Main Control Center Deligradska Street							
8-1	Servers for real time BWS control						
8-1-1	SQL Server (sw + hw)	2	2				
8-1-2	Telecommunication Network Server (sw + hw)	1	0				-1
8-1-3	Domain Controller server (sw + hw)	1	1				
8-1-4	Master SCADA server	1	1				
8-1-5	Web server	0	1				+1
8-1-6	GPRS server	0	1				+1
8-2	Workstation for monitor						
8-2-1	Workstation (sw + hw) /SCADA HMI	3	2				-1
8-2-2	50" Display	0	4				+4
8-3	Voice over IP equipment						
8-3-1	VOIP gateway	1	0				-1
8-3-2	VOIP gatekeeper	1	0				-1
8-4	Printer	0	1				+1
8-5	UPS	0	1				+1
9. Laboratory measuring equipment and instrument							
9-1	Chemical laboratory						
9-1-1	Atomic Absorption Spectrometer (AAS)	1	1				
9-1-2	Total Organic Carbon Analyzer (TOC)	1	1				
9-1-3	UV-VIS Spectrometer	1	1				
9-1-4	High-Performance Liquid Chromatography (HPLC)	1			1		
9-1-5	Ion Chromatography - IC	1		1			
9-1-6	Analytical balance, 0.001g	1			1		
9-1-7	Glassware Washer	1		1			
9-2	Microbiological Laboratory						
9-2-1	Microscope	1	1				
9-2-2	Autoclave	1	1				
9-2-3	Glassware Washer with drying system	1		1			
9-3	Chemical laboratory (waste water)						
9-3-1	Atomic Absorption Spectrometer (AAS)	1		1			
9-3-2	Gas Chromatograph, PPC, FID and ECD	1		1			
9-3-3	Total Organic Carbon Analyzer (TOC)	1			1		

These items are studied in accordance with the design policy mentioned in the paragraph 2-2-1. The results of study are as follows;

① Equipments/materials to be procured by the recipient side in accordance with the Japanese Grant Aid Scheme

The transformer for the primary power feeder is required for the operation of water distribution pumps. The primary power is stepped down from 10 Kv to 400 v by this transformer. The primary power is fed to the motor for pump through wattmeter/secondary feeder and pump starting panel. As the Project is categorized as the equipment supply project, all of feeder cable and associated materials (including transformers) shall be procured by BVK.

Deletion: Transformer (2-3 in Table 2-3) 14 sets

② Equipment able to be procured by BVK

These have been already procured and subsequently can be procured by BVK.

Deletion: Flap gates for well pumps (1-5 in Table 2-3) 100sets

Existing exclusive line is available among Main Control Center, WTP and Distribution pump station. This exclusive line is currently used for telecommunication of the existing monitoring system. As this exclusive line has enough capacity, it is possible to use it for the monitoring/control system under the Project.

Deletion: Optical cable (5-1-1 in Table 2-3) 31.1km

③ Equipments required for monitoring/control system

These are necessary for the system configuration of the monitoring/control system although not requested by BVK.

Addition: Equipment to be associated with the system (2-7, 2-8, 2-10, 2-11, 2-12, 2-13,4-4, 5-1-2-1, 5-1-2-4, 6-3, 6-4, 6-5, 6-6 in Table 2-3)

④ System/equipment to require authorization and/or permit from the local authorities.

The telecommunication system is required to comply with the local regulation and/or law and must be connected with the existing system. As it is difficult to procure this system by Japan side, this system shall be procured by BVK.

Deletion: Telecommunication system (5-2 in Table 2-3) 1 lot

⑤ Equipment out of the scope of the project

Although two atomic absorption spectrometers (AAS) both for potable water and wastewater are on the list of the request, one AAS for potable water shall be procured since the project purpose is focused on improvement of water supply.

Deletion: Atomic Absorption Spectrometer for wastewater (9-3-1 in Table 2-3)

(2) Equipment Plan

The scope of work for the Project is to procure the equipments categorized as the priority 1 and to install, commission and instruct SCADA (Supervisory Control and Data Acquisition) system. The equipment plan is made as below-mentioned;

1) Water Distribution Pump Station Equipment

The seven water distribution pump stations come under the Requested Japanese Assistance. The equipment required is pumps/motors, frequency inverters, soft starters, control cubicles, flaps and pressure transmitters. The pressure transmitters are also installed in the pump stations other than the above-mentioned seven pump stations and transmit signals of pressure from the pump stations.

This Requested Japanese Assistance aims at increase of the transmitted water flow rate from the water treatment plants and increase of the distributed water flow fate to the first, second, third and fourth distributed water zone by renewal of the pumps/motors located in the first distributed water zone mainly.

a) Pump and Motor

The pumps/motors located in the pump stations other than PS-18 aim at pumping water from the clean water reservoirs or distributed water reservoirs adjacent to the pump stations and transmitting/distributing water to the respective reservoirs or distributed water zones. PS-18 is required to pump water from the clean water culvert, which has the shape of tunnel, laid down from Banovo Brdo water treatment plant. Therefore, the pumps/motors located in PS-18 use vertical shafts because of low suction head as compared with the pump installation level.

Each pump uses low voltage motor (400 V). The primary power for the motors is stepped down to 400 V with the power transformer. This is why the low voltage motor can avoid being affected by harmonics from a frequency inverter or a soft starter.

i) Quantity

Table 2-4 Quantity of Pumps and Motors

Pump Station	No.	Capacity (L/s)	Head (m)	Motor Voltage (V)
PS-1a Bele Vode	1	167	160	400
	2	167	160	400
	3	167	160	400
PS-1b Bele Vode	1	400	90	400
	2	400	90	400
	3	400	90	400
	4	400	90	400
PS-18 Trasmajan	1	400	65	400
	2	400	65	400
	3	400	65	400
	4	400	65	400
PS-19 Bezanija	1	200	65	400
	2	200	65	400
	3	200	65	400
PS-23 Studentski Grad	1	500	70	400
	2	500	70	400
	3	500	70	400
	4	500	70	400
	5	500	70	400
PS-17 Zvezdara	1	120	80	400
	2	120	80	400
	3	120	80	400
PS-20 Zeleznik	1	240	150	400
	2	240	150	400

ii) Pump Shaft Power

The pump shaft power is calculated from the following formula written in "Guideline on Design for Water Facilities" issued by Japan Water Works Association.

Namely; $P = (0.163 \times \gamma \times Q \times H) / E$

Hereupon;

P : Pump Shaft Power Q : Pump Discharge Rate (m^3/min.)

γ : Unit Mass of Liquid (Kg/L) H : Total Head of Pump (m)

Table 2-5 Pump Shaft Power (per a pump)

Item of Pump	Pump Efficiency	Pump Shaft Power (KW)	Safety Factor (S.F.)	Motor Output (KW)
PS-1a Bele Vode	0.78	335.03	1.15	385.28
PS-1b Bele Vode	0.83	424.19.	1.15	487.82
PS-18 Transmajdan	0.80	317.85	1.15	365.53
PS-19 Bezanija	0.82	155.05	1.15	178.31
PS-23 Stu. Grad	0.82	417.44	1.15	480.05
PS-17 Zvezdara	0.78	120.37	1.15	138.42
PS-20 Zeleznik	0.77	457.25	1.15	525.83

iii) Specification for Pump

	For PS-1a,1b,17,19,20 & 23	For PS-18
Applicable Standard	: ISO 9905 & 9906	: ISO 9905 &9906
Type of Pump	: Horizontal double suction volute pump	: Vertical mix-flow pump
Connection with Motor	: Direct connection	: Direct connection
Synchronous Speed	: Max. 1,500 rpm	: Max. 1,500 rpm
Materials for Main Parts	: Casing-Cast iron	: Casing-Cast iron
	Impeller-Cast bronze	Impeller-Cast bronze
	Shaft-Carbon steel	Shaft-Carbon steel
	Sleeve-Cast bronze	Shaft-Cast bronze

The outline drawings of pumps are shown in the Drawing No. M-01 & M-02 respectively.

iv) Specification for Motor

	For PS-1a,1b,17,19,20 & 23	For PS-18
Applicable Standard	: IEC 60043 & 60072	: IEC 60043 & 60072
Type of Motor	: Open drip-proof 3 phase squirrel cage horizontal shaft induction motor	: Open drip-proof 3 phase squirrel cage vertical shaft induction motor
Rated Voltage	: 400 V	: 400 V
Frequency	: 50 Hz	: 50 Hz
Number of Pole	: 4	: 4
Insulation	: F class	: F class

The power rating of the motor shall be larger than the following;

- 115 % of the power input to the pump duty point (point of normal operation)
- Maximum power input while operating within system resistance curve considering more than 2 pumps operating in parallel

b) Frequency Inverter, Soft Starter and Control Cubicle

A frequency inverter adjusts motor speed by variation of frequency. A soft starter starts a motor with less starting current. In this Project, the frequency inverter has a function to control water flow rate by adjusting pump speed. When the discharge flow rate of the operating pump is required to increase or decrease to the adequate flow rate, it is possible to do it with frequency inverter by transmitting the pump discharge pressure and flow rate.

i) Quantity

Table 2-6 Quantity of Frequency Inverters, Soft Starters and Control Cubicles

Location of Pump	No.	Frequency Inverter	Soft Starter	Control Cubicle
PS-1a Bele Vode	1	1		1
	2		1	
	3		1	
PS-1b Bele Vode	1	1		1
	2		1	
	3		1	
	4		1	
PS-18 Trasmajan	1	1		1
	2		1	
	3		1	
	4		1	
PS-19 Bezanija	1	1		1
	2		1	
	3		1	
PS-23 Studentski Grad	1	1		1
	2	1		
	3		1	
	4		1	
	5		1	
PS-17 Zvezdara	1	1		1
	2		1	
	3		1	
PS-20 Zeleznik	1	1		1
	2		1	

ii) Specification for Frequency Inverter

Applicable Standard	:	IEC 61800
Rated Voltage, Phase, Frequency	:	400 V, 3 Phase, 50 Hz
Starting Duty	:	Not less than 30 starts per hour
Continuous Output	:	110 % at 1 minute
Output Frequency	:	0-50 Hz
Protection	:	Overload, overheat, phase imbalance
Input Signal	:	4-20 mA DC for speed control, start/stop contact
Output Signal	:	4-20 mA DC for speed, running/fault contact

iii) Specification for Soft Starter

Applicable Standard	:	IEC 60947
Rated voltage, Phase, Frequency	:	400 V, 3 phase, 50 Hz
Ramp Time during Start	:	1-30 seconds
Ramp Time during Stop	:	1-30 seconds
Level of Current Limit	:	100-400 % of motor current

Initial Voltage of Start	:	10-50 % of rated voltage
Protection	:	Overload, overheat, phase imbalance
Input Signal	:	Start/Stop contact
Output Signal	:	Running/Fault contact

iv) Specification for Control Cubicle

Applicable Standard	:	IEC 60439
Type	:	Indoor use metal-enclosed self-standing or wall mounting, dust and vermin proof type
Components	:	MCCB, Push button, Indication lamp, Selector switch, Control relay, Timer, Buzzer, Terminal block, etc.

c) Flap Gate (Check Valve) for Water Distribution Pump Station

i) A flap gate is installed at the pump discharge pipeline and prevents the reverse flow. A flap gate is used to avoid closing valve rapidly after pump stops. However, when the pump stops, the flap gate alone cannot avoid shock wave. Accordingly the existing surge vessel complements the flap gate.

Table 2-7 Quantities of Flaps

Pump Station	Quantity	Size (mm)
PS-1a	3	250
PS-1b	2 2	250 450
PS-18	1 3	350 400
PS-19	3	300
PS-17	1 2	200 250
PS-17a	3	300
PS-20	3	300

ii) Specification for Flap (Check Valve)

Applicable Standards	:	AWWA, JIS or other international standard
Type	:	Swing type with counter-weight
Materials of Main Parts	:	Casing - cast iron or ductile iron or cast steel Disc - cast iron or ductile iron or cast steel Spindle - stainless steel

The outline & sectional drawing for check valve is shown in the Drawing No. M-03 of Basic Design Drawings.

d) Pressure transmitter

A pressure transmitter transmits a signal of pressure measured with a pressure indicator on the pump discharge pipeline. A pressure signal is transmitted to the main control station and used to control a pump.

i) Quantity

Table 2-8 Quantity of Pressure Transmitters

Location of Equipment	Quantity	Pump Rated Pressure (bar)	Measuring Span (bar)
PS-1a	3	15.7	0-25
PS-1b	4	8.8	0-16
PS-4	3	6.9	0-16
PS-15	3	6.9	0-16
PS-15a	4	12.3	0-25
PS-16	3	6.4	0-16
PS-16a	4	11.8~12.9	0-25
PS-18	5	6.4	0-16
PS-19	2	6.4~8.6	0-16
PS-23	5	6.9	0-16
PS-25	3	14.2	0-25
PS-25a	3	8.0	0-16
PS-28	2	10.8~14.1	0-25
PS-28a	4	5.1~6.3	0-16
PS-5	2	5.9	0-25
PS-17	3	7.8	0-16
PS-17a	3	8.0	0-16
PS-21	3	6.4	0-16
PS-20	3	14.7	0-25
PS-26	3	15.6~17.0	0-25
PS-33	2	26.1~26.5	0-40
PS-3	3	3.3~4.4	0-16
PS-6	2	3.9	0-16
PS Lesce	3		0-16

ii) Specification for Pressure Transmitter

Applicable Standard	:	IEC
Type	:	Water-proof
Mounting	:	Stem mounting
Case	:	Stainless steel
Power Supply	:	DC 24 V
Output Signal	:	4-20 mA DC, 2 wires
Accuracy	:	Not more than +/- 1.0 FS

Accessory	:	Connecting valve
Pressure Range	:	0-16 bar (49 sets)
		0-25 bar (24 sets)
		0-40 bar (2 sets)

2) Residual Chlorine Analyzer for Reservoir

A residual chlorine analyzer measures concentration of residual chlorine in a reservoir. The residual chlorine in water shows that clean water is disinfected by chlorine. When residual chlorine in water is little, the water is subjected to have a problem on safety. On the other side, when it is much, it is uncomfortable as drinking water due to strong odor of chlorine. By measuring residual chlorine in a reservoir, the chlorine injection rate at the water treatment plant can be controlled. In this Project, the concentration of residual chlorine is only transmitted and monitored at the main control station. The central control station can give direction for the adequate chlorine injection rate to each water treatment plant based on this measuring data.

a) Quantity

Table 2-9 Quantity of Residual Chlorine Analyzers

Location of Equipment	Equipment Name	Quantity
Reservoirs	Residual Chlorine Analyzer	20

b) Specification for Residual Chlorine Analyzer

Method of Analysis	:	DPD (Diethyle Phenylene Diamine)
Measuring Range	:	0-5 mg/L
Accuracy	:	+/- 5 %
Minimum Detection Limit	:	0.035 mg/L
Cycle Time	:	2.5 minutes
Sample Flow	:	200-500 mL/min.
Output	:	4-20 mA

3) SCADA (Supervisory Control and Data Acquisition) System

The SCADA (Supervisory Control and Data Acquisition) system means monitoring, control and data accumulation system. In this Project, the SCADA system is designed so that the following work can be done;

① The system aims at controlling the water distribution pumps adequately. The main control room monitors each pump discharge pressure and flow rate, grasps operation status of the pumps, and controls the pumps through local staffs at the pump stations.

② The local control centers located at the water treatment plants can monitor operation status of well pumps and control the well pumps remotely.

③ By measuring and monitoring residual chlorine in the reservoir, the main control center can control chlorine injection rate through local staffs at the water treatment plants.

④ The main control center and the local control centers can accumulate and analyze the data.

The facilities to be monitored and/or controlled by the SCADA system under this Project are shown in Drawing 2-1and Table 2-10.

Legend

Reservoir

Water Treantment Plant

Pump Station

Red: Scope of SCADA System

Reservoir 20 Places (Monitoring)

Water Treatment Plant 4 places (Local Control Center)
Note: Main Control Center is located in BVK head office.

Pump Station (Monitoring)

Pump Station (Monitoring) / Pump Renewal

275 m

225 m

225 m

175 m

175 m

125 m

125 m

75 m

R Drazanovac

R Srednji kraj

WT Lipovica

R Guncati

Booster Kumodraz

R Kumodraz

To R. "Spomenik stari" and "Spom. Novi"

Ripanjski put

Plandište

IV PRESSURE ZONE

R Lesce

R Stojicino brdo

"Torlak" CS 22

R Torlak

"Avala" CS 33

R Suplja stena

VT Kosutnjak

Crpna stanica Lipovica CS 30

R.Lipovica

Hidrofo Mirijevo IV

III PRESSURE ZONE

Settlement Gaj

Settlement Ravni

Zvezdara CS 17

R Zvezdara

M.Brdo IV CS 25a

M.Brdo III CS 25

R Mokrolusko brdo

Dedinje CS 10

R Dedinje

"Ripanj" CS 26

R. Petlovo brdo

R Barajevo

booster "Sr.kraj"

II PRESSURE ZONE

CS Lesce

"Pionir" CS 21

R Topciderska Zvezda

R Pionir

"Crv.Krst" CS 4

R.Glavni

Buster Glavni

CS 5

R Krajinski

Zark.III CS 28a

Zark.II CS 28

R Zarkovo

Kosutnjak CS 24

"Zeleznik" CS 20

R Zeleznik

R Umka

booster Umka

I PRESSURE ZONE

"Bezanija" CS 19

CS 19a

"Stud.grad" CS 23

CS 18a

"Tasmajdan" CS 18

"Vracar II" CS 16a

"Vracar I" CS 16

"Topcider II" CS 15a

"Topcider I" CS 15

"Makis BB" CS 27

"Makis-Za" CS 27a

Vincacista CS 31

"Bele Vode II" CS 1a

"Bele Vode I" CS 1b

PP Bezanija

PS Surcin

CS 3

CS 3a

f 1200 mm Underneath river Sava (R42-R2m)

PP Banovo brdo

PP Makis (Makis + Jezero)

CS 6 (Vinca)

PP Bele Vode

BVK Head Office (Main Control Center)

WT Progar

Water Intake Well : 97wells (Monitoring & Control)

Ranney wells 2 - 22 Usce-NoviBeograd

Ranney wells 35-38 Blok45-Galovica

Ranney wells 40 - 51 Galovica-Ostruz.most

Ranney wells63-98 Jakovo,Boljevci,Progar

Ranney wells 8a - 7 Makisko polje

Ranney wells 18 - 20 Ada ciganlija

CS Sava (Water intake)

Ranney wells 3-2m

CS Sabacka

LEFT BANK GROUND WATER SOURCE

RIGHT BANK GROUND WATER SOURCE

RIVER Sava

Figure 2-1 Scope of SCADA System

a) Quantity

Table 2-10 Quantity of SCADA Equipment

No.	Location of SCADA Equipment	SCADA Equipment																	
		WEB Server	SQL Server	Master SCADA	Local SCADA	DC Server	Monitor /HMI	50" Display	Printer	UPS	GPRS Server	GPRS Modem	SHDSL Router	Layer 3 SW	Layer 2 SW	Media Conv.	PLC	Touch Panel	TN Server
1	Main Control Center(Deligradska)	1	2	1		1	2	4	1	1	1	1	1		1	1			
2	Local Control Center(Bezanija)		1			1	1		1	1	1	1	1	1		1			
3	Local Control Center(Banovo Brdo)		1			1	1		1	1	1	1	3	1					1
4	Local Control Center(Makis)		1				1		1	1	1	1	1	1		1			
5	Local Control Center(Bele Bode)				1		1		1	1		1	2	1		1			
	Relay Station - Kneza Milosa												11			1			
	Relay Station - Kosutnjak															1			
6	PS 1a - Bele Vode											1			1	1	1	1	
7	PS 1b - Bele Vode											1					1	1	
8	PS 3 - Surcin											1					1	1	
9	PS 4 - Crveni Krst				1		1		1	1		1	1		1		1	1	
10	PS 5 - Teo dora Drajzera											1	1		1		1	1	
11	PS 6 - Dunav				1		1		1	1		1			1		1	1	
12	PS 10 - Dedinje				1		1		1	1		1	1		1				
13	PS 15 - Topcider				1		1		1	1		1	1		1	1	1	1	
14	PS 15a - Topcider											1			1	1	1	1	
15	PS 16 - Vracar				1		1		1	1		1	1		1	1	1	1	
16	PS 16a - Vracar											1			1	1	1	1	
17	PS 17 - Zvezdara				1		1		1	1		1	1		1		1	1	
18	PS 17a - Zvezdara											1					1	1	
19	PS 18 - Tasmajdan				1		1		1	1		1	1		1		1	1	
20	PS 19 - Bezanija											1			1	1	1	1	
21	PS 20 - Zeleznik				1		1		1	1		1	2		1		1	1	
22	PS 21 - Pionir				1		1		1	1		1	1		1		1	1	
23	PS 22 - Torlak											1			1		1	1	
24	PS 23 - Studentski Grad				1		1		1	1		1	2		1		1	1	
25	PS 24 - Kosutnjak											1			1	1	1	1	
26	PS 25 - Mokrolusko Brdo				1		1		1	1		1			1		1	1	
27	PS 26 - Ripanj											1					1	1	
28	PS 27 - Makis Cista Voda				1		1		1	1		1			1	1			
29	PS 28 - Zarkovo				1		1		1	1		1			1		1	1	
30	PS 30 - Lipovica				1		1		1	1		1	1		1				
31	PS 33 - Avala											1					1	1	
32	- Lesce											1					1	1	
33	Well Pumps (99 Sites)											97					50		
34	Reservoirs (20 Sites)											20					20		
	TOTAL	1	5	1	15	3	20	4	19	19	4	149	32	4	22	14	94	24	1

b) Specification for SCADA System

i) System Configuration

The system configuration for the SCADA system is shown on the Drawing No. S-1 in Basic Design Drawings.

The locations where SCADA system shall be installed are as follows;

Name of location	Number of locations
- Main control center (MCC)	1
- Local control center (LCC)	4 (Bezanija, Banov Brdo, Makis, Vele Bode)
- Water distribution pump station (PS-A)	14

The locations where data for SCADA system shall be collected are as follows;

- Water distribution pump station (PS-B)	13
- Well pump station (Well Pump)	99
- Water Reservoir (Reservoir)	20

ii) Data Transmission System

The data transmission shall be carried out by 3 telecommunication systems as follows;

- Wireless system-GPRS (General Packet Radio Service)
- Wireless system-WLL (Wireless Local Loop)
- Wired system-SHDSL (Symmetric Hierarchy Digital Subscriber Line)

These telecommunication systems shall be constructed by BVK.

The telecommunication system to be used at each location is shown on the Drawing No. S-2 in Basic Design Drawings.

iii) Main Function of SCADA System

The SCADA system mainly has the following functions;

(a) Human machine interface (HMI)

The man-machine interface shall have full-graphic technology with proprietary windows based supervisory, control and data acquisition (SCADA) software. Interface activities shall be made with tool bar, dialog box and icon operations using a mouse and keyboard through windows. The main graphical supervision shall include the displays with

operational status, process data, etc. for wide-area and medium-area under jurisdiction of each LCC and each PS.

(b) Data acquisition

Digital and analogue data of various signals collected from each facility shall be stored in the database for mentoring real-time operations, trend graphs, engineering analysis and report. The history of operation and trouble shall be displayed in a chronological list with date and time-stamped message.

(c) Real-time control for well pumps

Remote operation and supervision for well pumps shall be made. The sixty-two well pumps located in left bank of River Sava are operated and supervised from LCC (Bezanija) and Thirty-seven well pumps located in the right bank from LCC (Banovo Brdo).

(d) Historical information system

The SCADA system shall be provided with the capability to make out historical trend graph and daily, monthly, and annual report. These reports shall be made out and printed by efficient and easy-to-use software tools.

iv) Main functions of servers and PLC(Programmable Logic Controller)

The severs and PLC to be used with the SCADA system shall have functions as follows;

(a) GPRS server (MCC, LCC-Bezanija/Banovo Brdo/Makis)

The GPRS server collects real-time data from PLC connected with the GPRS network. Well pumps are controlled by the server's remote control commands. The server is also used as a relay server between GPRS and Ethernet communication. The collected data are relayed to the SCADA server in LCC.

System Configuration:

- Slave PLC: OMRON Model CQM1H (Serial Communication Board)
- Data sampling rates: every minute or more (each facility)
- Communication system between PLC and GPRS sever: GPRS network(64Kbps)
- Communication system between SCADA and GPRS server: TCP/IP Socket

(b) Local SCADA server (LCC, PS-A)

The local SCADA server receives data directly from GPRS server or PLC connected with GPRS network and sends all data to the master SCADA server in MCC (upper level transmission) and the collected real-time data can be stored in this server.

The local SCADA server can access and display other facilities besides its own.

System Configurations:

- Data sampling rate (upper level transmission): every ten seconds
- Data sampling rate (lower level transmission): every second
- Communication system: TCP/IP socket

The local SCADA severs to be located at LCC (Bezanija, Banovo Brdo, Makis) shall be included in the respective SQL severs.

(c) Master SCADA server (MCC)

The master SCADA server can store all data, and has function to manage the SCADA system as a master and to distribute data to the local SCADA servers in LCC and PS. In addition, the master SCADA server can automatically make out daily, monthly and annual reports from the collected data.

System Configurations:

- Data sampling rate: every ten seconds
- Communication system: TCP/IP socket
- Report data storage period: ten years
- Report data form: Microsoft EXCEL XP

(d) DN server (MCC, LCC-Bezanija/Banovo Brdo)

The domain name server has function for domain name system so that domains can correspond to IP addresses.

(e) TN server (LCC-Banovo Brdo)

The telecommunication network server supervises the connection status of the digital network such as SHDSL, WLL and Ethernet.

(f) SQL server (MCC, LCC-Bezanija/Banovo Brdo/Makis)

The SQL server stores the last one-year data of the facilities collected from the master SCADA server in MCC. These stored data are sent to each SCADA HMI.

System Configurations:

- Process data storage period: one year
- Historical data storage period: one year
- Standard server software: Microsoft SQL Server 2000

(g) WEB server (MCC)

The WEB server makes reference to data stored at the master SCADA server and SQL servers in MCC, and distributes them onto WEB. The WEB server has function to announce alarm by using e-mails or SMS when it occurs.

(h) Programmable Logic Controller (PS-A, PS-B, Well Pumps, Reservoirs)

PLC shall be used to receive process data from well pumps, water distribution pump stations, reservoirs and measuring points. These process data shall be transmitted to the servers through the network.

Currently BVK is using OMRON CQM1H type PLC to collect the process data from a part of well pumps and PS.

Therefore these existing PLC shall be interfaced with this SCADA system.

The PLC input/output (I/O) requirement is shown on the Drawing No.S-3 in Basic Design Drawings.

v) Particular Specification of SCADA equipment

The equipment list of SCADA system is shown on the Drawing No.S-2.

All equipment, control desk, rack, etc. shall be of high-performance and heavy-duty type designed for continuous industrial service. The system shall contain products of a single manufacturer, as far as possible, and shall consist of equipment models which are currently in production.

(a) Control Desk

Type	:	Indoor use, office desk type
Accessory	:	2-chair
Equipment to be installed	:	Refer to Drawing No. S-1

(b) Server Rack

Type	:	Indoor use, computer rack type
Accessory	:	Socket outlet
Equipment to be installed	:	Refer to Drawing No. S-1

(c) Interface Panel

Type	:	Indoor use, Metal-enclosed, self or wall mounting type

Main parts per unit	:	1 set of MCCB 1 set of Isolator for I/O signal 1set of Arrestor 1 set of I/O relay 1 set of DC power supply unit 1 set of PLC, refer to item viii) 1 set of Touch Panel, refer to item xiv) 1 set of GPRS modem, refer to item xv) 1 set of other necessary parts

(d) Master SCADA Server/Local SCADA Server

CPU	:	Pentium4 2.8GHz
Memory	:	1GB (with ECC)
HDD	:	250GB (with RAID 1)
CD-ROM	:	24xCD-ROM/RW
Network Interface	:	100Base-TX
Operating System	:	Windows 2003 Server

(e) SQL Server

CPU	:	Pentium4 2.8GHz
Memory	:	1GB (with ECC)
HDD	:	250GB (with RAID 1)
CD-ROM	:	24xCD-ROM/RW
Network Interface	:	100Base-TX
Operating System	:	Windows 2003 Server

(f) WEB Server

CPU	:	Pentium4 2.8GHz
Memory	:	1GB (with ECC)
HDD	:	250GB (with RAID 1)
CD-ROM	:	24xCD-ROM/RW
Network Interface	:	100Base-TX
Operating System	:	Windows 2003 Server

(g) DN Server

CPU	:	Pentium4 2.8GHz
Memory	:	512MB

HDD	:	60GB
CD-ROM	:	24xCD-ROM/RW
Network Interface	:	100Base-T

(h) TN Server

CPU	:	Pentium4 2.8GHz
Memory	:	512MB
HDD	:	60GB
CD-ROM	:	24xCD-ROM/RW
Network Interface	:	100Base-T

(i) GPRS Server

CPU	:	Pentium4 2.8GHz
Memory	:	512MB
HDD	:	60GB
CD-ROM	:	24xCD-ROM/RW
Network Interface	:	100Base-T

(j) SCADA HMI

CPU	:	Pentium4 2.8GHz
Memory	:	512MB
HDD	:	160GB
CD-ROM	:	24xCD-ROM/RW
Network Interface	:	100Base-TX
Software		
Operating System	:	Windows XP
Application	:	Office XP

(k) TFT Monitor

Type	:	TFT
Size	:	Not less than 15 inch
Resolution	:	1,280 x 1,024

(l) Plasma Display

Type	:	PDP (RGB input port)
Size	:	50 inch
Resolution	:	1,280 x 768

(m)Leaser Printer (MCC)

Type	:	Color laser beam
RAM size	:	96MB
Resolution	:	Approx.9,600x 600dpi
Paper size	:	A3, A4
Network interface	:	100Base-TX

(n) Ink-jet Printer (LCC, PS-A)

Type	:	Color inkjet type
Paper size	:	A4
Resolution		Approx.2,400 x 1,200dpi
Network interface	:	USB

(o) SHDSL Router

Type	:	Network layer (3)
Computer interface	:	100Base-TX

(p) GPRS Modem

Type	:	Industrial GPRS modem
Interface	:	RS232C

(q) Layer 3 Switch

Type	:	Network layer (3)
Computer interface	:	100Base-TX
Nos. of port	:	Not less than 8

(r) Layer 2 Switch

Type	:	Data-link layer (2)
Computer interface	:	100Base-TX
Nos. of port	:	Not less than 8

(s) Media Converter

Computer interface	:	100Base-TX
Fiber cable interface	:	100Base-FX

(t) Server Console Switch

Type	:	Mechanical switch
Nos. of port	:	Not less than 8

(u) Touch Panel

Type	:	Color TFT
Resolution	:	800 x 600 dots

(v) Programmable Logic Controller (PLC)

CPU	:	14.4kB
I/O unit	:	Digital and Analogue
Nos. of I/O point	:	Refer to I/O list
Interface	:	RS-232C/RS-422

(w) Uninterruptible Power Supply (UPS)

Type	:	Battery back-up type
Capacity	:	1, 2 or 3kVA
Input	:	AC230V, 50Hz
Output	:	AC230V, 50Hz
Back-up time	:	20 minutes
Interface	:	RS232C

4) Laboratory Equipment

a) Quantity

Table 2-11 Quantity of Laboratory Equipment

Name of Equipment	Quantity
Chemical laboratory Equipment	
Atomic Absorption Spectrometer	1
Total organic Carbon Analyzer	1
UV-VIS Spectrometer	1
Microbiological Equipment	
Autoclave	1
Microscope	1

b) Specification for Laboratory Equipment

i) Automatic Absorption Spectrometer

Type	:	Real-time double-beam optical system
Wavelength Range	:	190-900 mm
Number of Grating Grooves	:	1800 lines/mm blazed at 200 nm
Grating Dimension	:	40 x 40 mm

Reciprocal Linear Dispersion	:	2.0 nm
Focal Length	:	298 mm
Spectral Bandwidth	:	0.2, 0.7 and 2.0 nm, motorized slit drive for automatic slit selection
Background Correction	:	High speed self reversal method or Zeeman method
Accessories	:	Flame module, graphite furnace module, furnace auto-sampler, hallow cathode lamp, data processing unit, circulated cooling water unit, mercury vaporization unit, hydride vapor generator unit, gas and pressure regulator unit, etc.

ii) Total Organic Carbon Analyzer

Measurement Method	:	680 degree C combustion catalytic oxidation
Measured Items	:	TC, IC, TOC, NPOC, TN
Applicable Samples	:	Aqueous sample
Measurement Range	:	TC 0 to 25000 micron g/L, IC 0 to 30000 micron g/L
Detection Limit	:	4 micron g/L
Measurement Accuracy	:	CV 1.5 % max.
Measuring Time	:	TC approx. 3 minutes
Sample Injection	:	Automatic
Sample Injection Volume	:	10 to 2000 micron L
IC Pre-treatment	:	Automatic internal acidification and sparging
Automatic Dilution	:	Dilution factor 2 to 50
Accessories	:	TN (Total Nitrogen) unit, carrier gas purification unit, data processing unit, etc.

iii) UV-VIS Spectrometer

Wavelength Range	:	190-1100 nm
Wavelength Display	:	0.1 nm step
Photometric System	:	Double beam optics
Spectral Bandwidth	:	2 nm
Wavelength Accuracy	:	+/- 1.0 nm
Stray Light	:	Less than 0.05 %
Accessories	:	Data processing unit, 10mm silica sell, etc.

iv) Autoclave

Capacity	:	85 liter
Max. Working Pressure	:	0.26 MPa
Working Temperature Range	:	105-135 degree C

Accessories	:	Timer, pressure gage, safety unit, forced cooling water unit, printer, basket, etc.

v) Microscope

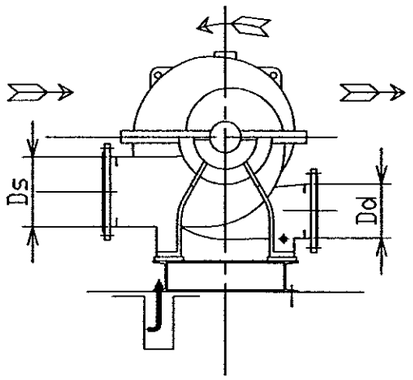
Optical System	:	Infinity corrected optical system
Parfocal Distance	:	60 mm
Magnification	:	100X-1000X for observation
Eyepiece Tube	:	Trinocular eyepiece tube, F.O.V. 22/25mm, siedentopf type, interpupillary distance 50-70mm with TV tube for TV adapter
Eyepiece Lens	:	Widefield 10X (F.O.V. 22mm) with diopter adjustment (2 pcs)
Objective Lens	:	Plan fluor 10X, N.A. 0.30, W.D. 16mm Plan fluor 20X, N.A. 0.50, W.D.2.1mm, spring-loaded Plan fluor 40X, N.A. 0.75, W.D.0.72mm, spring-loaded Plan fluor 100X, N.A. 1.30, W.D. 0.20mm, oil immersion spring-loaded
Nosepiece	:	Sextuple DIC nosepiece
Coarse/Fine Focusing	:	Fine-0.1mm per rotation, coarse-14mm per rotation
Accessories	:	Digital camera system, vinyle dust cover, precentered lamphouse, power cord, halogen lamp, immersion oil, etc.

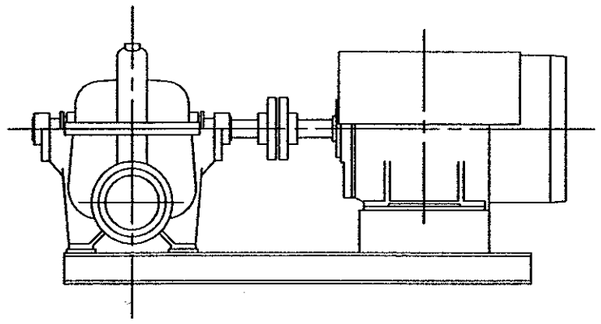
2-2-3 Basic Design Drawings

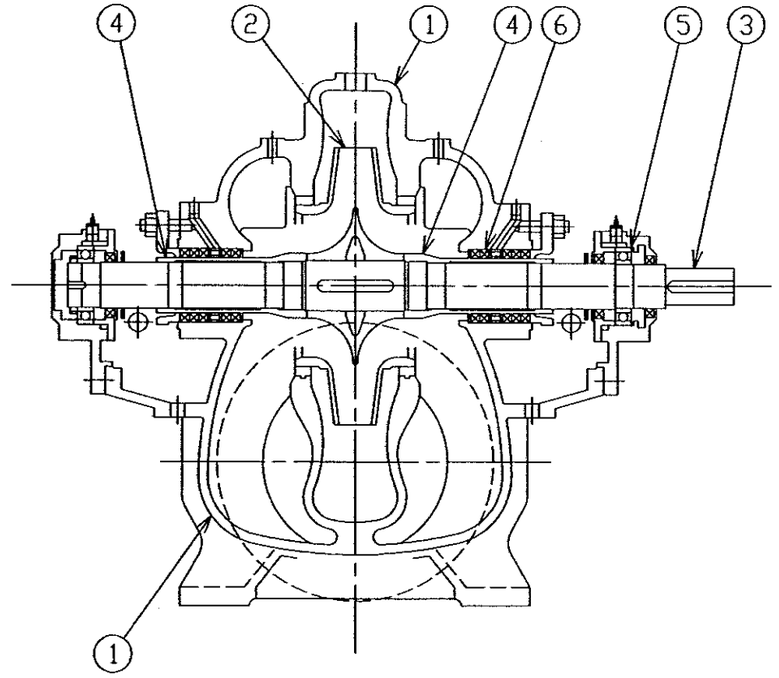
As the result of basic design, the following drawings and tables were prepared;

Table 2-12 Basic Design Drawings

Title of Drawing or Table	Drawing Number
Pump Outline & Sectional Drawing	2-2
Pump Outline & Sectional Drawing	2-3
Valve Outline & Sectional Drawing	2-4
Single Line Diagram for Pump Station	2-5
SCADA System Configuration	2-6
Equipment List for SCADA system	2-7
Input/Output List for SCADA	2-8







No.	PARTSNAME	MATERIAL
1	CASING	CAST IRON
2	IMPELLER	BRONZE
3	SHAFT	CARBON STEEL
4	SLEEVE	BRONZE
5	BALL BEARING	-
6	GLAND PACKING	-

LOCATION	PUMP Q'TY	CAPACITY(L/S)	HEAD(m)	Ds	Dd
PS-1A BELE VODE	3	167	160	300	200
PS-1B BELE VODE	4	400	90	400	300
PS-19 BEZANIJA	3	200	65	300	200
PS-23 STU. GRAD	5	500	70	450	350
PS-17 ZVEZDARA	3	120	80	250	150
PS-20 ZELEZNIK	2	240	150	300	200

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THE BASIC DESIGN STUDY ON THE PROJECT FOR IMPROVEMENT OF WATER SUPPLY SYSTEM

Title: Pump Outline & Sectional Drawing | Scale: 1:NON

October 2004 | Drawing No.: M-01

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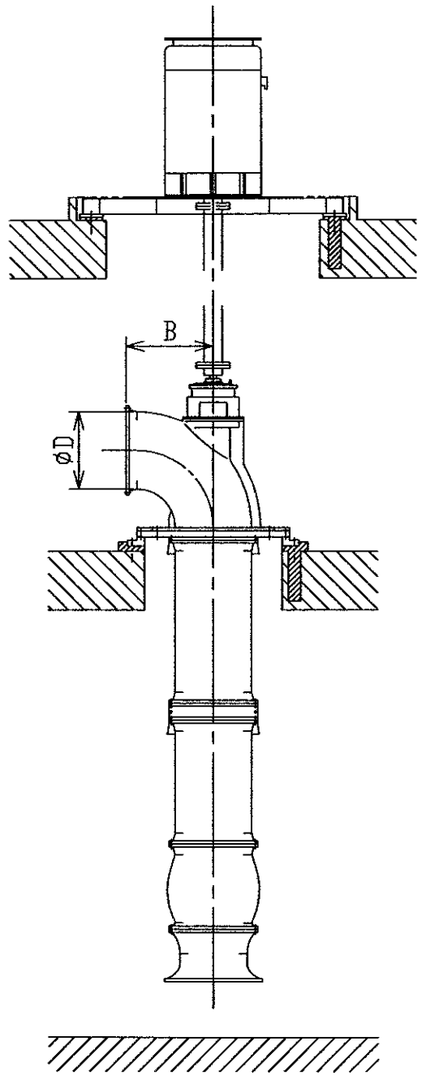
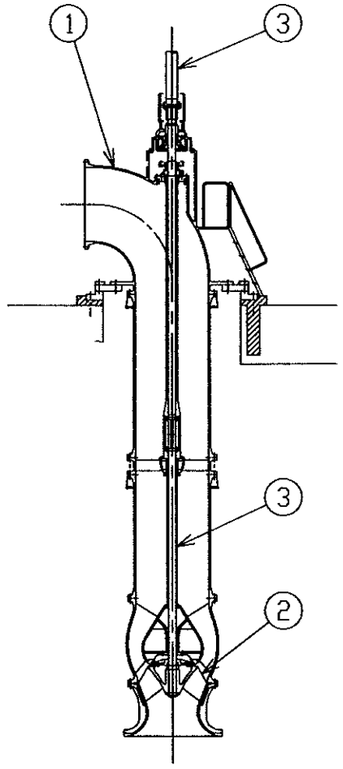
Figure 2-2 Pump Outline & Sectional Drawing





No.	PARTSNAME	MATERIAL
1	CASING	CAST IRON
2	IMPELLER	BRONZE
3	SHAFT	CARBON STEEL

LOCATION	PUMP Q'TY	CAPACITY(L/S)	HEAD(m)	OUTOUT(kW)	B	D
PS-18 TRASMAJDAN	4	400	65	400	500	400

NOTE: DIMENSION IN THE TABLE ARE FOR REFERENCE ONLY.

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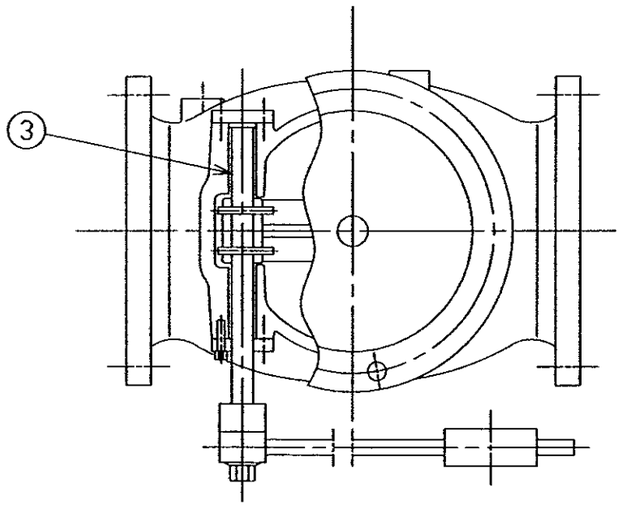
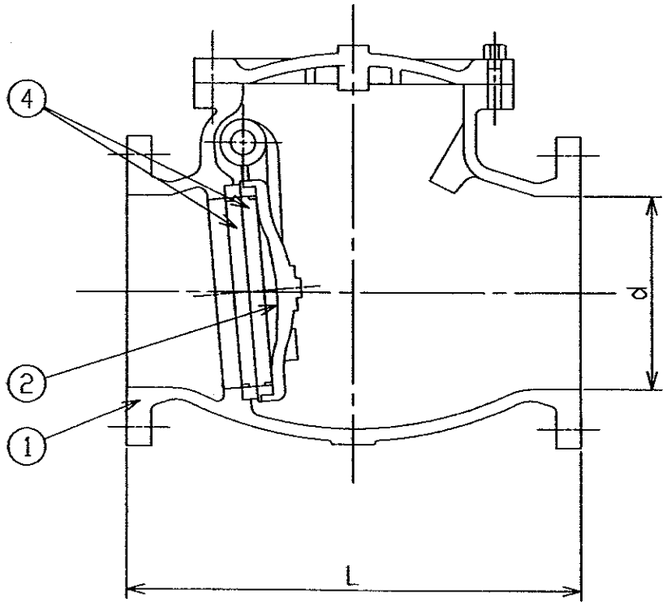
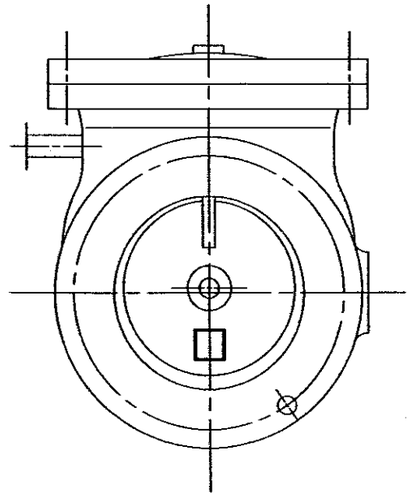
THE BASIC DESIGN STUDY ON THE PROJECT FOR IMPROVEMENT OF WATER SUPPLY SYSTEM	
Title: Pump Outline & Sectional Drawing	Scale: 1:NON
October 2004	Drawing No.: M-02
JAPAN INTERNATIONAL COORERATION AGENCY	

Figure 2-3 Pump Outline & Sectional Drawing



LOCATION	d	L
PS-1A BELE VODE	250	540
PS-1B BELE VODE	250	540
	450	850
PS-18 TRASMAJDAN	350	680
	400	750
PS-19 BEZANIJA	300	620
PS-17 ZVEZDARA	200	500
	250	540
PS-17a –	300	620
PS-20 ZELEZNIK	300	620





No.	PARTSNAME	MATERIAL
1	VALVE BODY	CAST IRON OR DUCTILE IRON OR CAST STEEL
2	VALVE DISK	CAST IRON OR DUCTILE IRON OR CAST STEEL
3	SPINDLE	STAINLESS STEEL
4	SEAT	BRONZE

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THE BASIC DESIGN STUDY ON THE PROJECT FOR IMPROVEMENT OF WATER SUPPLY SYSTEM

Title: Valve Outline & Sectional Drawing | Scale: 1:NON

October 2004 | Drawing No.: M-03

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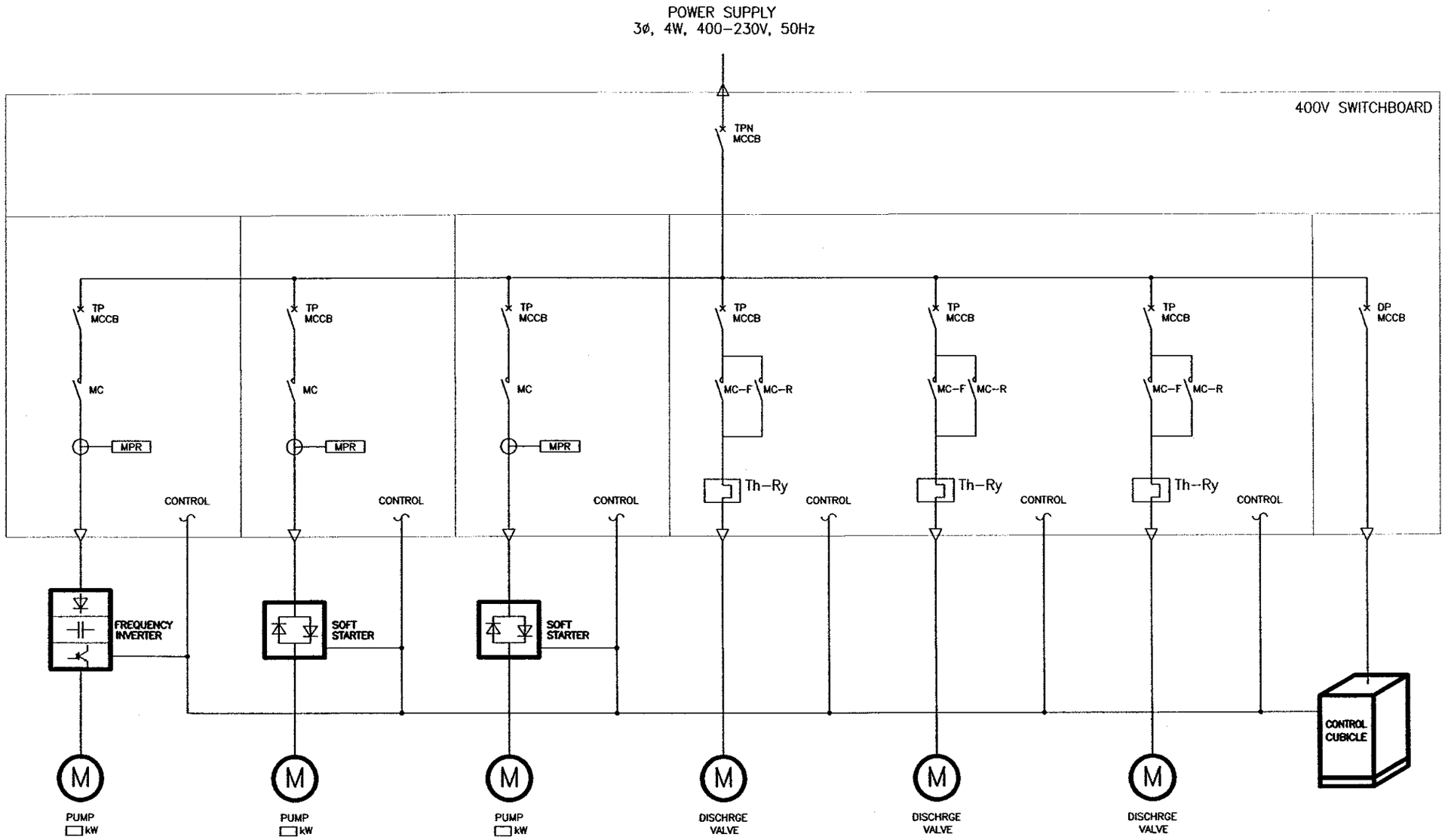
Figure 2-4 Valve Outline & Sectional Drawing



1) Scope of Japan side
- Supply of frequency inverter, soft starter, control cubicle, and motor.

2) Scope of BVK side
- Installation of equipment to be provided by Japan side.
- Supply and installation of 400V switchboard.
- Cabling work of power supply and control between control cubicle and each equipment.

CITY ASSEMBLY OF BELGRADE BELGRADE WATERWORKS AND SEWERAGE SERBIA AND MONTENEGRO	
THE BASIC DESIGN STUDY ON THE PROJECT FOR IMPROVEMENT OF WATER SUPPLY SYSTEM	
Title: Single Line Diagram For Pump Station	Scale:
October 2004	Drawing No.: E-01
JAPAN INTERNATIONAL COORERATION AGENCY	

Figure 2-5 Single Line Diagram for Pump Station

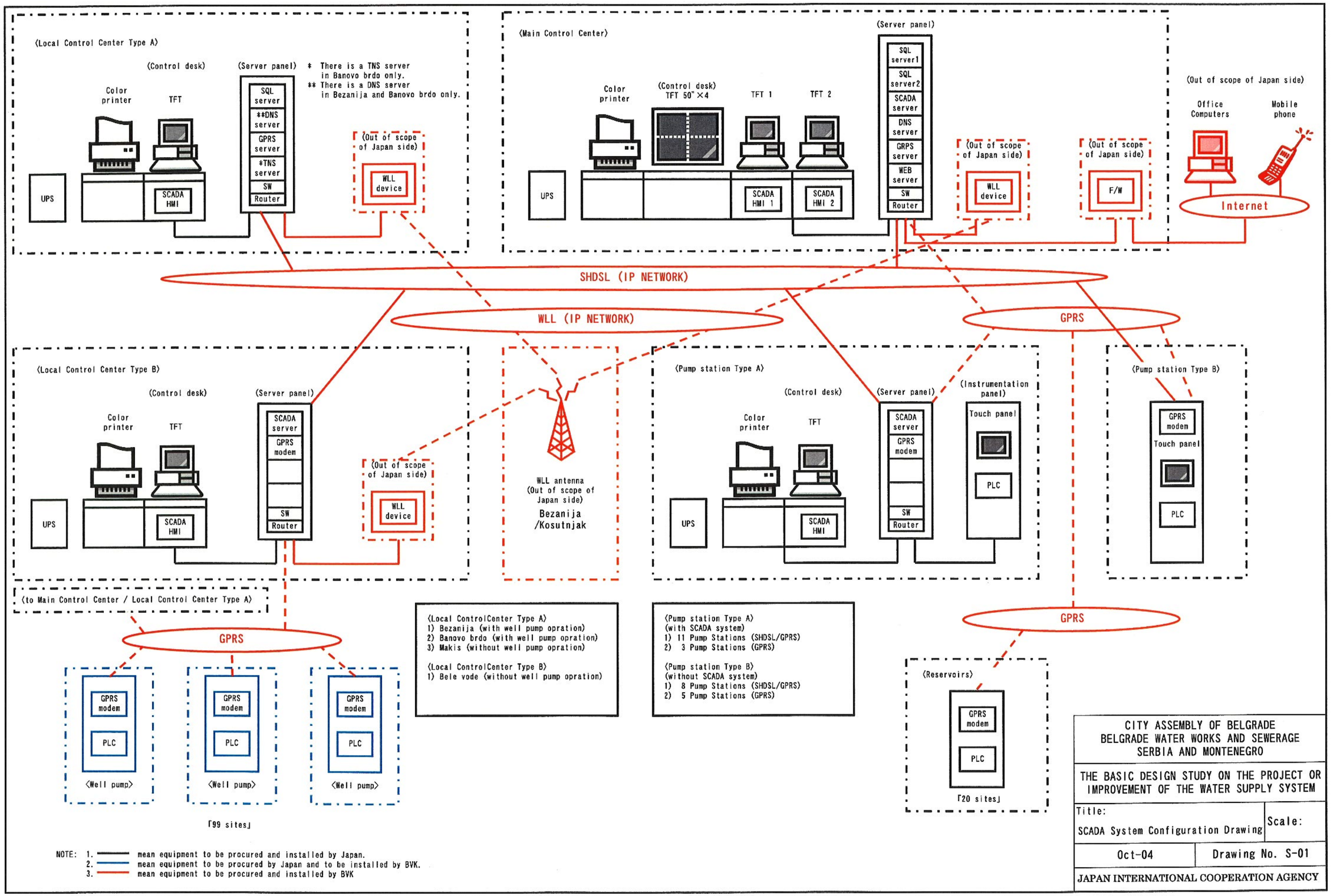


Figure 2-6 SCADA System Configuration Drawing

Equipment List for SCADA System

No.	Location of Equipment	Equipment for SCADA System																		Telecommunication Sys.			Remarks
		WEB Server	SQL Server	Master SCADA	Local SCADA	DC Server	Monitor /HMI	50" Display	Printer	UPS	GPRS Server	GPRS Modem	SHDSL Router	Layer 3 SW	Layer 2 SW	Media Conv.	PLC	Touch Panel	TN Server	Others	SHDSL	WLL	GPRS	
1	Main Control Center(Deligradska)	1	2	1		1	2	4	1	1	1	1	1		1	1				2*1	o	o	o	
2	Local Control Center(Bezanija)		1			1	1		1	1	1	1	1	1		1				2*1	o	o	o	
3	Local Control Center(Banovo Brdo)		1			1	1		1	1	1	1	3	1					1	2*1	o	o	o	
4	Local Control Center(Makis)		1				1		1	1	1	1	1	1		1				2*1	o	o	o	
5	Local Control Center(Bele Bode)				1		1		1	1		1	2	1		1				2*1	o	o	o	
	Relay Station - Kneza Milosa												11			1					o			BVK to provide Layer3 SW
	Relay Station - Kosutnjak															1					o	o		BVK to provide Layer2 SW
6	PS 1a - Bele Vode											1			1	1	1	1		1*2	o	o	o	SHDSL & WLL to be made via LCC Bele Bode.
7	PS 1b - Bele Vode											1					1	1		1*2	o	o	o	
8	PS 3 - Surcin											1					1	1		1*2			o	
9	PS 4 - Crveni Krst				1		1		1	1		1	1		1		1	1		3*3	o		o	
10	PS 5 - Teo dora Drajzera											1	1		1		1	1		1*2	o		o	
11	PS 6 - Dunav				1		1		1	1		1			1		1	1		3*3			o	
12	PS 10 - Dedinje				1		1		1	1		1	1		1					2*1	o		o	Existing PLC to be used.
13	PS 15 - Topcider				1		1		1	1		1	1		1	1	1	1		3*3	o		o	
14	PS 15a - Topcider											1			1	1	1	1		1*2	o		o	SHDSL to be made via PS 15.
15	PS 16 - Vracar				1		1		1	1		1	1		1	1	1	1		3*3	o		o	
16	PS 16a - Vracar											1			1	1	1	1		1*2	o		o	SHDSL to be made via PS 16.
17	PS 17 - Zvezdara				1		1		1	1		1	1		1		1	1		3*3	o	o	o	
18	PS 17a - Zvezdara											1					1	1		1*2	o		o	SHDSL to be made via PS 17.
19	PS 18 - Tasmajdan				1		1		1	1		1	1		1		1	1		3*3	o		o	
20	PS 19 - Bezanija											1			1	1	1	1		1*2	o		o	
21	PS 20 - Zeleznik				1		1		1	1		1	2		1		1	1		3*3	o		o	
22	PS 21 - Pionir				1		1		1	1		1	1		1		1	1		3*3	o		o	
23	PS 22 - Torlak											1			1		1	1		1*2		o	o	
24	PS 23 - Studentski Grad				1		1		1	1		1	2		1		1	1		3*3	o		o	
25	PS 24 - Kosutnjak											1			1	1	1	1		1*2	o		o	
26	PS 25 - Mokrolusko Brdo				1		1		1	1		1			1		1	1		3*3			o	
27	PS 26 - Ripanj											1					1	1		1*2			o	
28	PS 27 - Makis Cista Voda				1		1		1	1		1			1	1				2*1	o		o	Existing PLC to be used
29	PS 28 - Zarkovo				1		1		1	1		1			1		1	1		3*3			o	
30	PS 30 - Lipovica				1		1		1	1		1	1		1					2*1	o		o	Existing PLC to be used.
31	PS 33 - Avala											1					1	1		1*2			o	
32	- Lesce											1					1	1		1*2			o	
33	Well Pumps (99 Sites)											97					50			50*4			o	Existing PLC(47) to be used
34	Reservoirs (20 Sites)											20					20			20*4			o	
	TOTAL	1	5	1	15	3	20	4	19	19	4	149	32	4	22	14	94	24	1					

*1 One server rack and one control desk.
*2 One Interface panel.
*3 One server, one control desk and one interface panel.
*4 Interface panels.

CITY ASSEMBLY OF BELGRADE BELGRADE WATERWORKS AND SEWERAGE		THE BASIC DESIGN ON THE PROJECT FOR IMPROVEMENT OF WATER SUPPLY SYSTEM	
Title : Equipment List for SCADA System	Drawing No.: S-02	Oct. 2004	JAPAN INTERNATIONAL COOPERATION AGENCY

Figure 2-7 Equipment List for SCADA System

i) Distribution Pump Station

No.	Items	Input		Output
		Digital	Analog	Digital
	Pump Signals/Measurements			
1	Motor started	1		
2	Motor protection	1		
3	Command for motor starting			1
4	Command for motor stopping			1
5	Frequency inverter working	1		
6	Frequency inverter failure	1		
7	Pump commanding position–Manual	1		
8	Pump commanding position–Automatic	1		
9	Flap position opened	1		
10	Flap position closed	1		
11	Pump motor temperature		1	
12	Pump temperature		1	
13	Current of motor	1		
14	Frequency of motor	1		
15	Valve failure	1		
16	Valve opened	1		
17	Valve closed	1		
18	Command of valve opening			1
19	Command of valve closing			1
20	Pump discharge pressure		1	
	Station Signals/Measurement			
21	Minimum level	1		
22	Vacuum installation working	1		
23	Vacuum installation failure	1		
24	Pump station output pressure		1	
25	Pump station output flow		1	
26	Water level in hydraulic vessel		1	
27	Pressure in hydraulic vessel		1	
28	Command for compressor starting			1
29	Compressor started	1		

No.	Items	Input		Output
		Digital	Analog	Digital
30	Electric power breakout	1		
31	Command voltage control (24 V DC)		1	
32	Command voltage breakout (24 V DC)	1		
33	Batteries failure	1		
34	Forced intrusion	1		
	Energy Signals/Measurements			
35	State of high voltage contact	1		
36	Transformer 0.4 KV protection	1		
37	Transformer 0.4 KV cell	1		
38	Electrical energy active VA(high voltage)		1	
39	Electrical energy reactive Var (high)		1	
		24	10	5

ii) Well Pump Station

No.	Items	Input		Output
		Digital	Analog	Digital
1	Current		1	
2	Pump Motor Temperature		1	
3	Pump Discharge Presuure		1	
4	Voltage 0.4kV		1	
5	Voltage 10kV		1	
6	Water Level		1	
7	Pump Operation Mode – Local	1		
8	Pump Operation Mode – Remote	1		
9	Water Level – Minimum	1		
10	Pump Motor Temperature Protection	1		
11	Motor Started			1
12	Motor Starting	1		
13	Motor Stopping	1		
14	Motor Stopped			1
15	Protection Signal reset	1		
16	Short-circuit Protection	1		

No.	Items	Input		Output
		Digital	Analog	Digital
17	Overcurrent Protection	1		
18	Nonsymmetry Phase Protection	1		
19	Ground shortcut of motor side	1		
20	Frequency Inverter Failure	1		
21	Transformer Temperature Warning	1		
22	Transformer Temperature Stopping	1		
23	Buchholz-transformer Protection	1		
24	Command Voltage Control (24 V)	1		
25	Batteries Failure	1		
26	Fuse 24 V Breakout	1		
27	Electric Power Breakout	1		
28	Forced intrusion	1		
29				
30				
		20	6	2

iii) Reservoir

No.	Items	Input		Output
		Digital	Analog	Digital
1	Water Level at Left Comora		1	
2	Minimum Level at Left Comora	1		
3	Maximum Level at Left Comora	1		
4	Water Level at Right Comora		1	
5	Minimum Level at Right Comora	1		
6	Maximum Level at Right Comora	1		
7	Command Voltage 24V		1	
8	220V AC Failure	1		
9	Manual / Automatic Switch	1		
10	Valve 1 Position		1	
11	Valve 1 Opened	1		
12	Valve 1 Closed	1		
13	Valve 1 Failure	1		

No.	Items	Input		Output
		Digital	Analog	Digital
14	Valve 2 Position		1	
15	Valve 2 Opened	1		
16	Valve 2 Closed	1		
17	Valve 2 Failure	1		
18	Valve 1 Closing			1
19	Valve 1 Opening			1
20	Valve 2 Closing			1
21	Valve 2 Opening			1
22	Protection Signal Reset	1		
23	Forced intrusion	1		
		14	5	4

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

Taking into consideration the relevance as the grant aid assistance, the priority list by BVK and expected effects such as dissolution of perpetual water shortage areas, immediate restoration from power failure, construction of stable water intake and distribution system and renewal of laboratory equipment for various water quality tests, the following works are implemented by Japan side under the Japanese Cooperation Assistance;

1) Procurement for water distribution pumps/motors and related electrical equipments such as frequency inverter, soft starter and control cubicle.
2) Procurement for water quality analysis equipments
3) Procurement, installation and commissioning for SCADA system of water supply facilities.

Meanwhile, the following works are implemented by Serbia and Montenegro side:

1) Installation for water distribution pumps/motors and related electrical equipments such as frequency inverters, soft starters and control cubicles.
2) Installation for water quality analysis equipments
3) Procurement and installation for telecommunication system required for SCADA system and for wiring with local signals

The SCADA system requires the construction of hardware and software. As this is the most critical work in the implementation schedule, Japan side implements the procurement and installation of this system.

Taking into consideration the installation schedule of Serbia and Montenegro side, Japan side shall plan carefully the timely ordering and delivery of the equipments so as to meet with their installation schedule.

As the most important item in the installation work is the SCADA system, BVK shall obtain all the permits required for the telecommunication system and carry out electrical work for the primary power to the system in advance of procurement work. The wiring connection work to the telecommunication system and the pump installation work shall be carried out concurrently. Because both works are closely related with the SCADA system. If either is delayed, the subsequent works such as integration of the system, commissioning work and site acceptance test will be delayed. It is required to discuss and work closely with BVK about the delivery time of equipment, installation work schedule, preparation of system construction, etc. during the kick-off meeting.

Taking into consideration the local technical level, maintenance work after turnover, availability of spare parts and service after sales for the equipments, the most beneficial products for the Serbia and Montenegro are to be selected out of the local products, the third country products or Japanese products.

The recipient agent of the procured equipment is BVK and the ownership of these equipments belongs to BVK.

2-2-4-2 Implementation Conditions

The Serbia and Montenegro side shall take care of implementation of the scope, import permit, duty exemption, custom clearance and any other procedures for importing the equipments in timely manner.

The Japanese procurement contractor is required to make sure of the transportation status of the equipments, and take care of these equipments for custom clearance, receiving and installation so as to be executed promptly, and furthermore, take care of the construction work of SCADA system especially such as installation work, commissioning work, trial operation, etc. so as to be executed without delay.

2-2-4-3 Scope of Work

The work demarcation of procurement and installation between Japan side and Serbia and Montenegro side under the Project is shown in Table 2-13.

Table 2-13 Scope of Work

Items	Procurement	Installation
1. Water Distribution Pump Station		
(1) Pump/Motor	**Japan**	**Serbia**
(2) Control Cubicles	**Japan**	**Serbia**
(3) Frequency Inverter/Soft Starter	**Japan**	**Serbia**
(4) Flap (Check Valve)	**Japan**	**Serbia**
(5) Pressure Transmitter	**Japan**	**Serbia**
(6) Electrical and Instrument Wiring	**Serbia**	**Serbia**
(7) Piping for Pump	**Serbia**	**Serbia**
2. SCADA System		
(1) SCADA System	**Japan/Serbia**[*1]	**Japan/Serbia**[*3]
(2) PLC/Radio Modem (except for well pumps)	**Japan/Serbia**[*2]	**Japan/Serbia**[*4]
(3) PLC/Radio Modem (for well pumps)	**Japan/Serbia**[*2]	**Serbia**
(4) Residual Chlorine Analyzer	**Japan/Serbia**[*5]	**Japan/Serbia**[*6]
(5) Telecommunication System	**Serbia**	**Serbia**
3. Laboratory Equipment	**Japan**	**Serbia**

Note: *1 Serbia and Montenegro side shall carry out procurement for power cable.
*2 Serbia and Montenegro side shall carry out procurement for power cable and telecommunication cable.
*3 Serbia and Montenegro side shall carry out installation for power cable.
*4 Serbia and Montenegro side shall carry out installation for power cable and telecommunication cable.
*5 Serbia and Montenegro side shall carry out procurement for sampling pipe.
*6 Serbia and Montenegro side shall carry out installation for sampling pipe.

Installation of Pumps

According to the past performance records of BVK, the renewal work for the water distribution pumps takes between a half of month and one month per pump including dismantling work of the existing pump, foundation work and electrical work.

Table 2-14 Water Distribution Pump Renewal Work Schedule (Reference)

Work Item	1 day	2 day	3 day	4 day	5 day	6 day	7 day	8 day	9 day	10 day	11 day	12 day	13 day
Drawing Confirm	━	━											
Work Confirm	━	━											
Pump dismantle			━										
Electr. Dismantle				━									
Foundation dism.					━	━							
Found. install						━	━						
Found. curring							━	━	━	━			
Electrical										━	━	━	
Pump install										━	━	━	
Adjustment													━

As BVK has much experience of pump installation works and has many construction equipments and plants, BVK implements these works.

Installation of SCADA System

For the installation of equipments of the SCADA system, high grade of technique is not required. However, the installation works of SCADA system shall be carried out by Japan side in consideration of the followings;

- Contractor should carry out commissioning and trial operation after the installation.
- Equipment of SCADA system is a precision machine. Contractor should install the equipment under its responsibility. (to clarify responsibility for damages and malfunction)

BVK will carry out the wiring work for telecommunication system and the electrical work for primary power supply.

Water Quality Analysis Equipment

Water quality analysis equipment such as an atomic absorption spectrometer, an autoclave, etc, requires the installation work. This installation work shall be done by BVK since the local contractor has done the installation work for the gas chromatograph procured by BVK recently.

As for an atomic absorption spectrometer, an UV-VIS spectrometer and a total organic carbon analyzer, Japan side shall take care of extending supervision of installation work and commissioning.

2-2-4-4 Procurement Supervision Plan

The consultant and the procurement contractor shall carry out the procurement supervision for the procurement works from tender to site delivery and for the installation works from installation to turnover, aiming to be accomplished smoothly.

The procurement supervision includes the followings;

- The consultant makes an arrangement for the meeting with the procurement contractor, makes sure of the purchase order and executes inspections of the equipment before delivery from the factory.

- The consultant coordinates the activities between BVK and Contractor in order to complete the project within the scheduled time.

- The consultant coordinates and witnesses the OJT so as to transfer the maintenance technique to BVK engineers certainly.

2-2-4-5 Quality Plan

The factory tests for the equipment procured are carried out before delivery to make sure of quality for the equipment. As for SCADA system, the factory acceptance test (FAT) in addition to the site acceptance test (SAT) is carried out after delivery at site and installation to make sure of quality for the system.

Meanwhile, the criteria for test shall comply with the international codes and/or standards such as ISO, etc.

2-2-4-6 Procurement Plan

From the point of view for cost reduction and service after sales, it is expected that the equipments should be procured from the third countries. However, as for the equipments of the SCADA system, Japanese products are highly and internationally competitive for price and marketability and have considerable share in the EU countries. Therefore, the procurement from Japan as well as third countries should be studied.

As the manufacturers of high-grade water quality analysis equipments are limited to a part of advanced countries such as Japan, USA, etc., the procurement from both Japan and third countries should be studied.

(1) Service after Sales

Pumps & Motors

As BVK has no import permit for any equipment and spare parts, BVK cannot place any order with the venders outside of the country. Accordingly, an import agent inside the country places orders for equipments or spare parts. Many import agents exist in the Belgrade city. Binemikom corporation, which is an import agent specialized in the equipments and materials for water and sewerage system, has the most experience for delivery of equipments and spare parts to BVK, and for service after sales to BVK. After delivery of the equipments and/or materials to BVK, Binemikom corporation will be able to make a contract with BVK on the service after sales and implement the installation work, repair work and delivery of spare parts.

Taking into consideration the maintenance technique of BVK maintenance department and support after sales to BVK by these import agents, there is no problem for procurement of spare parts after delivery of the equipment.

SCADA System

The agents or branch offices of major system equipment manufacturers or engineering companies such as OMRON, SIEMENS, ASTRA, etc. exist in the Belgrade city. All of these companies can provide service after sales as well as system construction, adjustment and operation instructions. However, the system construction and adjustment require the engineers dispatched from the head office or the branch offices located in EU countries.

It should be considered that the contract on services after sales could be concluded between BVK and the Contractor to support BVK's maintenance works of SCADA system.

Water Quality Analysis Equipment

The import agents for manufacturers of laboratory equipments, such as SHIMADZU and AGILENT TECHNOLOGIES (separated from HEWLETT PACKARD in 1999) etc., exist in the Belgrade city. As BVK has the experience of procurement for laboratory equipments of these manufacturers through their agents, it is considered that there is no problem for the procurement of spare parts and the technical support.

(2) Country of Origin

Pumps & Motors

Although JASTREBAC Corporation exists as the pump manufacturer of the Serbia and Montenegro, many engineers had left this company during economic sanctions and their

production capability deteriorated remarkably. Currently, the production capacity is limited, the kind of products is limited, and it seems to be some problems for the supply and delivery time of spare parts. Meanwhile, the foreign pump manufacturers have their factories in many countries according to their products. As the countries of origin, Germany, Italy, Austria, Brazil, Sweden, France, Belgium, Croatia, Vietnam, etc. are enumerated.

SCADA System

There is no manufacturer who is capable to manufacture and provide the SCADA system in the Serbia and Montenegro. The foreign manufacturers have their factories in many countries at product-wise and the products manufactured in various countries are constantly distributed. Prices of equipments for the system have almost no deference between the countries for procurement. Japanese products have considerable share in the EU countries. As the countries of origin, Japan, Holland, Germany, France, Denmark, USA, UK, Croatia, etc. are enumerated.

Water Quality Analysis Equipment

The manufacturers for laboratory equipments, for which the advanced technology is required, such as an atomic absorption spectrometer, a TOC analyzer, a UV-VIS spectrometer, etc. are limited internationally, that is, SHIMADZU, AGLIENT TECHNOLOGIES, etc. Meanwhile, an autoclave and a microscope can be procured from the neighboring EU countries. As the countries of origin, Japan, USA, Germany, UK, Italy, Austria, etc. are enumerated.

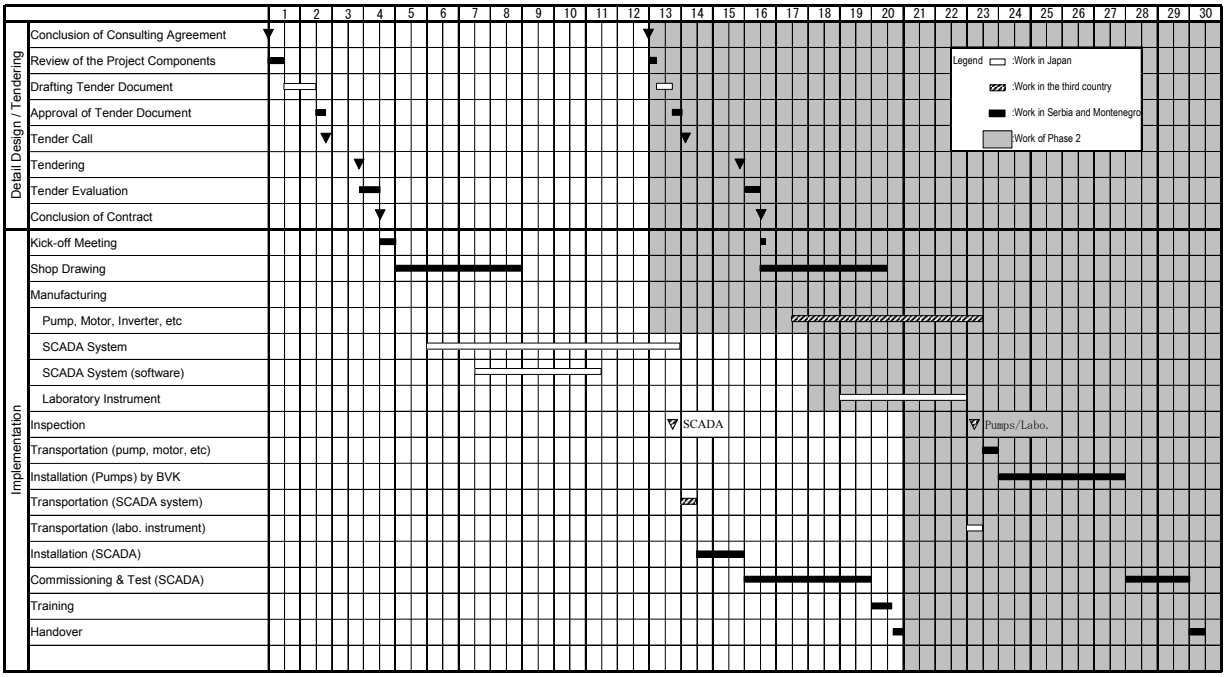
2-2-4-7 Soft Component Plan

Although SCADA system needs to give instruction to operation and maintenance, the contractor will give instruction to installation, operation and maintenance by OJT before turnover of SCADA system. Judging from capability of BVK IT department, the technical transfer by Soft Component is not required especially.

2-2-4-8 Implementation Schedule

The project is composed of two phases. Phase 1, providing SCADA system, takes 20 months, Phase 2 for pumps and laboratory equipment takes 17.5 months. Implementation schedule is shown in the following table.

Table 2-15 Implementation Schedule



2-3 Obligations of Recipient Country

The Project consists of the procurement work for equipments to be renewed in the existing facilities and the procurement, installation and technical guidance works for SCADA system to be installed newly. The SCADA system is a new facility, but BVK has already established IT dept. and decided the locations to install the system in the existing buildings as a preparation for the Project.

BVK dismantles the existing water distribution pumps and installs the new ones. The installation work for these pumps will be carried out by the operation & maintenance dept. that is organized under the maintenance division holding the staff of 200 persons.

The operation & maintenance dept. implements dismantling and installation works for mechanical equipment mainly, and they have much experience and enough staff.

For the past 10 years, they have the experience of dismantling and installation for approx. 100 well pumps and 6 water distribution pumps.

The procurement and installation works for the telecommunication system are implemented by BVK. BVK can execute these works successfully including application for permit of telecommunication system since the maintenance division of BVK had experience for construction of radio system in the water treatment plant in the past.

The instrumentation works for well pumps, water distribution pump stations and reservoirs are carried out together by IT dept. and the maintenance division.

As the Serbia and Montenegro has the experience of projects under the general grant aid three times and the Belgrade city has the same experience two times, they are familiar with the procedures such as duty exemption, etc.

2-4 Project Operation Plan

The counter part of the Project is BVK. The operation and maintenance work for the water distribution pumps will be carried out by the operation & maintenance dept. organized under the maintenance division holding the staff of 200 persons. They have much experience for operation, maintenance and repair works. As the pumps to be procured under the Project are a little bigger but of the same type as compared with the existing ones, the operation and maintenance work can be done as well as the current routine work.

The SCADA system will be operated and maintained mainly by IT dept., which was established in order to construct the said system and has the staff of 8 persons. The IT dept. has experience for installing software mainly of the computer, which was installed as a test case, with the assistance of a computer maker.

Meanwhile, the operation and maintenance work for hardware will be carried out under the support of maintenance division. The system equipments to be procured under the Project include software to be built by Japan side. Since the technical transfer based on OJT (on-the-job training) is carried into effect during the installation and commissioning works by Japan side, BVK staff can master the system sufficiently considering their high level of capability.

2-5 Project Cost

2-5-1 Project Cost

The total cost estimated for the implementation of the Project is ¥ 1,243 million. Based on the scope of work for Japan side and Serbia and Montenegro side above-mentioned and the condition for estimate below-mentioned, the costs to be burdened by both sides are estimated below. This estimated project cost does not mean the maximum aid amount to be mentioned in the Exchange of Notes.

(1) Expense for Japanese side

Procurement of SCADA system Approx. ¥ 1,177 million

Table 2-16 Cost to be Burdened by Japan

Expense item		Estimated Cost (Million Yen)
Equipment	Distribution pump, Motor, Inverter, etc. SCADA system Water quality analysis equipment	1,094
Detail design / Supervision of Procurement		83

(2) Cost to be burdened by Belgrade city

The cost to be burdened by BVK under this Project is shown in Table 2-17.

Table 2-17 Cost Covered by Serbia and Montenegro Side

No.	Item to be burdened by BVK	Qt'y	Amount (Euro)	Amount (JPY)
1.	Transformer	14 sets	250,000	
2.	Telecommunication system Dedicated radio system, Antenna	1 lot	40,000	
3.	Installation Materials Cable, ladder, rack	1 lot	200,000	
	Total		490,000	65,963,800

The cost takes 0.49 million Euro (approx. 66 million yen) in total.

The cost will be supplied from the financial source of Belgrade city for this Project in accordance with the request from BVK.

In the past, for a project of KfW(Germany) grant aid, the expense of 0.7 million EUR was supplied. These financial sources are from the general account of the City and the budget of the City Land Agency. The total budget in 2004 is 55 million EUR and the above mentioned expense is less than 1 % of the total budget. Accordingly, it is considered that it is certainly possible to prepare the budget for the expense to be spent under the Project

(3) Condition for Estimation

① Estimated on : July 31, 2004

② Exchange rate : 1 EUR = ¥134.62
1 CSD = ¥2.06

③ Procurement period : Please refer to the project implementation schedule for the required period of detail design and construction

④ Others : The Project shall be implemented in accordance with the Guideline for Grant Aid Cooperation of the Government of Japan.

2-5-2 Operation and Maintenance Cost

The BVK financial report is written in a lump together with water supply and sewerage. In respect of water supply services, the income of water charge covers the operation cost. As for entire balance including sewerage, the expenditure has exceeded the revenue by about 20% these three years.

The water distribution pumps having more than 100 kW motors are 98 sets including the spare pumps and total motor rated load is 29,797 kW. The spare rate of the pumps is about 30 %. Twenty-four sets of the pumps are procured and renewed under this Project. When renewed, the pump capacity and head is changed and the motor rated load for the existing pumps and the renewal pumps become 21,350 kW and 8,985 kW, respectively and total motor rated loads become 30,335 kW. Accordingly 1.8 % of total loads increases as compared with those before Project.

From the Financial Report 2003, the electric charges are 421,000,000 CSD. If the electric charges are multiplied by 0.18 % abovementioned, the annual electric charges will increase 7,601,368 CSD.

Meanwhile, the life of the pumps is 15 years**. Table 2-18 shows change of total electric power consumption for the pumps.

Note: **from Japanese local public enterprise enforcement regulations

Table2-18 Change of Electric Power Consumption for Water Distribution Pumps

		Before Project	After Project	Change
Pump	Existing Electric Power Consumption (kWh)	29,797	21,350	
	Renewal Electric Power Consumption (kWh)	-	8,985	
	Total Electric Power Consumption (kWh)	29,797	30,335	
	Total Electric Power Consumption (kW/year) (*1)	261,021720	265,734,600	1.8 %
	Actual Electric Power Consumption (kW/year) (*2)	217,000,000	220,918,045	1.8 %
	Electric Power Charge (Dinar /year) (*3)	421,000,000	428,601,368	1.8 %

Note (*1): For all the pumps including spare pumps.
(*2): Total electric power consumption for water supply and sewerage written in the Financial Report 2003 (Preliminary Study Report 2004)
(*3): From the Financial Report 2003 (BVK, 2004)

The water quality analysis equipments are procured for the renewal of the existing equipments. Accordingly, the manpower cost, electric charge, etc. for operation and maintenance are the same as before. Meanwhile, the life of these equipments is estimated as about 10 years**.

The introduction of SCADA system under the Project increases the telecommunication charge. However, as a part of maintenance staffs becomes unnecessary due to change from manned monitoring to unmanned monitoring for the pump station, the manpower cost decreases.

According to the financial report 2003, the telecommunication charge is included into other operation expenses and is 514 million Dinar. Meanwhile, the manpower cost is 1,348 million Dinar. After introduction of this system, it will be required to reduce the unnecessary staff. However, it will be difficult to reduce these staff immediately because it is imperative to discuss with the labor union and so on.

Three kinds of the telecommunication system are used under the Project and the cost increases as follows;

① SHDSL: free of charge due to BVK own line

② WLL : 3,000 Euro of initial charges for use and free of charge for operation

Note: 3000 EUR is incorporated into the construction cost as the expense of Belgrade city.

③ GSP (Mobile communication system for GPRS Network): 0.001 EUR per Kbite for operation. Estimated annual operation charge is 1,027.08 EUR (66,760 CSD) when the operation capacities are 21,312 Byte for well pump stations, 20,160 Byte for reservoirs and 37,728 Byte for water distribution pump stations.

Meanwhile, the life of telecommunication system is 9 years and monitoring system is 10 years**.

Note: **from Japanese local public enterprise enforcement regulations

The operation expenses year 2003 and after this Project are summarized in Table 2-19.

Table 2-19 Operation Expense

Item	Expenses in 2003 (million CSD)	Expenses after the Project (million CSD)
Power charge	421	429
Manpower cost	1,348	1,348
Chemical cost	250	250
Other expenses	514	514
Total operation cost	**2,533**	**2,541**

If this Project is implemented, the operation expense will increase 8 million Dinar as compared with 2,533 million Dinar of the operation expense year 2003. This increases approx. 0.3 %. As far as this figure is seen, this increment can be ignored for annual operation expense. Accordingly it is considered that this Project is feasible.

CHAPTER 3

PROJECT EVALUATION AND RECOMMENDATION

CHAPTER 3 PROJECT EVALUATION AND RECOMMENDATION

3-1 Project Effect

The current situation and problems of the Project and the direct and indirect effect expected by the implementation of Project are summarized in the Table 3-1.

Table 3-1 Effect of Project Implementation

Current Situation & Problems		Action of Project	Effect of Project
Direct Effect			
1.	Water shortage in a part of service areas	Effective water distribution by renewal of distribution pumps	It will be possible to supply water for 24 hours to 100,000 residents in the areas of water shortage.
2.	Imbalanced water distribution due to separate operation of each facilities	Introduction of monitoring control system	Strengthening of monitoring function and saving of labor and personnel by new system
3.	Inadequate management for safe drinking water	Renewal of equipments for water quality analysis	It will be possible to supply safe and stable quality water to 1,300,000 persons in the service areas.
Indirect Effect			
1.	Inconvenience of civil life under unstable conditions of water supply	Improvement of water supply system	Improvement of citizens' living environment
2.	BVK is the leader in the Country for water supply service (Water Supply Association). In the Country, there are locations contaminated by arsenic, ammonia & heavy metals.	Improvement & effective utilization of laboratories for water quality analysis	Enhancement of services for safe and sufficient water supply in the Country

3-2 Recommendations

In order to achieve the objective of Project "Elimination of water shortage areas and water shortage in summer season" through the effective utilization of equipments procured by the Project, it is required that Serbia and Montenegro side voluntarily and positively tackles with the matters mentioned below.

1) It is necessary positively to tackle with the environmental improvement of river contamination, etc. in order to secure the source for water supply. The Project will improve the water supply facilities and consequently increase the sewage volume. In parallel with the Project, Serbia and Montenegro side shall enhance the implementation of sewage improvement in order to conform to the EU standard.

2) From the construction of monitoring and control system to its adjustment, Japan side and Serbia and Montenegro side shall work together in cooperation. It is essential for Serbia and Montenegro side to acquire the technology transferred from Japan side and to succeed it within their organizations.

3) The Project marks the first step of the monitoring and control system. In the future, based on this step, it is necessary for BVK to expand the system for the complete construction of SCADA such as remote control, effective use of data, etc.

4) From the financial strengthening of BVK, it is essential to reallocate the surplus personnel when the SCADA system is introduced.

APPENDICES

Appendix 1
List of the Study Team Members

MEMBER LIST OF THE STUDY TEAM

1. Member List of the Field Survey

Mr. KURAKATA Hiroshi	Team Leader	Group Director Project Management Group 1, Grant Aid Management Department, JICA
Ms. YOSHIDA Sanae	Project Coordinator	Water and Sanitation Team, Project Management Group 1, Grant Aid Management Department, JICA
Mr. OKAGA Toshifumi.	Chief Consultant / Water Supply Planner	Pacific Consultants International
Mr. NAKATAKE Shunichi	Water Supply Facilities / Equipment Planner	Pacific Consultants International
Mr. MASUI Isao	Monitoring System / Equipment Planner	Pacific Consultants International
Mr. SAMESHIMA Kunio	Monitoring System / Software Planner	Pacific Consultants International
Mr. ARAKI Takayuki	Cost Estimate / Procurement Planner	Pacific Consultants International

2. Member List of the Draft Report Explanation

Mr. MURAOKA Keiichi	Team Leader	Managing Director, Austria Office, JICA
Ms. YOSHIDA Sanae	Project Coordinator	Water and Sanitation Team, Project Management Group 1, Grant Aid Management Department, JICA
Mr. OKAGA Toshifumi.	Chief Consultant / Water Supply Planner	Pacific Consultants International
Mr. MASUI Isao	Monitoring System / Equipment Planner	Pacific Consultants International
Mr. ARAKI Takayuki	Cost Estimate / Procurement Planner	Pacific Consultants International

Appendix 2
Study Schedule

STUDY SCHEDULE

1. Study schedule of the Field Survey

	Date			Official	Chief Consultant / Water Supply Planner	Water Supply Facility / Equipment Planner	Remote Control System / Equipment Planner	Remote Control System / System Engineer	Cost Estimation / Procurement Planner
				Mr. Kurakata Ms. Yoshida	Mr. Okaga	Mr. Nakatake	Mr. Masui	Mr. Sameshima	Mr. Araki
1	July	14	Wed	Leaving Narita					
2		15	Thu	Arriving at Belgrade, Courtesy call to Embassy of Japan and Ministry of Foreign Affairs					
3		16	Fri	Courtesy call to City Assembly of Belgrade and BVK, Discussion with BVK (Explanation of Inception Report)					
4		17	Sat	Site survey					
5		18	Sun	Internal Meeting					
6		19	Mon	Discussion with BVK					
7		20	Tue	Discussion with BVK on draft Minutes of Discussion (M/D)		Site Survey (Intake Facility, Water Treatment Plant, Transmission Facility)			
8		21	Wed	Signing of M/D, Leaving Belgrade (Officials)					
9		22	Thu	Report to JICA (Vienna office), Leaving Vienna	Meeting with C/P, Collection of information, Preparation for Site Survey				
10		23	Fri	Arrival at Japan	Site survey (intake facility)				Data collection and survey on local suppliers and agencies
11		24	Sat						
12		25	Sun		Internal meeting				
13		26	Mon		Site survey (intake facility)				Data collection and survey on local suppliers and agencies
14		27	Tue		Site survey (water treatment plant)				
15		28	Wed						
16		29	Thu		Site survey (distribution tanks and pumps)				
17		30	Fri		Site survey (monitoring points)				
18		31	Sat		Data analysis				
19	August	1	Sun		Internal meeting				
20		2	Mon		Discussion with C/P Basic Design Policy and the Organization Necessary for the Project	Discussion with C/P Policy for the Rehabilitation of Water Supply Facilities	Discussion with C/P Policy for the Establishment of SCADA System		Leaving Belgrade
21		3	Tue						Arriving at Narita
22		4	Wed						
23		5	Thu						
24		6	Fri						
25		7	Sat		Analysis of Collected Information, Summarizing of Survey Report				
26		8	Sun		Internal meeting				

<table>
<tr><th rowspan="2"></th><th rowspan="2" colspan="3">Date</th><th>Official</th><th>Chief Consultant / Water Supply Planner</th><th>Water Supply Facility / Equipment Planner</th><th>Remote Control System / Equipment Planner</th><th>Remote Control System / System Engineer</th><th>Cost Estimation / Procurement Planner</th></tr>
<tr><th>Mr. Kurakata
Ms. Yoshida</th><th>Mr. Okaga</th><th>Mr. Nakatake</th><th>Mr. Masui</th><th>Mr. Sameshima</th><th>Mr. Araki</th></tr>
<tr><td>27</td><td rowspan="4">August</td><td>9</td><td>Mon</td><td rowspan="4"></td><td colspan="4">Meeting with C/P</td><td rowspan="4"></td></tr>
<tr><td>28</td><td>10</td><td>Tue</td><td colspan="4">Report to Embassy of Japan, Leaving Belgrade</td></tr>
<tr><td>29</td><td>11</td><td>Wed</td><td colspan="4">Report to JICA (Vienna office), Leaving Vienna</td></tr>
<tr><td>30</td><td>12</td><td>Thu</td><td colspan="4">Arriving at Narita</td></tr>
</table>

2. Study schedule of the Explanation of the Draft Basic Design Report

<table>
<tr><th rowspan="2"></th><th rowspan="2" colspan="3">Date</th><th>Team Leader</th><th>Project Coordinator</th><th>Chief Consultant / Water Supply Planner</th><th>Remote Control System / Equipment Planner</th><th>Cost Estimation / Procurement Planner</th></tr>
<tr><th>Mr. Muraoka</th><th>Ms. Yoshida</th><th>Mr. Okaga</th><th>Mr. Masui</th><th>Mr. Araki</th></tr>
<tr><td>1</td><td rowspan="16">December</td><td>12</td><td>Sun</td><td rowspan="6"></td><td colspan="4">Leaving Narita</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">13</td><td rowspan="2">Mon</td><td>Arriving at Vienna, Meeting with JICA Austria Office</td><td colspan="3"></td></tr>
<tr><td colspan="4">Arriving at Belgrade
Courtesy Visit to Embassy of Japan</td></tr>
<tr><td rowspan="3">3</td><td rowspan="3">14</td><td rowspan="3">Tue</td><td colspan="2">Courtesy Visit to Ministry of Foreign Affairs</td><td colspan="2">Internal Meeting on Supplementary Survey</td></tr>
<tr><td colspan="4">Courtesy visit and Explanation to BVK</td></tr>
<tr><td colspan="2">Courtesy Visit to City Assembly</td><td colspan="2">Discussion with BVK</td></tr>
<tr><td rowspan="2">4</td><td rowspan="2">15</td><td rowspan="2">Wed</td><td rowspan="2">Arriving at Belgrade</td><td colspan="4">Discussion with BVK on M/D</td></tr>
<tr><td colspan="2">Courtesy Visit to Ministry of International Economic Relations</td><td>Meeting with BVK</td><td>Meeting with Laboratory</td></tr>
<tr><td rowspan="2">5</td><td rowspan="2">16</td><td rowspan="2">Thu</td><td colspan="3">Signing of M/D</td><td rowspan="2">Meeting with BVK</td><td>Signing of M/D</td></tr>
<tr><td colspan="3">Reporting to Embassy of Japan</td><td>Supplementary Survey</td></tr>
<tr><td>6</td><td>17</td><td>Fri</td><td colspan="2">Leaving Belgrade</td><td colspan="2">Meeting with BVK</td><td>Supplementary Survey</td></tr>
<tr><td>7</td><td>18</td><td>Sat</td><td rowspan="5"></td><td>Arriving at Narita</td><td colspan="2">Meeting with BVK</td><td>Supplementary Survey</td></tr>
<tr><td>8</td><td>19</td><td>Sun</td><td rowspan="4"></td><td colspan="2">Internal Meeting</td><td>Supplementary Survey</td></tr>
<tr><td>9</td><td>20</td><td>Mon</td><td colspan="2">Meeting with BVK</td><td>Meeting with Laboratory</td></tr>
<tr><td>10</td><td>21</td><td>Tue</td><td colspan="3">Leaving Belgrade</td></tr>
<tr><td>11</td><td>22</td><td>Wed</td><td colspan="3">Arriving at Narita</td></tr>
</table>

Appendix 3
List of Parties Concerned

LIST OF PARTIES CONCERNED IN SERBIA AND MONTENEGRO

1. Ministry of Foreign Affairs, Serbia and Montenegro

Vera Mavrić	Minister Plenipotentiary
Zoran Jeremić	Ambassador, Director, Department for Economic Bilateral Relations
Nada Dragić	First Secretary, Department for Economic Bilateral Relations

2. Ministry of International Economic Relations, Republic of Serbia

Gordana Lazarević	Assistant Minister
Mirjana Jelić	
Ivana Duranović	Consultant

3. Ministry of Agriculture, Forestry and Water Management, Republic of Serbia

Vladimir Tanacković	Head, Directorate for Water
Olivera Janković	Independent Expert Associate
Marija Kostić	Independent Expert Associate

4. City Assembly of Belgrade

Bojan Stanojević	City Manager

5. Serbia and Montenegro Waterworks Association

Milorad Rosić	Executive Director

6. Belgrade Waterworks & Sewerage (BVK)

Vladimir Taušanović	Managing Director
Miroslav Cvjetković	Deputy General Manager
Bojan Ćatić	Director Center
Radivojević Zoran	Director of Razvoj Project Sector
Milan Milanović	Director of Održavanja
Dušan Zimonić	Advisor to the Managing Director
Mihailo Kovačević	Head, Telemmatics Department
Milica Jerotić	Deputy Head, Telemmatics Department
Djordje Andrejević	Head, Water Supply Department
Aleksandar Šotić	Deputy Head, Water Supply Department

Ksenija Simunović	Civil Engineer, Water Supply Department
Vladimir Milojević	Head, Mechanical Maintenance Section
Radoslav Babić	Head, Water Quality Control Department
Ljiljana Vasiljević	Deputy Head, Water Quality Control Department

7. University of Belgrade

Ljiljana Janković	Programme Officer, Faculty of Civil Engineering, International Research and Training Centre for Urban Drainage / Urban Water Network

8. Mott MacDonald

Radu Rautu	Team Leader
Ratko Janković	Local Project Coordinator

9. Rehabilitation of Urban Water Supply and Sanitation in Nis and Belgrde – Phase II

A. Günther Gutknecht	Project Manager

10. Embassy of Japan in Serbia and Montenegro

Ryuichi TANABE	Ambassador Extraordinary and Plenipotentiary
Shigemi JOMORI	Minister Counselor
Kazumasa MIYAZAKI	First Secretary
Akira SANO	Second Secretary

11. Japan International Cooperation Agency, Austria Office

Keiichi MURAOKA	Managing Director
Katsutoshi FUSHIMI	Assistant Resident Representative
Yumiko HONDA	Project Formulation Adviser
Milan Marinović	National Coordinator

Appendix 4
Minutes of Discussions

Appendix 4.1

Minutes of Discussions
(July 21, 2004)

MINUTES OF DISCUSSIONS
ON THE BASIC DESIGN STUDY ON THE PROJECT FOR IMPROVEMENT OF WATER SUPPLY SYSTEM IN BELGRADE IN SERBIA AND MONTENEGRO

Based on the results of the Preparatory Study, the Government of Japan decided to conduct a Basic Design Study on THE PROJECT FOR IMPROVEMENT OF WATER SUPPLY SYSTEM IN BELGRADE (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Serbia and Montenegro the Basic Design Study Team (hereinafter referred to as "the Team"), which is headed by Mr. Hiroshi Kurakata, Team Director, Water and Sanitation Team, Project Management Group I, Grant Aid Management Department, and is scheduled to stay in the country from 15th July to 21st July.

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

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

Belgrade, Serbia and Montenegro, 21st July 2004

Hiroshi Kurakata
Leader
Basic Design Study Team
Japan International Cooperation Agency
Japan

Bojan Stanojevic
Vice President of the Executive Board
City Assembly of Belgrade
Serbia and Montenegro

Vladimir Tausanovic
Managing Director
Belgrade Waterworks and Sewerage
Serbia and Montenegro

ATTACHMENT

1. Objective of the Project

The objective of the Project is to improve the capacity of water supply for residents in the project sites in Belgrade through the procurement of equipment for the water supply system.

2. Project Sites

The Team and Serbia and Montenegro sides confirmed that the Project site is located in the Belgrade City.

3. Responsible and Implementing Agency

3-1 The Responsible Agency is the City Assembly of Belgrade.
3-2 The Implementing Agency is the Belgrade Waterworks and Sewerage.

4. Items Requested by the Government of Serbia and Montenegro

After discussions with the Team, the items described in Annex-1 were finally requested by Serbia and Montenegro side. JICA will assess the appropriateness of the request and will recommend to the Government of Japan for approval.

5. Japan's Grant Aid Scheme

5-1 Serbia and Montenegro side understands the Japan's Grant Aid Scheme explained by the Team, as described in Annex-3.
5-2 Serbia and Montenegro side will take the necessary measures, as described in Annex-4 for smooth implementation of the Project, as a condition for the Japan's Grant Aid to be implemented.

6. Schedule of the Study

6-1 The Team will proceed to further studies in Serbia and Montenegro until 10th August.
6-2 JICA will prepare the draft report in English and dispatch a mission to Serbia and Montenegro in order to explain its contents to Serbia and Montenegro side towards the end of October, 2004.
6-3 In case that the contents of the report is accepted in principle by the Government of Serbia and Montenegro, JICA will complete the final report and send it to the Government of Serbia and Montenegro by January 2005.

7. Other Relevant Issues

The following issues were discussed and confirmed by both sides.

7-1 Public Private Partnership(PPP) for Belgrade Waterworks and Sewerage

The Serbia and Montenegro side explained that the conclusion of PPP has not terminated yet.

Now Government of Serbia and Montenegro is requested to keep the EU environmental standard strongly by the EU countries, because they release the untreated waste water to Sava and Dunav river directly. Therefore PPP should be more concentrated on the waste water treatment than the water supply sector. Now they are studying the possible improvement of private partnership in solving the environmental issues. Considering these situation, it can be mentioned clearly that PPP can not be applyed to the water supply sector in near future.

7-2 Proposed components of the Project

Both sides agreed that the Project would be composed the items described in Annex-1.

However, the final components of the Project shall be determined according to the result of further studies and analysis in Japan and further discussions between Serbia and Montenegro side and the Japanese side.

Moreover, the team explained there might be a change in the item by the result of the Study.

7-3 Priority components of the Project

The Serbia and Montenegro side promised to make a list of priority content of the request, and to present it to the Team by the end of July 2004.

7-4 Installation of Equipment and Devices

The Serbia and Montenegro side promised that the installation of equipment and devices will be executed by themselves, and that the budget for installation will be ensured from the City Assembly of Belgrade. Complete installation schedule will be discussed with a Team through the Basic Design Study.

The technical undertakings by each side are shown in Annex 4.

As for the establishment works of monitoring system such as development of software and its installation, both side confirmed that the further study would be carried out by the Team during their stay in Serbia and Montenegro considering technical assistance by experts called "Soft Component" and total cost of the Project.

7-5 Budget Allocation

The Serbia and Montenegro side promised to assign necessary budget for items to be covered by the Serbia and Montenegro side.

Both sides agreed that the requested item "transformer" is belongs to primary electricity supply and it should be covered by the Serbia and Montenegro side.

Annex-1

Requested components

Item No.	Equipment	Q'ty
1. Well Equipment (97 wells)		
1-1	Aggregate (Pump & Motor)	49
1-2	Frequency Inverter	8
1-3	Measuring equioment	8
1-4	Valves	100
1-5	Flaps	100
1-6	Control Cubicle	50
1-7	Terminal Equipment hw + sw	50
1-8	Telecommunication equipment	97
2. Pump Station Equipment (26 PS)		
2-1	Aggregate (Pump & Motor)	28
2-2	Frequency Inverter	53
2-3	Control Cubicle	44
2-4	Flaps	65
2-5	Measuring equioment	75
2-6	Terminal Equipment hw + sw	23
2-7	Telecommunication equipment	24
2-8	Local SCADA	14
3. Measuring Point Equipment (28 points)		
3-1	Chlorine measurement	28
3-2	Control Cubicle	28
3-3	Terminal Equipment hw + sw	28
3-4	Telecommunication equipment	28
4. Reservoir Equipment		
4-1	Chlorine measurement	20
4-2	Terminal Equipment hw + sw	20
4-3	Telecommunication equipment	20
5. Telecommunication Network		
5-1	IP Data network	
5-1-1	Optical cable link 31.1km	1
5-1-2	Active components	
5-1-2-1	SHDSL Layer 3 router	30
5-1-2-2	Layer 3 switch	4
5-1-2-3	Layer 2 switch	12
5-2	Wireless data transmission network	8
6. Local Control Center Bezanija		
6-1	Domain Controller server (sw + hw)	1
6-2	SQL Server (sw + hw)	1

Item No.	Equipment	Q'ty
7. Local Control Center Banovo Brdo		
7-1	SQL Server (sw + hw)	1
7-2	Telecommunication Network Server (sw + hw)	1
7-3	Domain Controller server (sw + hw)	1
8. Main Control Center Deligradska Street		
8-1	Servers for real time BWS control	
8-1-1	SQL Server (sw + hw)	3
8-1-2	Telecommunication Network Server (sw + hw)	1
8-1-3	Domain Controller server (sw + hw)	2
8-1-4	Master SCADA server	1
8-2	Workstation	
8-2-1	Workstation (sw + hw)	3
8-3	Voice over IP equipment	
8-3-1	VOIP gateway	1
8-3-2	VOIP gatekeeper	1
9. Laboratory measuring equipment and instrument		
9-1	Chemical laboratory	
9-1-1	Atomic Absortion Spectrometer(AAS)	1
9-1-2	Total Organic Carbon Analyzer(TOC)	1
9-1-3	UV-VIS Spectrometer	1
9-1-4	HighPerformance Liquid Chromatography(HPLC)	1
9-1-5	Ion Chromatography - IC	1
9-1-6	Analytical balance, 0.001g	1
9-1-7	Glassware Washer	1
9-2	Microbiological Laboratory	
9-2-1	Microscope	1
9-2-2	Autoclave	1
9-2-3	Glassware Washer with drying system	1
9-3	Chemical laboratory(waste water)	
9-3-1	Atomic Absortion Spectrometer(AAS)	1
9-3-2	Gas Chromatograph, PPC, FID and ECD	1
9-3-3	Total Organic Carbon Analyzer(TOC)	1

Annex-2

Requested components and Undertaking

Requested components	undertaking		Remarks
	Serbia and Montenegro side	Japan side	
1. Well Equipment (97 wells)	*Installation*	*Provision*	
2. Pump Station Equipment (26 PS)	*Installation*	*Provision*	
3. Measuring Point Equipment (28 points)	*Installation*	*Provision*	
4. Reservoir Equipment	*Installation*	*Provision*	
5. Telecommunication Network	*Installation*	*Provision*	
6. Local Control Center Bezanija	*Installation*	*Provision*	
7. Local Control Center Banovo Brdo	*Installation*	*Provision*	
8. Main Control Center Deligradska Street	*Installation*	*Provision*	
9. Laboratory measuring equipment and instrument	*Installation*	*Provision*	
1-9. Terminal Equipment software	*Development*	*Provision*	

Annex-3

JAPAN'S GRANT AID

1. Japan's Grant Aid System

(1) Grant Aid Procedures

1) Japan's Grant Aid Program is executed through the following procedures.

- Application (Request made by a recipient country)
- Study (Basic Design Study conducted by JICA)
- Appraisal & Approval
  (Appraisal by the Government of Japan and Approval by the Cabinet)
- Determination of the implementation
  (The Notes exchanged between the Governments of Japan and the recipient country)
- Implementation (Implementation of the Project)

2) Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study), using Japanese consulting firms.

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Programme, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

(2) Basic Design Study

1) Contents of the Study

The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on a requested project (hereinafter referred to as "the Project"), is to provide a basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Study are as follows:

i) Confirmation of the background, objectives and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation;
ii) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme
from a technical, social and economic points of view;
iii) Confirmation of items agreed on by both parties concerning the basic concept of the Project;
iv) Preparation of a basic design of the Project; and
v) Estimation of costs of the Project.

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

The Government of Japan 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 Study, JICA uses a registered consulting firm. JICA selects a firm based on proposals submitted by interested firms. The firm selected carries out a Basic Design Study and writes a report, based upon terms of reference set by JICA.

The consultant firm used for the Study is recommended by JICA to the recipient country to also work in the Project's implementation after the Exchange of Notes, in order to maintain technical consistency and also to avoid any undue delay in implementation should the selection process be prepared.

(3) Japan's Grant Aid Scheme

1) What is Grant Aid?

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

2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

3) "The period of the Grant" means the one fiscal year which the Cabinet approves the project for. Within the fiscal year, all procedure such as exchanging of the Notes, concluding contracts with consulting firms and contractors and final payment to them must be completed.

However, in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

4) Under the Grant, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However, the prime contractors, namely consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

5) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by

the Government of Japan. This "Verification" is deemed necessary to secure accountability of Japanese taxpayers.

6) Undertakings required to the Government of the recipient country

In the implementation of the Grant Aid project, the recipient country is required to undertake such necessary measures as the followings:

i) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction;

ii) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the site;

iii) To secure buildings prior to the procurement in case the installation of the equipment;

iv) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid;

v) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts;

vi) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts such as facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work;

vii) "Proper Use"

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

viii) "Re-export"

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

ix) Banking Arrangement (B/A)

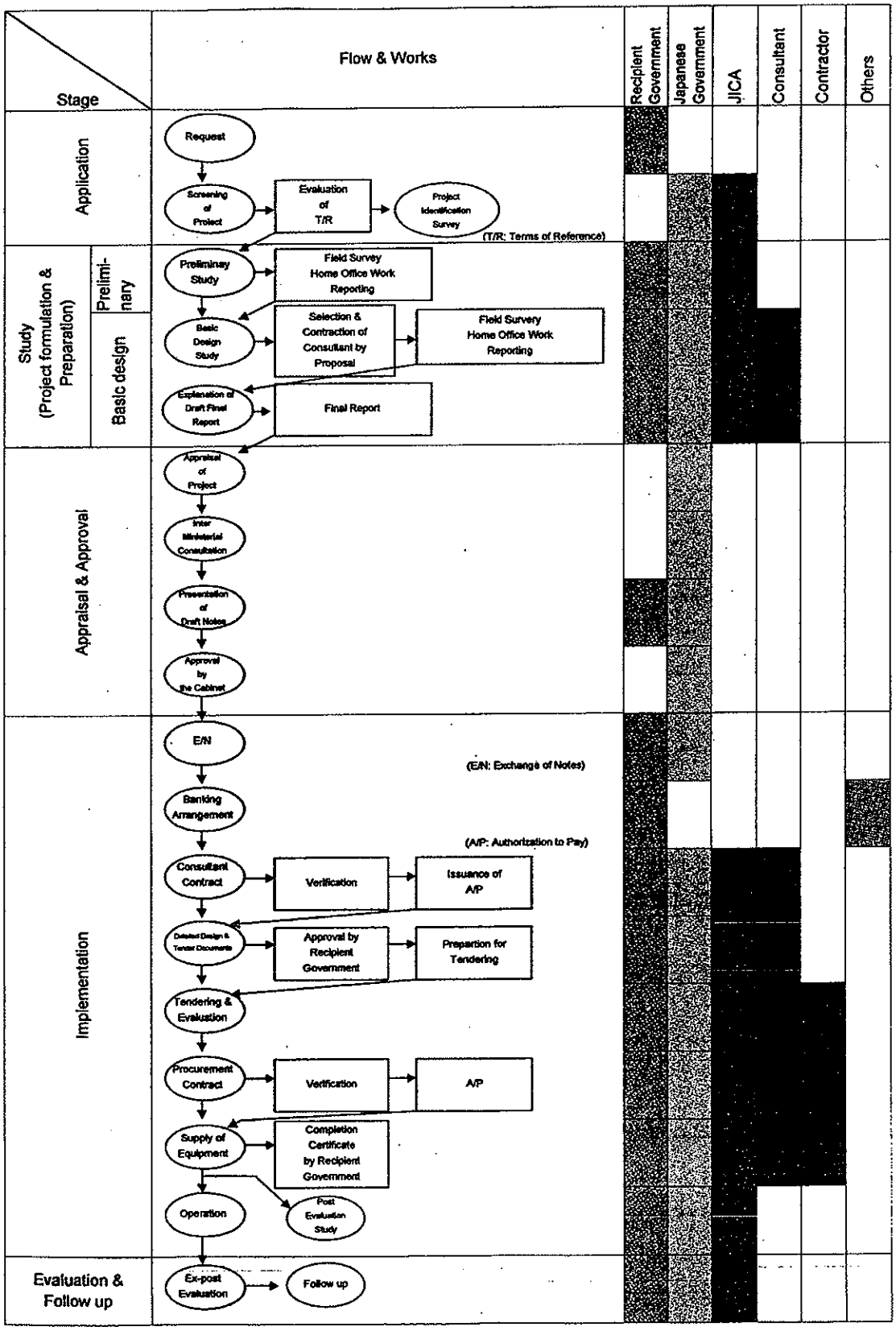
a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments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

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

x) Authorization to Pay

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

FLOW CHART OF JAPAN'S GRANT AID PROCEDURES



Annex-4

Major Undertakings to be taken by Each Government For the Procurement

NO.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To bear the following commissions to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
2	To ensure unloading and customs clearance at port of disembarkation in recipient country		
	1) Marine (Air) transportation of the products from Japan to the recipient country	●	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the project site	(●)	(●)
3	To accord Japanese nationals, whose services may be required in connection with the supply of the products and the services under the verified contact, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
4	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts.		●
5	To maintain and use properly and effectively the facilities constructed and/or equipment provided under the Grant Aid		●
6	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for the transportation and installation of the equipment		●

(B/A: Banking Arrangement, A/P: Authorization to Pay)

Appendix 4.2

Technical Notes
(August 9, 2004)

TECHNICAL NOTES
ON THE BASIC DESIGN STUDY
ON
THE PROJECT FOR IMPROVEMENT OF WATER SUPPLY SYSTEM
IN BELGRADE
IN THE REPUBLIC OF SERBIA AND MONTENEGRO

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 System in Belgrade (hereinafter referred to as "the Project") signed on 21st July 2004 between the Basic Design Study Team (hereinafter referred to as "the Team") of Japan International Cooperation Agency (hereinafter referred to as "JICA") and Belgrade Waterworks and Sewerage (hereinafter referred to as "BVK"), of the Government of the Republic of Serbia and Montenegro, the consultant members of the Team had a series of discussions and conducted field surveys from 16th July 2004 to 9th August 2004.

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

Belgrade, 9th August 2004

Okaga Toshifumi
Chief Consultant,
Basic Design Study Team,
Japan International Cooperation Agency
Japan

Vladimir Tausanovic
Managing Director,
Belgrade Waterworks and Sewerage,
The republic of Serbia and Montenegro

ATTACHMENT

Both parties agreed upon and confirmed the following items.

1. Equipment Requested

Both parties confirmed that the equipment listed in Table 1 was updated taking the present situation into consideration. The major points are as follows;

Following item shall delete.

- Transformer ------ from 14 to 0
- Flap valve for well equipment ------ from 100sets to 2sets
- Frequency inverter for distribution pump station ----from 53 panels to 28 panels
- Optical cable--------from 31.1km to 0km
- Control cubicle ------ from 44 panels to 28panels.

Following item is added.

- Auxiliary equipment for SCADA system required for system configuration. The details and specifications of the equipment are to be examined in the studies to be made in Japan.

2. Priority List

The Team agreed the priority list prepared by BVK and scope of supply is to be examined in the studies to be made in Japan as stipulated in M/D. Priority list is shown Table 2.

3. Scope of Work for Installation

Both parties confirmed that the scope of work for installation was discussed as follows:

- Installation works for the equipment to be supplied from Japan are done by BVK except for the equipment for SCADA system.
- Installation work for SCADA system including software is done by Japan side. However, telecommunication system for SCADA system is done by BVK.
- All hardware and software for SCADA system are required to be tested by Japan side.

Detailed work demarcation for installation between Japan side and BVK is shown in Table 3.

4. Implementation Work Schedule

Based on the scope of work, BVK prepared implementation schedule shown in Table 4 for their works. The schedule is to be examined in the studies as total implementation schedule of Japan Grand Aid system to be made in Japan.

5. Basic Design

5-1 SCADA System

Both parties agreed to the system configuration for SCADA system shown in Table 5.

5-2 Distribution and Well Pump

Both parties agreed to the basic design conditions for distribution pump and well pump shown in Table 6.

Table 1

BILL OF QUANTITY

Item No.	Equipment	Q'ty Original	Q'ty Proposal	Specification Sheet	Note
1. Well Equipment (97 wells)					
1-1	Aggregate (Pump & Motor)	49	49	SS-01	
1-2	Frequency Inverter	8	8	SS-02	
1-3	Measuring equioment	8	8	SS-03	
1-4	Valves	100	100	SS-04	
1-5	Flaps	100	0	SS-04	deleted by BVK
1-6	Control Cubicle	50	50	SS-05	
1-7	Terminal Equipment hw + sw	50	50	SS-06	
1-8	Telecommunication equipment (GPRS modem)	97	97	SS-07	
2. Pump Station Equipment (26 PS)					
2-1	Aggregate (Pump & Motor)	28	28	SS-01	
2-2	Frequency Inverter	53	53	SS-02	
2-3	Transformer	14	3	SS-08	out of Japan Grant Aid System
2-4	Control Cubicle	44	44	SS-05	
2-5	Flaps	65	65	SS-04	
2-6	Measuring equioment	75	75	SS-03	
2-7	Terminal Equipment hw + sw	23	13	SS-06	required to carry out data processing
2-8	Telecommunication equipment (GPRS modem)	24	27	SS-07	
2-9	Local SCADA (SCADA Server)	14	14	SS-10	
2-10	Monitor/ SCADA HMI	0	14	SS-10	required to monitor operation data for water distribution at pump station
2-11	Printer	0	14	SS-10	same as 2-10
2-12	UPS	0	14	SS-10	same as 2-10
2-13	Touch panel	0	24	SS-10	same as 2-10
3. Measuring Point Equipment (28 points)					
3-1	Chlorine measurement	28	28	SS-11	
3-2	Cubicle	28	28	SS-05	
3-3	Terminal Equipment hw + sw	28	28	SS-06	
3-4	Telecommunication equipment (GPRS modem)	28	28	SS-07	
4. Reservoir Equipment					
4-1	Chlorine measurement	20	20	SS-11	
4-2	Terminal Equipment hw + sw	20	20	SS-06	
4-3	Telecommunication equipment(GPRS modem)	20	20	SS-07	
4-4	Cubicle	0	20	SS-11	required to provide as same as cubicles for measuring point equipment
5. Telecommunication Network					
5-1	IP Data network				
5-1-1	Optical cable link 31.1km	1	0	SS-09	Deleted by BVK
5-1-2	Active components				
5-1-2-1	SHDSL Layer 3 router	30	33	SS-09	
5-1-2-2	Layer 3 switch	4	4	SS-09	
5-1-2-3	Layer 2 switch	12	20	SS-09	revised based on basic design
5-1-2-4	Media converter	0	14	SS-09	revised based on basic design
5-2	Wireless data transmission network	8	0	SS-09	provided by BVK
6. Local Control Center Bezanija					
6-1	Domain Controller server (sw + hw)	1	1	SS-10	
6-2	SQL Server (sw + hw)	1	1	SS-10	
6-3	GPRS server	0	1	SS-10	required to monitor operation data for water distribution at LCC
6-4	Monitor/ SCADA HMI	0	1	SS-10	same as 6-3
6-5	Printer	0	1	SS-10	same as 6-3
6-6	UPS	0	1	SS-10	same as 6-3
7. Local Control Center Banovo Brdo					
7-1	SQL Server (sw + hw)	1	1	SS-10	
7-2	Telecommunication Network Server (sw + hw)	1	1	SS-10	
7-3	Domain Controller server (sw + hw)	1	1	SS-10	
7-4	GPRS server	0	1	SS-10	same as 6-3
7-5	Monitor/SCADA HMI	0	1	SS-10	same as 6-3
7-6	Printer	0	1	SS-10	same as 6-3
7-7	UPS	0	1	SS-10	same as 6-3
7A. Local Control Center Bele Bode					
7A-1	SCADA Server(sw + hw)	0	1	SS-10	same as 6-3
7A-2	Telecommunication equipment(GPRS modem)	0	1	SS-10	same as 6-3
7A-3	Monitor/ HMI SCADA	0	1	SS-10	same as 6-3
7A-4	Printer	0	1	SS-10	same as 6-3
7A-5	UPS	0	1	SS-10	same as 6-3
7B. Local Control Center Makis					
7B-1	SQL Server (sw + hw)	0	1	SS-10	same as 6-3
7B-2	GPRS server	0	1	SS-10	same as 6-3
7B-3	Monitor/SCADA HMI	0	1	SS-10	same as 6-3
7B-4	Printer	0	1	SS-10	same as 6-3
7B-5	UPS	0	1	SS-10	same as 6-3
8. Main Control Center Deligradska Street					
8-1	Servers for real time BWS control				
8-1-1	SQL Server (sw + hw)	2	0	SS-10	deleted back-up server
8-1-2	Telecommunication Network Server (sw + hw)	1	0	SS-10	not required
8-1-3	Domain Controller server (sw + hw)	2	0	SS-10	deleted back-up server
8-1-4	Master SCADA server	1	1	SS-10	
8-1-5	Web server	0	1	SS-10	required to interface with other IP network
8-1-6	GPRS server	0	1	SS-10	required to connect with telecommunication system
8-2	Workstation for monitor				
8-2-1	Workstation (sw + hw) /SCADA HMI	3	2	SS-10	deleted one workstation and added a 50 inch display to facilitate monitoring work
8-2-2	50" Display	0	1	SS-10	same as 8-2-1
8-3	Voice over IP equipment				
8-3-1	VOIP gateway	1	0		provided by BVK
8-3-2	VOIP gatekeeper	1	0	SS-10	provided by BVK
8-4	Printer	0	1	SS-10	required to print the daily report, operation data, etc.
8-5	UPS	0	1	SS-10	required to shutdown SCADA system safely under power failure
9. Laboratory measuring equipment and instrument					
9-1	Chemical laboratory				
9-1-1	Atomic Absortion Spectrometer(AAS)	1	1	SS-12	
9-1-2	Total Organic Carbon Analyzer(TOC)	1	1	SS-12	
9-1-3	UV-VIS Spectrometer	1	1	SS-12	
9-1-4	HighPerformance Liquid Chromatograph(HPLC)	1	1	SS-12	
9-1-5	Ion Chromatography - IC	1	1	SS-12	
9-1-6	Analytical balance, 0.001g	1	1	SS-12	
9-1-7	Glassware Washer	1	1	SS-12	
9-2	Microbiological Laboratory				
9-2-1	Microscope	1	1	SS-12	
9-2-2	Autoclave	1	1	SS-12	
9-2-3	Glassware Washer with drying system	1	1	SS-12	
9-3	Chemical laboratory(waste water)				
9-3-1	Atomic Absortion Spectrometer(AAS)	1	1	SS-12	
9-3-2	Gas Chromatograph, PPC, FID and ECD	1	1	SS-12	
9-3-3	Total Organic Carbon Analyzer(TOC)	1	1	SS-12	
				Total	

Tabl 2

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SS-01 / SPECIFICATION OF Pumps & Motor

Item No.	Name of Station	Q'ty	Flow capacity (l/sec)	Head (m)	Motor Output (kW)	rpm	priority
<< Well Equipment >>							
1-1-01	RW-6m	1	100	75	132	1500	2
1-1-02	RW-2m	1	100	75	132	1500	2
1-1-03	RW-8m	1	70	75	90	1500	2
1-1-04	RW-1m	1	100	75	132	1500	2
1-1-05	RW-19/1	1	100	75	132	1500	2
1-1-06	RW-20/1	1	100	75	132	1500	2
1-1-07	RW-20	1	35	75	45	3000	2
1-1-08	RW-15/1	1	70	75	90	1500	2
1-1-09	RW-14/1	1	35	75	45	3000	2
1-1-10	RW-13/1	1	35	75	45	3000	2
1-1-11	RW-11/1	1	70	75	90	1500	2
1-1-12	RW-12/1	1	35	75	45	3000	2
1-1-13	RW12/2	1	70	75	90	1500	2
1-1-14	RW-3	1	35	75	45	3000	2
1-1-15	RW-9	1	35	75	45	3000	2
1-1-16	RW-7	1	35	75	45	3000	2
1-1-17	RW22/1	1	130	75	160	3000	2
1-1-18	RW-2	1	100	75	132	1500	2
1-1-19	RW-4/1	1	130	75	160	3000	2
1-1-20	RW-40	1	70	75	90	1500	2
1-1-21	RW-42	1	100	75	132	1500	2
1-1-22	RW-43	1	70	75	90	1500	2
1-1-23	RW-45	1	100	75	132	1500	2
1-1-24	RW-46	1	100	75	132	1500	2
1-1-25	RW-49	1	130	75	160	3000	2
1-1-26	RW-63	1	100	75	132	1500	2
1-1-27	RW-62	1	100	75	132	1500	2
1-1-28	RW-72	1	70	75	90	1500	2
1-1-29	RW-75	1	100	75	132	1500	2
1-1-30	RW-79	1	70	75	90	1500	2
1-1-31	RW-81	1	70	75	90	1500	2
1-1-32	RW-87	1	100	75	132	1500	2
1-1-33	RW-88	1	100	75	132	1500	2
1-1-34	RW-90	1	130	75	160	3000	2
1-1-35	RW-98	1	35	75	45	3000	2
1-1-36	RW-65	1	70	75	90	1500	2
1-1-37	RW-66	1	70	75	90	1500	2
1-1-38	RW-41	1	70	75	90	1500	2
1-1-39	RW-35	1	100	75	132	1500	2
1-1-40	RW-29	1	35	75	45	3000	2
1-1-41	RW-23/1	1	70	75	90	1500	2
1-1-42	RW-14	1	70	75	90	1500	2
1-1-43	RW-12/3	1	70	75	90	1500	2
1-1-44	RE-5m	1	35	75	45	3000	2
1-1-45	RW-8A	1	130	75	160	3000	2
1-1-46	RW-10	1	100	75	132	1500	2
1-1-47	RW-11	1	70	75	90	1500	2
1-1-48	RW-16/1	1	70	75	90	1500	2
1-1-49	RW-17	1	35	75	45	3000	2
<< Pump Station >>							
2-1-01	PS-1a Bele Vode	1	167	160	400	1500	1
2-1-02	PS-1a	1	167	160	400	1500	1
2-1-03	PS-1a	1	167	160	400	1500	1
2-1-04	PS-1b	1	400	90	550	1500	1
2-1-05	PS-1b	1	400	90	550	1500	1
2-1-06	PS-1b	1	400	90	550	1500	1
2-1-07	PS-1b	1	400	90	550	1500	1
2-1-08	PS-4 Crvrni Krst	1	300	70	400	1500	2
2-1-09	PS-18 Tasmajdan stari	1	400	65	400	1500	1

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SS-01 / SPECIFICATION OF Pumps & Motor

Item No.	Name of Station	Q'ty	Flow capacity (l/sec)	Head (m)	Motor Output (kW)	rpm	priority
2-1-10	PS-18	1	400	65	400	1500	1
2-1-11	PS-18	1	400	65	400	1500	1
2-1-12	PS-18	1	400	65	400	1500	1
2-1-13	PS-19 Bezanija	1	200	65	200	1500	1
2-1-14	PS-19	1	200	65	200	1500	1
2-1-15	PS-19	1	200	65	200	1500	1
2-1-16	PS-23 Studentski Grad	1	500	70	600	1500	1
2-1-17	PS-23	1	500	70	600	1500	1
2-1-18	PS-23	1	500	70	600	1500	1
2-1-19	PS-23	1	500	70	600	1500	1
2-1-20	PS-23	1	500	70	600	1500	1
2-1-21	PS-17 Zvezdara	1	120	80	160	1500	1
2-1-22	PS-17	1	120	80	160	1500	1
2-1-23	PS-17	1	120	80	160	1500	1
2-1-24	PS-21 Pionir	1	200	65	200	1500	2
2-1-25	PS-21	1	200	65	200	1500	2
2-1-26	PS-21	1	200	65	200	1500	2
2-1-27	PS-20 Zeleznik	1	240	150	600	1500	1
2-1-28	PS-20	1	240	150	600	1500	1

SS-02 / Specification of inverters and soft starters prioriteti

Item No.	Name of Station	Q'ty	Voltage(V)	Motor Output(kW)	priority
<< Well Equipment >>					
1-2-01	RW- 3	1	400	45	2
1-2-02	RW -9	1	400	45	2
1-2-03	RW-7	1	400	45	2
1-2-04	RW 46	1	400	132	2
1-2-05	RW-87	1	400	132	2
1-2-06	RW-88	1	400	132	2
1-2-07	RW-35	1	400	132	2
1-2-08	RW-49	1	400	160	2
<< Pump Station >>					
2-2-01	PS-1a Bele Vode	1	400	400	1
2-2-02	PS-1a	1	400	400	1
2-2-03	PS-1a	1	400	400	1
2-2-04	PS-1b	1	400	550	1
2-2-05	PS-1b	1	400	550	1
2-2-06	PS-1b	1	400	550	1
2-2-07	PS-1b	1	400	550	1
2-2-08	PS-4 Crvrni Krst	1	400	400	2
2-2-09	PS-18 Tasmajdan stari	1	400	400	1
2-2-10	PS-18	1	400	400	1
2-2-11	PS-18	1	400	400	1
2-2-12	PS-18	1	400	400	1
2-2-13	PS-19 Bezanija	1	400	200	1
2-2-14	PS-19	1	400	200	1
2-2-15	PS-19	1	400	200	1
2-2-16	PS-23 Studentski Grad	1	400	600	1
2-2-17	PS-23	1	400	600	1
2-2-18	PS-23	1	400	600	1
2-2-19	PS-23	1	400	600	1
2-2-20	PS-23	1	400	600	1
2-2-21	PS-17 Zvezdara	1	400	160	1
2-2-22	PS-17	1	400	160	1
2-2-23	PS-17	1	400	160	1
2-2-24	PS-21 Pionir	1	400	200	2
2-2-25	PS-21	1	400	200	2
2-2-26	PS-21	1	400	200	2
2-2-27	PS-20 Zeleznik	1	400	600	1
2-2-28	PS-20	1	400	600	1

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SS-03 SPECIFICATION OF MEASUREMENT EQUIPMENT (Preasure and Water Level)

Item No.	Name of Station	Q'ty	Type Pieso	Measuring Span	Depth of well (m)	priority
<< Well Equipment >>						
1-3-01	RW 3 Water Level	1	Pieso		0-40	2
1-3-02	RW 9	1	Pieso		0-40	2
1-3-03	RW 7	1	Pieso		0-40	2
1-3-04	RW 46	1	Pieso		0-40	2
1-3-05	RW 87	1	Pieso		0-40	2
1-3-06	RW 88	1	Pieso		0-40	2
1-3-07	RW 35	1	Pieso		0-40	2
1-3-08	RW 49	1	Pieso		0-40	2
<< Pump Station >>						
2-6-01	PS 1A Pressure	1	Pieso	0-16 bar		1
2-6-02	PS 1A	1	Pieso	0-16		1
2-6-03	PS 1A	1	Pieso	0-16		1
2-6-04	PS 1B	1	Pieso	0-16		1
2-6-05	PS 1B	1	Pieso	0-16		1
2-6-06	PS 1B	1	Pieso	0-16		1
2-6-07	PS 1B	1	Pieso	0-16		1
2-6-08	PS 4	1	Pieso	0-16		1
2-6-09	PS 4	1	Pieso	0-16		1
2-6-10	PS 4	1	Pieso	0-16		1
2-6-11	PS 15	1	Pieso	0-16		1
2-6-12	PS 15	1	Pieso	0-16		1
2-6-13	PS 15	1	Pieso	0-16		1
2-6-14	PS 15	1	Pieso	0-25		1
2-6-15	PS 15	1	Pieso	0-25		1
2-6-16	PS 15	1	Pieso	0-25		1
2-6-17	PS 15	1	Pieso	0-25		1
2-6-18	PS 16	1	Pieso	0-16		1
2-6-19	PS 16	1	Pieso	0-16		1
2-6-20	PS 16	1	Pieso	0-16		1
2-6-21	PS 16	1	Pieso	0-25		1
2-6-22	PS 16	1	Pieso	0-25		1
2-6-23	PS 16	1	Pieso	0-25		1
2-6-24	PS 16	1	Pieso	0-25		1
2-6-25	PS 18	1	Pieso	0-16		1
2-6-26	PS 18	1	Pieso	0-16		1
2-6-27	PS 18	1	Pieso	0-16		1
2-6-28	PS 18	1	Pieso	0-16		1
2-6-29	PS 18	1	Pieso	0-16		1
2-6-30	PS 19	1	Pieso	0-16		1
2-6-31	PS 19	1	Pieso	0-16		1
2-6-32	PS 23	1	Pieso	0-16		1
2-6-33	PS 23	1	Pieso	0-16		1
2-6-34	PS 23	1	Pieso	0-16		1
2-6-35	PS 23	1	Pieso	0-16		1
2-6-36	PS 23	1	Pieso	0-16		1
2-6-37	PS 25	1	Pieso	0-16		1
2-6-38	PS 25	1	Pieso	0-16		1
2-6-39	PS 25	1	Pieso	0-16		1
2-6-40	PS 25	1	Pieso	0-25		1
2-6-41	PS 25	1	Pieso	0-25		1
2-6-42	PS 25	1	Pieso	0-25		1
2-6-43	PS 28	1	Pieso	0-16		1
2-6-44	PS 28	1	Pieso	0-16		1
2-6-45	PS 28	1	Pieso	0-16		1
2-6-46	PS 28	1	Pieso	0-16		1
2-6-47	PS 28	1	Pieso	0-25		1
2-6-48	PS 28	1	Pieso	0-25		1
2-6-49	PS 5	1	Pieso	0-25		1
2-6-50	PS 5	1	Pieso	0-25		1
2-6-51	PS 17	1	Pieso	0-16		1

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SS-03 SPECIFICATION OF MEASUREMENT EQUIPMENT (Preasure and Water Level)

Item No.	Name of Station	Q'ty	Type Pieso	Measuring Span	Depth of well (m)	priority
2-6-52	PS 17	1	Pieso	0-16		1
2-6-53	PS 17	1	Pieso	0-16		1
2-6-54	PS 17	1	Pieso	0-16		1
2-6-55	PS 17	1	Pieso	0-16		1
2-6-56	PS 17	1	Pieso	0-16		1
2-6-57	PS 21	1	Pieso	0-16		1
2-6-58	PS 21	1	Pieso	0-16		1
2-6-59	PS 21	1	Pieso	0-16		1
2-6-60	PS 20	1	Pieso	0-25		1
2-6-61	PS 20	1	Pieso	0-25		1
2-6-62	PS 20	1	Pieso	0-25		1
2-6-63	PS 26	1	Pieso	0-25		1
2-6-64	PS 26	1	Pieso	0-25		1
2-6-65	PS 26	1	Pieso	0-25		1
2-6-66	PS 33	1	Pieso	0-40		1
2-6-67	PS 33	1	Pieso	0-40		1
2-6-68	PS 3	1	Pieso	0-16		1
2-6-69	PS 3	1	Pieso	0-16		1
2-6-70	PS 3	1	Pieso	0-16		1
2-6-71	PS 6	1	Pieso	0-16		1
2-6-72	PS 6	1	Pieso	0-16		1
2-6-73	PS Lesce	1	Pieso	0-16		1
2-6-74	PS Lesce	1	Pieso	0-16		1
2-6-75	PS Lesce	1	Pieso	0-16		1

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SS-04 / SPECIFICATION OF Valves & Flaps

Item No.	Name of Station	Flaps			Item No.	Valves		
		Q'ty	Diameter (mm)	priority		Q'ty	Diameter	priority
<< Well Equipment >>					<< Well Equipment >>			
1-4-01	1				1-5-01	1	200	2
1-4-02	1m				1-5-02	1	200	2
1-4-03	2				1-5-03	1	200	2
1-4-04	2m				1-5-04	1	200	2
1-4-05	3				1-5-05	1	200	2
1-4-06	3m				1-5-06	1	200	2
1-4-07	3A				1-5-07	1	200	2
1-4-08	4/I				1-5-08	1	200	2
1-4-09	4/III				1-5-09	1	200	2
1-4-10	4m				1-5-10	1	200	2
1-4-11	5				1-5-11	1	200	2
1-4-12	5m				1-5-12	1	200	2
1-4-13	6				1-5-13	1	200	2
1-4-14	6A				1-5-14	1	200	2
1-4-15	6M				1-5-15	1	200	2
1-4-16	7				1-5-16	1	200	2
1-4-17	7M				1-5-17	1	200	2
1-4-18	8A				1-5-18	1	200	2
1-4-19	8M				1-5-19	1	200	2
1-4-20	9				1-5-20	1	200	2
1-4-21	10				1-5-21	1	200	2
1-4-22	10M				1-5-22	1	200	2
1-4-23	11				1-5-23	1	200	2
1-4-24	11/I				1-5-24	1	200	2
1-4-25	12				1-5-25	1	200	2
1-4-26	12/1				1-5-26	1	200	2
1-4-27	12/2				1-5-27	1	200	2
1-4-28	12/3				1-5-28	1	200	2
1-4-29	13/1				1-5-29	1	200	2
1-4-30	14				1-5-30	1	200	2
1-4-31	14/1				1-5-31	1	200	2
1-4-32	15				1-5-32	1	200	2
1-4-33	15/1				1-5-33	1	200	2
1-4-34	16				1-5-34	1	200	2
1-4-35	16/1				1-5-35	1	200	2
1-4-36	17				1-5-36	1	200	2
1-4-37	18				1-5-37	1	200	2
1-4-38	19				1-5-38	1	200	2
1-4-39	19/1				1-5-39	1	200	2
1-4-40	20				1-5-40	1	200	2
1-4-41	20/1				1-5-41	1	200	2
1-4-42	21				1-5-42	1	200	2
1-4-43	22/I				1-5-43	1	200	2
1-4-44	22/II				1-5-44	1	200	2
1-4-45	23/I				1-5-45	1	200	2
1-4-46	23/II				1-5-46	1	200	2
1-4-47	24				1-5-47	1	200	2
1-4-48	25				1-5-48	1	200	2
1-4-49	26				1-5-49	1	200	2
1-4-50	27				1-5-50	1	200	2
1-4-51	28				1-5-51	1	200	2
1-4-52	29				1-5-52	1	200	2
1-4-53	30				1-5-53	1	200	2
1-4-54	35				1-5-54	1	200	2
1-4-55	36				1-5-55	1	200	2
1-4-56	37				1-5-56	1	200	2
1-4-57	38				1-5-57	1	200	2
1-4-58	40				1-5-58	1	200	2
1-4-59	41				1-5-59	1	200	2
1-4-60	42				1-5-60	1	200	2
1-4-61	43				1-5-61	1	200	2
1-4-62	44				1-5-62	1	200	2
1-4-63	45				1-5-63	1	200	2

SS-04 / SPECIFICATION OF Valves & Flaps

Item No.	Name of Station	Flaps			Item No.	Valves		
		Q'ty	Diameter (mm)	priority		Q'ty	Diameter	priority
1-4-64	46				1-5-64	1	200	2
1-4-65	47				1-5-65	1	200	2
1-4-66	48				1-5-66	1	200	2
1-4-67	49				1-5-67	1	200	2
1-4-68	50				1-5-68	1	200	2
1-4-69	51				1-5-69	1	200	2
1-4-70	52				1-5-70	1	200	2
1-4-71	53				1-5-71	1	200	2
1-4-72	59				1-5-72	1	200	2
1-4-73	60				1-5-73	1	200	2
1-4-74	61				1-5-74	1	200	2
1-4-75	62				1-5-75	1	200	2
1-4-76	63				1-5-76	1	200	2
1-4-77	64				1-5-77	1	200	2
1-4-78	65				1-5-78	1	200	2
1-4-79	66				1-5-79	1	200	2
1-4-80	69				1-5-80	1	200	2
1-4-81	72				1-5-81	1	200	2
1-4-82	73				1-5-82	1	200	2
1-4-83	75				1-5-83	1	200	2
1-4-84	78				1-5-84	1	200	2
1-4-85	79				1-5-85	1	200	2
1-4-86	80				1-5-86	1	200	2
1-4-87	81				1-5-87	1	200	2
1-4-88	83				1-5-88	1	200	2
1-4-89	84				1-5-89	1	200	2
1-4-90	85				1-5-90	1	200	2
1-4-91	86				1-5-91	1	200	2
1-4-92	87				1-5-92	1	200	2
1-4-93	88				1-5-93	1	200	2
1-4-94	89				1-5-94	1	200	2
1-4-95	90				1-5-95	1	200	2
1-4-96	92				1-5-96	1	200	2
1-4-97	93				1-5-97	1	200	2
1-4-98	94				1-5-98	1	200	2
1-4-99	95				1-5-99	1	200	2
1-4-100	98				1-5-100	1	200	2
<< Pump Station >>								
2-5-01	PS 1A	1	250	1				
2-5-02	PS 1A	1	250	1				
2-5-03	PS 1A	1	250	1				
2-5-04	PS 1B	1	450	1				
2-5-05	PS 1B	1	250	1				
2-5-06	PS 1B	1	450	1				
2-5-07	PS 1B	1	250	1				
2-5-08	PS 4	1	250	2				
2-5-09	PS 4	1	200	2				
2-5-10	PS 4	1	250	2				
2-5-11	PS 15	1	200	3				
2-5-12	PS 15	1	200	3				
2-5-13	PS 15	1	200	3				
2-5-14	PS 16	1	200	3				
2-5-15	PS 16	1	200	3				
2-5-16	PS 16	1	250	3				
2-5-17	PS 18	1	400	1				
2-5-18	PS 18	1	400	1				
2-5-19	PS 18	1	350	1				
2-5-20	PS 18	1	400	1				
2-5-21	PS 19	1	300	1				
2-5-22	PS 19	1	300	1				
2-5-23	PS 19	1	300	1				
2-5-24	PS 25	1	250	2				
2-5-25	PS 25	1	250	2				
2-5-26	PS 25	1	250	2				

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SS-04 / SPECIFICATION OF Valves & Flaps

Item No.	Name of Station	Flaps			Item No.	Valves		
		Q'ty	Diameter (mm)	priority		Q'ty	Diameter	priority
2-5-27	PS 25A	1	200	2				
2-5-28	PS 25A	1	200	2				
2-5-29	PS 25A	1	200	2				
2-5-30	PS 28	1	500	2				
2-5-31	PS 28	1	500	2				
2-5-32	PS 28	1	500	2				
2-5-33	PS 28	1	400	2				
2-5-34	PS 28	1	400	2				
2-5-35	PS 28	1	400	2				
2-5-36	PS 17	1	200	1				
2-5-37	PS 17	1	250	1				
2-5-38	PS 17	1	250	1				
2-5-39	PS 17A	1	300	1				
2-5-40	PS 17A	1	300	1				
2-5-41	PS 17A	1	300	1				
2-5-42	PS 21	1	300	2				
2-5-43	PS 21	1	150	2				
2-5-44	PS 21	1	150	2				
2-5-45	PS 22	1	300	3				
2-5-46	PS 22	1	300	3				
2-5-47	PS 24	1	350	3				
2-5-48	PS 24	1	350	3				
2-5-49	PS 24	1	350	3				
2-5-50	PS 20	1	300	1				
2-5-51	PS 20	1	300	1				
2-5-52	PS 20	1	300	1				
2-5-53	PS 26	1	100	3				
2-5-54	PS 26	1	100	3				
2-5-55	PS 26	1	100	3				
2-5-56	PS 30	1	150	4				
2-5-57	PS 30	1	150	4				
2-5-58	PS 3	1	500	3				
2-5-59	PS 3	1	500	3				
2-5-60	PS 3	1	500	3				
2-5-61	PS 6	1	200	3				
2-5-62	PS 6	1	200	3				
2-5-63	PS Lesce	1	200	4				
2-5-64	PS Lesce	1	200	4				
2-5-65	PS Lesce	1	200	4				

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SS-05 / SPECIFICATION OF CONTROL CUBICLE

Item No.	Name of Station	Q'ty	Voltage(V)	Installation Indoor / Outdoor	Contro Scheme	Major Component	Priority
<< Well Equipment >>							
1-6-01	RW-6m	1	400	indor			2
1-6-02	RW-2m	1	400	indor			2
1-6-03	RW-8m	1	400	indor			2
1-6-04	RW-1m	1	400	indor			2
1-6-05	RW-19/1	1	400	indor			2
1-6-06	RW-20/1	1	400	indor			2
1-6-07	RW-20	1	400	indor			2
1-6-08	RW-15/1	1	400	indor			2
1-6-09	RW-14/1	1	400	indor			2
1-6-10	RW-13/1	1	400	indor			2
1-6-11	RW-11/1	1	400	indor			2
1-6-12	RW-12/1	1	400	indor			2
1-6-13	RW12/2	1	400	indor			2
1-6-14	RW-3	1	400	indor			2
1-6-15	RW-9	1	400	indor			2
1-6-16	RW-7	1	400	indor			2
1-6-17	RW22/1	1	400	indor			2
1-6-18	RW-2	1	400	indor			2
1-6-19	RW-4/1	1	400	indor			2
1-6-20	RW-40	1	400	indor			2
1-6-21	RW-42	1	400	indor			2
1-6-22	RW-43	1	400	indor			2
1-6-23	RW-45	1	400	indor			2
1-6-24	RW-46	1	400	indor			2
1-6-25	RW-49	1	400	indor			2
1-6-26	RW-63	1	400	indor			2
1-6-27	RW-62	1	400	indor			2
1-6-28	RW-72	1	400	indor			2
1-6-29	RW-75	1	400	indor			2
1-6-30	RW-79	1	400	indor			2
1-6-31	RW-81	1	400	indor			2
1-6-32	RW-87	1	400	indor			2
1-6-33	RW-88	1	400	indor			2
1-6-34	RW-90	1	400	indor			2
1-6-35	RW-98	1	400	indor			2
1-6-36	RW-65	1	400	indor			2
1-6-37	RW-66	1	400	indor			2
1-6-38	RW-41	1	400	indor			2
1-6-39	RW-35	1	400	indor			2
1-6-40	RW-29	1	400	indor			2
1-6-41	RW-23/1	1	400	indor			2

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SS-05 / SPECIFICATION OF CONTROL CUBICLE

Item No.	Name of Station	Q'ty	Voltage(V)	Installation Indoor / Outdoor	Contro Scheme	Major Component	Priority
1-6-42	RW-14	1	400	indor			2
1-6-43	RW-12/3	1	400	indor			2
1-6-44	RE-5m	1	400	indor			2
1-6-45	RW-8A	1	400	indor			2
1-6-46	RW-10	1	400	indor			2
1-6-47	RW-11	1	400	indor			2
1-6-48	RW-16/1	1	400	indor			2
1-6-49	RW-17	1	400	indor			2
<< Pump Station >>							
2-4-01	PS-1a Bele Vode	1	400	indor			1
2-4-02	PS-1a	1	400	indor			1
2-4-03	PS-1a	1	400	indor			1
2-4-04	PS-1b	1	400	indor			1
2-4-05	PS-1b	1	400	indor			1
2-4-06	PS-1b	1	400	indor			1
2-4-07	PS-1b	1	400	indor			1
2-4-08	PS-4 Crvrni Krst	1	400	indor			2
2-4-09	PS-18 Tasmajdan stari	1	400	indor			1
2-4-10	PS-18	1	400	indor			1
2-4-11	PS-18	1	400	indor			1
2-4-12	PS-18	1	400	indor			1
2-4-13	PS-19 Bezanija	1	400	indor			1
2-4-14	PS-19	1	400	indor			1
2-4-15	PS-19	1	400	indor			1
2-4-16	PS-23 Studentski Grad	1	400	indor			1
2-4-17	PS-23	1	400	indor			1
2-4-18	PS-23	1	400	indor			1
2-4-19	PS-23	1	400	indor			1
2-4-20	PS-23	1	400	indor			1
2-4-21	PS-17 Zvezdara	1	400	indor			1
2-4-22	PS-17	1	400	indor			1
2-4-23	PS-17	1	400	indor			1
2-4-24	PS-21 Pionir	1	400	indor			2
2-4-25	PS-21	1	400	indor			2
2-4-26	PS-21	1	400	indor			2
2-4-27	PS-20 Zeleznik	1	400	indor			1
2-4-28	PS-20	1	400	indor			1
<< Measuring Point >>							
3-2-01		1	400	outdor			2
3-2-02		1	400	outdor			2
3-2-03		1	400	outdor			2
3-2-04		1	400	outdor			2

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SS-05 / SPECIFICATION OF CONTROL CUBICLE

Item No.	Name of Station	Q'ty	Voltage(V)	Installation Indoor / Outdoor	Contro Scheme	Major Component	Priority
3-2-05		1	400	outdor			2
3-2-06		1	400	outdor			2
3-2-07		1	400	outdor			2
3-2-08		1	400	outdor			2
3-2-09		1	400	outdor			2
3-2-10		1	400	outdor			2
3-2-11		1	400	outdor			2
3-2-12		1	400	outdor			2
3-2-13		1	400	outdor			2
3-2-14		1	400	outdor			2
3-2-15		1	400	outdor			2
3-2-16		1	400	outdor			2
3-2-17		1	400	outdor			2
3-2-18		1	400	outdor			2
3-2-19		1	400	outdor			2
3-2-20		1	400	outdor			2
3-2-21		1	400	outdor			2
3-2-22		1	400	outdor			2
3-2-23		1	400	outdor			2
3-2-24		1	400	outdor			2
3-2-25		1	400	outdor			2
3-2-26		1	400	outdor			2
3-2-27		1	400	outdor			2
3-2-28		1	400	outdor			2

SS-06 / SPECIFICATION OF TERMINAL EQUIPMENT (hw + sw)

Item No.	Name of Station	Q'ty	Specification	Priority
<< Well Equipment >>				
1-7-01	98	1	PLC with accessories, programing	1
1-7-02	95	1	PLC with accessories, programing	1
1-7-03	94	1	PLC with accessories, programing	1
1-7-04	93	1	PLC with accessories, programing	1
1-7-05	92	1	PLC with accessories, programing	1
1-7-06	90	1	PLC with accessories, programing	1
1-7-07	89	1	PLC with accessories, programing	1
1-7-08	88	1	PLC with accessories, programing	1
1-7-09	87	1	PLC with accessories, programing	1
1-7-10	86	1	PLC with accessories, programing	1
1-7-11	85	1	PLC with accessories, programing	1
1-7-12	84	1	PLC with accessories, programing	1
1-7-13	83	1	PLC with accessories, programing	1
1-7-14	81	1	PLC with accessories, programing	1
1-7-15	80	1	PLC with accessories, programing	1
1-7-16	79	1	PLC with accessories, programing	1
1-7-17	78	1	PLC with accessories, programing	1
1-7-18	75	1	PLC with accessories, programing	1
1-7-19	73	1	PLC with accessories, programing	1
1-7-20	72	1	PLC with accessories, programing	1
1-7-21	69	1	PLC with accessories, programing	1
1-7-22	62	1	PLC with accessories, programing	1
1-7-23	61	1	PLC with accessories, programing	1
1-7-24	60	1	PLC with accessories, programing	1
1-7-25	59	1	PLC with accessories, programing	1
1-7-26	66	1	PLC with accessories, programing	1
1-7-27	65	1	PLC with accessories, programing	1
1-7-28	64	1	PLC with accessories, programing	1
1-7-29	63	1	PLC with accessories, programing	1
1-7-30	51	1	PLC with accessories, programing	1
1-7-31	50	1	PLC with accessories, programing	1
1-7-32	49	1	PLC with accessories, programing	1
1-7-33	48	1	PLC with accessories, programing	1
1-7-34	47	1	PLC with accessories, programing	1
1-7-35	46	1	PLC with accessories, programing	1
1-7-36	45	1	PLC with accessories, programing	1
1-7-37	44	1	PLC with accessories, programing	1
1-7-38	43	1	PLC with accessories, programing	1
1-7-39	42	1	PLC with accessories, programing	1
1-7-40	41	1	PLC with accessories, programing	1
1-7-41	40	1	PLC with accessories, programing	1
1-7-42	38	1	PLC with accessories, programing	1
1-7-43	37	1	PLC with accessories, programing	1
1-7-44	36	1	PLC with accessories, programing	1
1-7-45	35	1	PLC with accessories, programing	1
1-7-46	22/I	1	PLC with accessories, programing	1
1-7-47	22/II	1	PLC with accessories, programing	1
1-7-48	23/I	1	PLC with accessories, programing	1
1-7-49	23/II	1	PLC with accessories, programing	1

SS-06 / SPECIFICATION OF TERMINAL EQUIPMENT (hw + sw)

Item No.	Name of Station	Q'ty	Specification	Priority
1-7-50	21	1	PLC with accessories, programing	1
<< Pump Station >>				
2-7-01	PS 1a Bele vode	2	PLC with accessories, programing	1
2-7-02	PS 1b Bele vode	2	PLC with accessories, programing	1
2-7-03	PS 4 Crveni krst	2	PLC with accessories, programing	1
2-7-04	PS 15 Topcider	2	PLC with accessories, programing	1
2-7-05	PS 15A Topcider	2	PLC with accessories, programing	1
2-7-06	PS 16 Vracar	2	PLC with accessories, programing	1
2-7-07	PS 16A Vracar	2	PLC with accessories, programing	1
2-7-08	PS 18 Tasmajdan	2	PLC with accessories, programing	1
2-7-09	PS 19 Bezanija	2	PLC with accessories, programing	1
2-7-10	PS 23 Stud. grad	2	PLC with accessories, programing	1
2-7-11	PS 25 Mokr.brdo	2	PLC with accessories, programing	1
2-7-12	PS 28 Zarkovo	2	PLC with accessories, programing	1
2-7-13	PS 5 T. Drajzera	2	PLC with accessories, programing	1
2-7-14	PS 17 Zvezdara	2	PLC with accessories, programing	1
2-7-15	PS 21 Pionir	2	PLC with accessories, programing	1
2-7-16	PS 22 Torlak	2	PLC with accessories, programing	1
2-7-17	PS 24 Kosutnjak	2	PLC with accessories, programing	1
2-7-18	PS 20 Zeleznik	2	PLC with accessories, programing	1
2-7-19	PS 26 Ripanj	2	PLC with accessories, programing	1
2-7-20	PS 33 Avala	2	PLC with accessories, programing	1
2-7-21	PS 3 Surcin	2	PLC with accessories, programing	1
2-7-22	PS 6 Dunav	2	PLC with accessories, programing	1
2-7-23	PS Lesce	2	PLC with accessories, programing	1
2-7-24	PS 17A Zvezdara	2	PLC with accessories, programing	1
<< Measuring Point >>				
3-3-01	1	1	PLC with accessories, programing	2
3-3-02	2	1	PLC with accessories, programing	2
3-3-03	3	1	PLC with accessories, programing	2
3-3-04	4	1	PLC with accessories, programing	2
3-3-05	5	1	PLC with accessories, programing	2
3-3-06	6	1	PLC with accessories, programing	2
3-3-07	7	1	PLC with accessories, programing	2
3-3-08	8	1	PLC with accessories, programing	2
3-3-09	9	1	PLC with accessories, programing	2
3-3-10	10	1	PLC with accessories, programing	2
3-3-11	11	1	PLC with accessories, programing	2
3-3-12	12	1	PLC with accessories, programing	2
3-3-13	13	1	PLC with accessories, programing	2
3-3-14	14	1	PLC with accessories, programing	2
3-3-15	15	1	PLC with accessories, programing	2
3-3-16	16	1	PLC with accessories, programing	2
3-3-17	17	1	PLC with accessories, programing	2
3-3-18	18	1	PLC with accessories, programing	2
3-3-19	19	1	PLC with accessories, programing	2
3-3-20	20	1	PLC with accessories, programing	2
3-3-21	21	1	PLC with accessories, programing	2
3-3-22	22	1	PLC with accessories, programing	2
3-3-23	23	1	PLC with accessories, programing	2
3-3-24	24	1	PLC with accessories, programing	2
3-3-25	25	1	PLC with accessories, programing	2
3-3-26	26	1	PLC with accessories, programing	2
3-3-27	27	1	PLC with accessories, programing	2
3-3-28	28	1	PLC with accessories, programing	2
<< Reservoir Equipment >>				
4-2-01	Pionir	1	PLC with accessories, programing	1
4-2-02	Glavni	1	PLC with accessories, programing	1

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SS-06 / SPECIFICATION OF TERMINAL EQUIPMENT (hw + sw)

Item No.	Name of Station	Q'ty	Specification	Priority
4-2-03	Krainski	1	PLC with accessories, programing	1
4-2-04	Zeleznik	1	PLC with accessories, programing	1
4-2-05	Zarkovo	1	PLC with accessories, programing	1
4-2-06	Umka	1	PLC with accessories, programing	1
4-2-07	Zvezdara	1	PLC with accessories, programing	1
4-2-08	Mokrolusko brdo	1	PLC with accessories, programing	1
4-2-09	Dedinje	1	PLC with accessories, programing	1
4-2-10	Barajevo	1	PLC with accessories, programing	1
4-2-11	Petlovo brdo	1	PLC with accessories, programing	1
4-2-12	Stojcino brdo	1	PLC with accessories, programing	1
4-2-13	Torlak	1	PLC with accessories, programing	1
4-2-14	Devojacki grob	1	PLC with accessories, programing	1
4-2-15	Lipovica	1	PLC with accessories, programing	1
4-2-16	Water tower Kosutnjak	1	PLC with accessories, programing	1
4-2-17	Suplja stena	1	PLC with accessories, programing	1
4-2-18	Kumodraz	1	PLC with accessories, programing	1
4-2-19	Water tower Lipovica	1	PLC with accessories, programing	1
4-2-20	Guncati	1	PLC with accessories, programing	1

SS-07 / SPECIFICATION OF TELECOMMUNICATION EQUIPMENT

Item No.	Name of Station	Q'ty	Specification	Priority
<< Well Equipment >>				
1-8-01	1	1	gprs modem, protocol converter	1
1-8-02	1m	1	gprs modem, protocol converter	1
1-8-03	2	1	gprs modem, protocol converter	1
1-8-04	2m	1	gprs modem, protocol converter	1
1-8-05	3	1	gprs modem, protocol converter	1
1-8-06	3m	1	gprs modem, protocol converter	1
1-8-07	3A	1	gprs modem, protocol converter	1
1-8-08	4/I	1	gprs modem, protocol converter	1
1-8-09	4m	1	gprs modem, protocol converter	1
1-8-10	5	1	gprs modem, protocol converter	1
1-8-11	5m	1	gprs modem, protocol converter	1
1-8-12	6	1	gprs modem, protocol converter	1
1-8-13	6A	1	gprs modem, protocol converter	1
1-8-14	6M	1	gprs modem, protocol converter	1
1-8-15	7	1	gprs modem, protocol converter	1
1-8-16	7M	1	gprs modem, protocol converter	1
1-8-17	8A	1	gprs modem, protocol converter	1
1-8-18	8M	1	gprs modem, protocol converter	1
1-8-19	9	1	gprs modem, protocol converter	1
1-8-20	10	1	gprs modem, protocol converter	1
1-8-21	10M	1	gprs modem, protocol converter	1
1-8-22	11	1	gprs modem, protocol converter	1
1-8-23	11/I	1	gprs modem, protocol converter	1
1-8-24	12	1	gprs modem, protocol converter	1
1-8-25	12/1	1	gprs modem, protocol converter	1
1-8-26	12/2	1	gprs modem, protocol converter	1
1-8-27	12/3	1	gprs modem, protocol converter	1
1-8-28	13/1	1	gprs modem, protocol converter	1
1-8-29	14	1	gprs modem, protocol converter	1
1-8-30	14/1	1	gprs modem, protocol converter	1
1-8-31	15	1	gprs modem, protocol converter	1
1-8-32	15/1	1	gprs modem, protocol converter	1
1-8-33	16	1	gprs modem, protocol converter	1
1-8-34	16/1	1	gprs modem, protocol converter	1
1-8-35	17	1	gprs modem, protocol converter	1
1-8-36	18	1	gprs modem, protocol converter	1
1-8-37	19	1	gprs modem, protocol converter	1
1-8-38	19/1	1	gprs modem, protocol converter	1
1-8-39	20	1	gprs modem, protocol converter	1
1-8-40	20/1	1	gprs modem, protocol converter	1
1-8-41	21	1	gprs modem, protocol converter	1
1-8-42	22/I	1	gprs modem, protocol converter	1
1-8-43	23/I	1	gprs modem, protocol converter	1
1-8-44	24	1	gprs modem, protocol converter	1
1-8-45	25	1	gprs modem, protocol converter	1
1-8-46	26	1	gprs modem, protocol converter	1
1-8-47	27	1	gprs modem, protocol converter	1
1-8-48	28	1	gprs modem, protocol converter	1
1-8-49	29	1	gprs modem, protocol converter	1
1-8-50	30	1	gprs modem, protocol converter	1
1-8-51	35	1	gprs modem, protocol converter	1
1-8-52	36	1	gprs modem, protocol converter	1
1-8-53	37	1	gprs modem, protocol converter	1
1-8-54	38	1	gprs modem, protocol converter	1
1-8-55	40	1	gprs modem, protocol converter	1
1-8-56	41	1	gprs modem, protocol converter	1
1-8-57	42	1	gprs modem, protocol converter	1
1-8-58	43	1	gprs modem, protocol converter	1
1-8-59	44	1	gprs modem, protocol converter	1
1-8-60	45	1	gprs modem, protocol converter	

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SS-07 / SPECIFICATION OF TELECOMMUNICATION EQUIPMENT

Item No.	Name of Station	Q'ty	Specification	Priority
1-8-61	46	1	gprs modem, protocol converter	1
1-8-62	47	1	gprs modem, protocol converter	1
1-8-63	48	1	gprs modem, protocol converter	1
1-8-64	49	1	gprs modem, protocol converter	1
1-8-65	50	1	gprs modem, protocol converter	1
1-8-66	51	1	gprs modem, protocol converter	1
1-8-67	52	1	gprs modem, protocol converter	1
1-8-68	53	1	gprs modem, protocol converter	1
1-8-69	59	1	gprs modem, protocol converter	1
1-8-70	60	1	gprs modem, protocol converter	1
1-8-71	61	1	gprs modem, protocol converter	1
1-8-72	62	1	gprs modem, protocol converter	1
1-8-73	63	1	gprs modem, protocol converter	1
1-8-74	64	1	gprs modem, protocol converter	1
1-8-75	65	1	gprs modem, protocol converter	1
1-8-76	66	1	gprs modem, protocol converter	1
1-8-77	69	1	gprs modem, protocol converter	1
1-8-78	72	1	gprs modem, protocol converter	1
1-8-79	73	1	gprs modem, protocol converter	1
1-8-80	75	1	gprs modem, protocol converter	1
1-8-81	78	1	gprs modem, protocol converter	1
1-8-82	79	1	gprs modem, protocol converter	1
1-8-83	80	1	gprs modem, protocol converter	1
1-8-84	81	1	gprs modem, protocol converter	1
1-8-85	83	1	gprs modem, protocol converter	1
1-8-86	84	1	gprs modem, protocol converter	1
1-8-87	85	1	gprs modem, protocol converter	1
1-8-88	86	1	gprs modem, protocol converter	1
1-8-89	87	1	gprs modem, protocol converter	1
1-8-90	88	1	gprs modem, protocol converter	1
1-8-91	89	1	gprs modem, protocol converter	1
1-8-92	90	1	gprs modem, protocol converter	1
1-8-93	92	1	gprs modem, protocol converter	1
1-8-94	93	1	gprs modem, protocol converter	1
1-8-95	94	1	gprs modem, protocol converter	1
1-8-96	95	1	gprs modem, protocol converter	1
1-8-97	98	1	gprs modem, protocol converter	1
<< Pump Station >>				
2-8-01	PS 1a Bele vode	1	gprs,prot.conv.,box, fiber, med.	1
2-8-02	PS 1b Bele vode	1	gprs,prot.conv., box	1
2-8-03	PS 4 Crveni krst	1	gprs,prot.conv., box	1
2-8-04	PS 15 Topcider	1	gprs,prot.conv., box	1
2-8-05	PS 15A Topcider	1	gprs,prot.conv., switch, box, fiber, med.	1
2-8-06	PS 16 Vracar	1	gprs,prot.conv., box	1
2-8-07	PS 16A Vracar	1	gprs,prot.conv., switch, box, fiber, med.	1
2-8-08	PS 18 Tasmajdan	1	gprs,prot.conv., box	1
2-8-09	PS 19 Bezanija	1	gprs,prot.conv., switch, box, fiber, med.	1
2-8-10	PS 23 Stud. grad	1	gprs,prot.conv., box	1
2-8-11	PS 25 Mokr.brdo	1	gprs,prot.conv., switch, box	1
2-8-12	PS 28 Zarkovo	1	gprs,prot.conv., switch, box	1
2-8-13	PS 5 T. Drajzera	1	gprs,prot.conv., switch, box	1
2-8-14	PS 17 Zvezdara	1	gprs,prot.conv., box	1
2-8-15	PS 21 Pionir	1	gprs,prot.conv., box	1
2-8-16	PS 22 Torlak	1	gprs,prot.conv., switch, box, wll subscr.	1
2-8-17	PS 24 Kosutnjak	1	gprs,prot.conv., switch, box	1
2-8-18	PS 20 Zeleznik	1	gprs,prot.conv., box	1
2-8-19	PS 30 Lipovica	1	gprs,prot.conv., box	1
2-8-20	PS 26 Ripanj	1	gprs,prot.conv., switch, box	1
2-8-21	PS 33 Avala	1	gprs,prot.conv., switch, box	1
2-8-22	PS 3 Surcin	1	gprs,prot.conv., switch, box	1
2-8-23	PS 6 Dunav	1	gprs,prot.conv., switch, box	1

SS-07 / SPECIFICATION OF TELECOMMUNICATION EQUIPMENT

Item No.	Name of Station	Q'ty	Specification	Priority
2-8-24	PS Lesce	1	gprs,prot.conv., switch, box	1
2-8-25	PS 17A Zvezdara	1	gprs,prot.conv., box	1
2-8-26	PS 10 Dedinje	1	gprs,prot.conv., box	1
2-8-27	PS 27 Makis cista voda	1	gprs,prot.conv., box	1
<< Measuring Point >>				
3-4-01	1	1	gprs modem, protocol converter	2
3-4-02	2	1	gprs modem, protocol converter	2
3-4-03	3	1	gprs modem, protocol converter	2
3-4-04	4	1	gprs modem, protocol converter	2
3-4-05	5	1	gprs modem, protocol converter	2
3-4-06	6	1	gprs modem, protocol converter	2
3-4-07	7	1	gprs modem, protocol converter	2
3-4-08	8	1	gprs modem, protocol converter	2
3-4-09	9	1	gprs modem, protocol converter	2
3-4-10	10	1	gprs modem, protocol converter	2
3-4-11	11	1	gprs modem, protocol converter	2
3-4-12	12	1	gprs modem, protocol converter	2
3-4-13	13	1	gprs modem, protocol converter	2
3-4-14	14	1	gprs modem, protocol converter	2
3-4-15	15	1	gprs modem, protocol converter	2
3-4-16	16	1	gprs modem, protocol converter	2
3-4-17	17	1	gprs modem, protocol converter	2
3-4-18	18	1	gprs modem, protocol converter	2
3-4-19	19	1	gprs modem, protocol converter	2
3-4-20	20	1	gprs modem, protocol converter	2
3-4-21	21	1	gprs modem, protocol converter	2
3-4-22	22	1	gprs modem, protocol converter	2
3-4-23	23	1	gprs modem, protocol converter	2
3-4-24	24	1	gprs modem, protocol converter	2
3-4-25	25	1	gprs modem, protocol converter	2
3-4-26	26	1	gprs modem, protocol converter	2
3-4-27	27	1	gprs modem, protocol converter	2
3-4-28	28	1	gprs modem, protocol converter	2
<< Reservoir >>				
4-3-01	Pionir	1	gprs modem, protocol converter	1
4-3-02	Glavni	1	gprs modem, protocol converter	1
4-3-03	Krainski	1	gprs modem, protocol converter	1
4-3-04	Zeleznik	1	gprs modem, protocol converter	1
4-3-05	Zarkovo	1	gprs modem, protocol converter	1
4-3-06	Umka	1	gprs modem, protocol converter	1
4-3-07	Zvezdara	1	gprs modem, protocol converter	1
4-3-08	Mokrolusko brdo	1	gprs modem, protocol converter	1
4-3-09	Dedinje	1	gprs modem, protocol converter	1
4-3-10	Barajevo	1	gprs modem, protocol converter	1
4-3-11	Petlovo brdo	1	gprs modem, protocol converter	1
4-3-12	Stojcino brdo	1	gprs modem, protocol converter	1
4-3-13	Torlak	1	gprs modem, protocol converter	1
4-3-14	Devojacki grob	1	gprs modem, protocol converter	1
4-3-15	Lipovica	1	gprs modem, protocol converter	1
4-3-16	Water tower Kosutnjak	1	gprs modem, protocol converter	1
4-3-17	Suplja stena	1	gprs modem, protocol converter	1
4-3-18	Kumodraz	1	gprs modem, protocol converter	1
4-3-19	Water tower Lipovica	1	gprs modem, protocol converter	1
4-3-20	Guncati	1	gprs modem, protocol converter	1

SS-09 / SPECIFICATION OF TELECOMMUNICATION NETWORK

Item No.	Name of Station	Q'ty	Specification	priority
5-1 IP data network for tehnical system data transmission				
5-1-2 Active components				
<< SHDSL Layer 3 router >>				
5-1-2-1-01	PS 30 Lipovica – PS 20	1	SHDSL Router Layer 3	1
5-1-2-1-02	PS 20 Zeleznik – PS 30	1	SHDSL Router Layer 3	1
5-1-2-1-03	PS 20 Zeleznik – PS 1B	1	SHDSL Router Layer 3	1
5-1-2-1-04	PS 1B Bele vode– PS 20	1	SHDSL Router Layer 3	1
5-1-2-1-05	PS 1B Bele vode–B.Brdo	1	SHDSL Router Layer 3	1
5-1-2-1-06	B.Brdo–PS 1B Bele vode	1	SHDSL Router Layer 3	1
5-1-2-1-07	B.Brdo–K.Milosa	1	SHDSL Router Layer 3	1
5-1-2-1-08	K.Milosa – B.Brdo	1	SHDSL Router Layer 3	1
5-1-2-1-09	K.Milosa – PS 15 Topcider	1	SHDSL Router Layer 3	1
5-1-2-1-10	PS 15– K.Milosa	1	SHDSL Router Layer 3	1
5-1-2-1-11	K.Milosa – PS 16 Vracar	1	SHDSL Router Layer 3	1
5-1-2-1-12	PS 16– K.Milosa	1	SHDSL Router Layer 3	1
5-1-2-1-13	K.Milosa – PS 4 C Krst	1	SHDSL Router Layer 3	1
5-1-2-1-14	PS 4– K.Milosa	1	SHDSL Router Layer 3	1
5-1-2-1-15	K.Milosa – PS 17 Zvezdara	1	SHDSL Router Layer 3	1
5-1-2-1-16	PS 17– K.Milosa	1	SHDSL Router Layer 3	1
5-1-2-1-17	K.Milosa – PS 18 Tasmajdan	1	SHDSL Router Layer 3	1
5-1-2-1-18	PS 18– K.Milosa	1	SHDSL Router Layer 3	1
5-1-2-1-19	K.Milosa – PS 21 Pionir	1	SHDSL Router Layer 3	1
5-1-2-1-20	PS 21– K.Milosa	1	SHDSL Router Layer 3	1
5-1-2-1-21	K.Milosa – PS 23 S.Grad	1	SHDSL Router Layer 3	1
5-1-2-1-22	PS 23– K.Milosa	1	SHDSL Router Layer 3	1
5-1-2-1-23	Bezanija– PS 23	1	SHDSL Router Layer 3	1
5-1-2-1-24	PS 23– Bezanija	1	SHDSL Router Layer 3	1
5-1-2-1-25	K.Milosa – Deligradska	1	SHDSL Router Layer 3	1
5-1-2-1-26	Deligradska – K.Milosa	1	SHDSL Router Layer 3	1
5-1-2-1-27	K.Milosa – PS 10 Dedinje	1	SHDSL Router Layer 3	1
5-1-2-1-28	PS 10– K.Milosa	1	SHDSL Router Layer 3	1
5-1-2-1-29	B.Brdo–Makis	1	SHDSL Router Layer 3	1
5-1-2-1-30	Makis – B.Brdo	1	SHDSL Router Layer 3	1
5-1-2-1-31	PS 5 T. drajzera–Kneza Milosa	1	SHDSL Router Layer 3	1
5-1-2-1-32	Kneza Milosa – PS 5 T.drazera	1	SHDSL Router Layer 3	1
<< Layer 3 switch >>				
5-1-2-2-01	PS 1B Bele vode	1	Layer 3 + acc	1
5-1-2-2-02	Banovo Brdo	1	Layer 3 + acc	1
5-1-2-2-03	Bezanija	1	Layer 3 + acc	1
5-1-2-2-04	K.Milosa	0	Layer 3 + acc	1
5-1-2-2-05	Makis	1	Layer 3 + acc	1
<< Layer 2 switch >>				
5-1-2-3-01	PS 30 Lipovica	1	Layer 2	1
5-1-2-3-02	PS 20 Zeleznik	1	Layer 2	1
5-1-2-3-03	PS 1A Bele vode	1	Layer 2	1
5-1-2-3-04	PS 4 Crveni krst	1	Layer 2	1
5-1-2-3-05	PS 15 Topcider	1	Layer 2	1
5-1-2-3-06	PS 15 A Topcider	1	Layer 2	1
5-1-2-3-07	PS 16 Vracar	1	Layer 2	1
5-1-2-3-08	PS 16 A Vracar	1	Layer 2	1
5-1-2-3-09	PS 17 Zvezdara	1	Layer 2	1
5-1-2-3-10	PS 18 Tasmajdan	1	Layer 2	1
5-1-2-3-11	PS 23 Studentski grad	1	Layer 2	1
5-1-2-3-12	PS 21 Pionir	1	Layer 2	1
5-1-2-3-13	PS Teodora drajzera	1	Layer 2	1
5-1-2-3-14	PS 10 Dedinje	1	Layer 2	1

SS-09 / SPECIFICATION OF TELECOMMUNICATION NETWORK

Item No.	Name of Station	Q'ty	Specification	priority
5-1-2-3-15	PS 22 Torlak	1	Layer 2	1
5-1-2-3-16	PS 24 Kosutnjak	1	Layer 2	1
5-1-2-3-17	PS 1A Bele Vode	1	Layer 2	1
5-1-2-3-18	Deligradska	1	Layer 2	1
5-1-2-3-19	PS 27 Cista voda	1	Layer 2	1
5-1-2-3-20	PS 19 Bezanija	1	Layer 2	1
5-1-2-3-21	PS 6 Dunav	1	Layer 2	1
5-1-2-3-22	PS 25 Mokrolusko brdo	1	Layer 2	1
5-1-2-3-23	PS 28 Zarkovo	1	Layer 2	1
<< Media converter >>				
5-1-2-4-01	Bezanija - PS 19 Bezanija	1	Media converter SM/FE 100Mbps	1
5-1-2-4-02	PS 19 Bezanija - Bezanija	1	Media converter SM/FE 100Mbps	1
5-1-2-4-03	PS15 Topcider - PS15A Topcide	1	Media converter SM/FE 100Mbps	1
5-1-2-4-04	PS15A Topcider - PS15 Topcide	1	Media converter SM/FE 100Mbps	1
5-1-2-4-05	PS16 Vracar - PS16A Vracar	1	Media converter SM/FE 100Mbps	1
5-1-2-4-06	PS16A Vracar - PS16 Vracar	1	Media converter SM/FE 100Mbps	1
5-1-2-4-07	Makis - PS 27 Cista voda	1	Media converter SM/FE 100Mbps	1
5-1-2-4-08	PS 27 Cista voda - Makis	1	Media converter SM/FE 100Mbps	1
5-1-2-4-09	PS1A B. vode - PS1B B. vod	1	Media converter SM/FE 100Mbps	1
5-1-2-4-10	PS1B B. vode - PS1A B. vod	1	Media converter SM/FE 100Mbps	1
5-1-2-4-11	Kosutnjak - PS 24 Kosutnjak	1	Media converter SM/FE 100Mbps	1
5-1-2-4-12	PS 24 Kosutnjak - Kosutnjak	1	Media converter SM/FE 100Mbps	1
5-1-2-4-13	PS 17 Zvezdara - Kosutnjak	1	Media converter SM/FE 100Mbps	1
5-1-2-4-14	Kosutnjak - PS 24 Kosutnjak	1	Media converter SM/FE 100Mbps	1

SS-10 / SPECIFICATION OF SERVER

Item No.	Name of Server	Q'ty	Specification	priority
<< Pump Station / Local SCADA >>				
2-9-01	PS 4 Crveni krst	1		1
2-9-02	PS 15 Topcider	1		1
2-9-03	PS 16 Vracar	1		1
2-9-04	PS 18 Tasmajdan	1		1
2-9-05	PS 23 Stud. grad	1		1
2-9-06	PS 25 Mokr.brdo	1		1
2-9-07	PS 28 Zarkovo	1		1
2-9-08	PS 27 Makis	1		1
2-9-09	PS 10 Dedinje	1		1
2-9-10	PS 17 Zvezdara	1		1
2-9-11	PS 21 Pionir	1		1
2-9-12	PS 20 Zeleznik	1		1
2-9-13	PS 30 Lipovica	1		1
2-9-14	PS 6 Dunav	1		1
<< Pump Station / Monitor HMI Scada >>				
2-12-01	PS 4 Crveni krst	1		1
2-12-02	PS 15 Topcider	1		1
2-12-03	PS 16 Vracar	1		1
2-12-04	PS 18 Tasmajdan	1		1
2-12-05	PS 23 Stud. grad	1		1
2-12-06	PS 25 Mokr.brdo	1		1
2-12-07	PS 28 Zarkovo	1		1
2-12-08	PS 27 Makis	1		1
2-12-09	PS 10 Dedinje	1		1
2-12-10	PS 17 Zvezdara	1		1

SS-10 / SPECIFICATION OF SERVER

Item No.	Name of Server	Q'ty	Specification	priority
2-12-11	PS 21 Pionir	1		1
2-12-12	PS 20 Zeleznik	1		1
2-12-13	PS 30 Lipovica	1		1
2-12-14	PS 6 Dunav	1		1
<< Pump Station / printer >>				
2-13-01	PS 4 Crveni krst	1		1
2-13-02	PS 15 Topcider	1		1
2-13-03	PS 16 Vracar	1		1
2-13-04	PS 18 Tasmajdan	1		1
2-13-05	PS 23 Stud. grad	1		1
2-13-06	PS 25 Mokr.brdo	1		1
2-13-07	PS 28 Zarkovo	1		1
2-13-08	PS 27 Makis	1		1
2-13-09	PS 10 Dedinje	1		1
2-13-10	PS 17 Zvezdara	1		1
2-13-11	PS 21 Pionir	1		1
2-13-12	PS 20 Zeleznik	1		1
2-13-13	PS 30 Lipovica	1		1
2-13-14	PS 6 Dunav	1		1
<< Pump Station / UPS >>				
2-14-01	PS 4 Crveni krst	1		1
2-14-02	PS 15 Topcider	1		1
2-14-03	PS 16 Vracar	1		1
2-14-04	PS 18 Tasmajdan	1		1
2-14-05	PS 23 Stud. grad	1		1
2-14-06	PS 25 Mokr.brdo	1		1

SS-10 / SPECIFICATION OF SERVER

Item No.	Name of Server	Q'ty	Specification	priority
2-14-07	PS 28 Zarkovo	1		1
2-14-08	PS 27 Makis	1		1
2-14-09	PS 10 Dedinje	1		1
2-14-10	PS 17 Zvezdara	1		1
2-14-11	PS 21 Pionir	1		1
2-14-12	PS 20 Zeleznik	1		1
2-14-13	PS 30 Lipovica	1		1
2-14-14	PS 6 Dunav	1		1
<< Pump Station / Touch panel >>				
2-15-01	PS 1a Bele vode	1		1
2-15-02	PS 1b Bele vode	1		1
2-15-03	PS 4 Crveni krst	1		1
2-15-04	PS 15 Topcider	1		1
2-15-05	PS 15 Topcider	1		1
2-15-06	PS 16 Vracar	1		1
2-15-07	PS 16 Vracar	1		1
2-15-08	PS 18 Tasmajdan	1		1
2-15-09	PS 19 Bezanija	1		1
2-15-10	PS 23 Stud. grad	1		1
2-15-11	PS 25 Mokr.brdo	1		1
2-15-12	PS 28 Zarkovo	1		1
2-15-13	PS 5 T. Drajzera	1		1
2-15-14	PS 17 Zvezdara	1		1
2-15-15	PS 17 a Zvezdara	1		1
2-15-16	PS 21 Pionir	1		1
2-15-17	PS 22 Torlak	1		1

SS-10 / SPECIFICATION OF SERVER

Item No.	Name of Server	Q'ty	Specification	priority
2-15-18	PS 24 Kosutnjak	1		1
2-15-19	PS 20 Zeleznik	1		1
2-15-20	PS 26 Ripanj	1		1
2-15-21	PS 33 Avala	1		1
2-15-22	PS 3 Surcin	1		1
2-15-23	PS 6 Dunav	1		1
2-15-24	PS Lesce	1		1
<< Local Control Center Bezanija >>				
6-1	Domain Controller Server	1		1
6-2	SQL Server (sw + hw)	1		1
6-3	GPRS server	1		1
6-4	Monitor/HMI Scada	1		1
6-5	Printer	1		1
6-6	UPS	1		1
<< Local Control Center Banovo Brdo >>				
7-1	SQL Server (sw + hw)	1		1
7-2	Telecommunication Network Server (sw+hw)	1		1
7-3	Domain Controller Server	1		1
7-4	GPRS server	1		1
7-5	Monitor/HMI Scada	1		1
7-6	Printer	1		1
7-7	UPS	1		1

SS-10 / SPECIFICATION OF SERVER

Item No.	Name of Server	Q'ty	Specification	priority
<< Local Control Center Bele vode >>				
7A-1	Scada server (SW+HW)	1		1
7A-2	GPRS modem	1		1
7A-3	Monitor/HMI Scada	1		1
7A-4	Printer	1		1
7A-5	UPS	1		1
<< Local Control Center Makis >>				
7B-1	SQL Server (sw + hw)	1		1
7B-2	GPRS server	1		1
7B-3	Monitor/HMI Scada	1		1
7B-4	Printer	1		1
7B-5	UPS	1		1
<< Main Control Center Deligradska Street >>				
8-1	Server for real time BWS control			1
8-1-1	SQL Server (sw + hw)	2		1
8-1-2	GPRS server	1		1
8-1-3	Domain Controller Server	1		1
8-1-4	Master SCADA server (hw)	1		1
8-1-5	WEB server	1		1
8-2	Workstation			1
8-2-1	Workstation HMI SCADA	2		1
8-2-2	50 " display	1		1
8-2	Printer	1		1
8-3	UPS	1		1

SS-11 / SPECIFICATION OF Chlorine Measurement

Item No.	Name of Station (check point)	Q'ty	Specification			priority
			chlorine	residual	cubicle	
<< Measuring Point Equipment >>						
3-1-01	1	1				2
3-1-02	2	1				2
3-1-03	3	1				2
3-1-04	4	1				2
3-1-05	5	1				2
3-1-06	6	1				2
3-1-07	7	1				2
3-1-08	8	1				2
3-1-09	9	1				2
3-1-10	10	1				2
3-1-11	11	1				2
3-1-12	12	1				2
3-1-13	13	1				2
3-1-14	14	1				2
3-1-15	15	1				2
3-1-16	16	1				2
3-1-17	17	1				2
3-1-18	18	1				2
3-1-19	19	1				2
3-1-20	20	1				2
3-1-21	21	1				2
3-1-22	22	1				2
3-1-23	23	1				2
3-1-24	24	1				2
3-1-25	25	1				2
3-1-26	26	1				2
3-1-27	27	1				2
3-1-28	28	1				2
<< Reservoir Equipment >>						
4-1-01	Pionir	1			1	1
4-1-02	Glavni	1			1	1
4-1-03	Krainski	1			1	1
4-1-04	Zeleznik	1			1	1
4-1-05	Zarkovo	1			1	1
4-1-06	Umka	1			1	1
4-1-07	Zvezdara	1			1	1
4-1-08	Mokrolusko brdo	1			1	1
4-1-09	Dedinje	1			1	1
4-1-10	Barajevo	1			1	1
4-1-11	Petlovo brdo	1			1	1
4-1-12	Stojcino brdo	1			1	1
4-1-13	Torlak	1			1	1
4-1-14	Devojacki grob	1			1	1
4-1-15	Lipovica	1			1	1
4-1-16	Water tower Kosutnjak	1			1	1
4-1-17	Suplja stena	1			1	1
4-1-18	Kumodraz	1			1	1
4-1-19	Water tower Lipovica	1			1	1
4-1-20	Guncati	1			1	1

SS-12 / SPECIFICATION OF Laboratory Measuring Equipment

Item No.	Name of Station (check point)	Q'ty	Specification			Remarks
<< Chemical Laboratory Equipment >>						
9-1-01	Atomic Absortion Spectrometer(AAS)					1
9-1-02	Total Organic Carbon Analyzer(TOC)					1
9-1-03	UV-VIS Spectrometer					1
9-1-04	HighPerformance Liquid Chromatography(HPLC)					3
9-1-05	Ion Chromatography - IC					2
9-1-06	Analytical balance, 0.001g					3
9-1-07	Glassware Washer					2
<< Microbiological Laboratory Equipment >>						
9-2-01	Microscope					2
9-2-02	Autoclave					1
9-2-03	Glassware Washer with drying system					1
<< Chemical Laboratory Equipment (waste water) >>						
9-3-01	Atomic Absortion Spectrometer(AAS)					1
9-3-02	Gas chromatograph, PPC, FID and ECD					2
9-3-03	Total Organic Carbon Analyzer(TOC)					3

Work Demarcation for Installation between Japan Side and BVK

1. The well equipment to be provided by Japan side shall be installed by BVK.

2. The mechanical and electrical equipment for the pump stations such as pumps/motors, frequency converters, control cubicles and flaps to be provided by Japan side shall be installed by BVK. Meanwhile, the terminal equipment, telecommunication equipment and SCADA servers related to SCADA system to be provided by Japan side shall be installed by Japan side.

3. The measuring point equipment and reservoir equipment to be provided by Japan side shall be installed by Japan side.

4. The equipment for SCADA system located in the central control station and the local control stations to be provided by Japan side shall be installed by Japan side.

5. The laboratory measuring equipment and instrument to be provided by Japan side shall be installed by BVK.

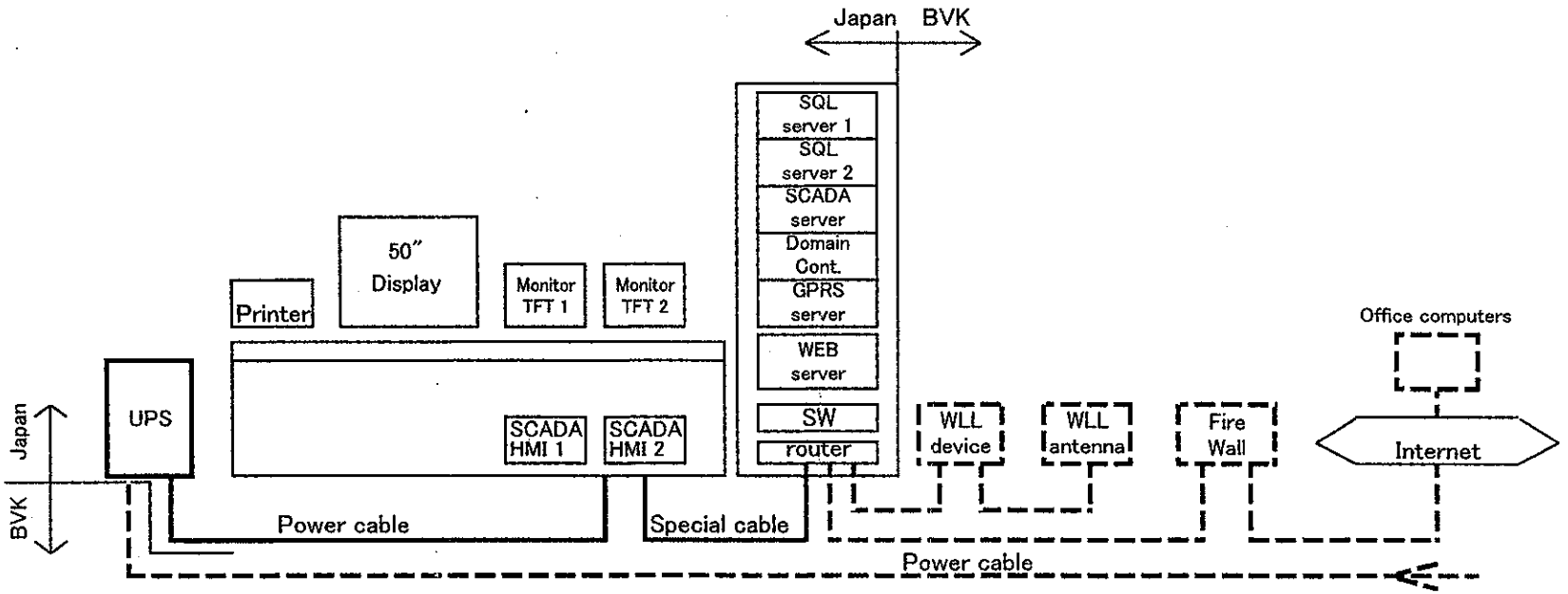
6. For detail work demarcation between Japan side and BVK for SCADA system, please refer to Appendix 1 to 8.

Work demarcation of Main Control Center

Japan side: Supply, installation, connection and site test of the following equipment indicated by solid line below.

- GPRS modem
- SQL Server
- GPRS server
- Domain Controller server
- SCADA server
- WEB server
- Layer 2 switch
- SHDSL Layer 3 router
- Monitor/SCADA HMI
- 50″ Display
- Printer
- UPS

BVK side: 1. Procurement, installation and connection of materials indicated by dotted line below.



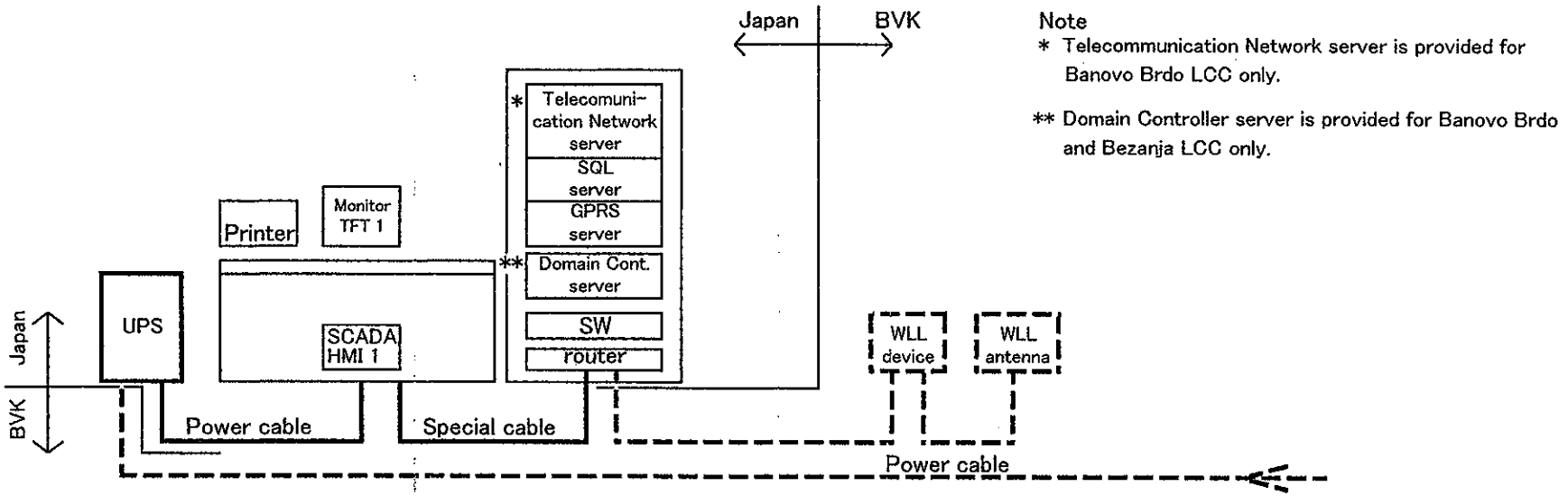
Work demarcation of Local Control Center (Type A)

Japan side: Supply, installation, connection and site test of the following equipment indicated by solid line below.

- Telecomunication Network Server *
- SQL Server
- GPRS server
- Domain Controller server

- Layer 3 switch
- SHDSL Layer 3 router
- Monitor/SCADA HMI
- Printer
- UPS

BVK side: 1. Procurement, installation and connection of materials indicated by dotted line below



Note
* Telecommunication Network server is provided for Banovo Brdo LCC only.

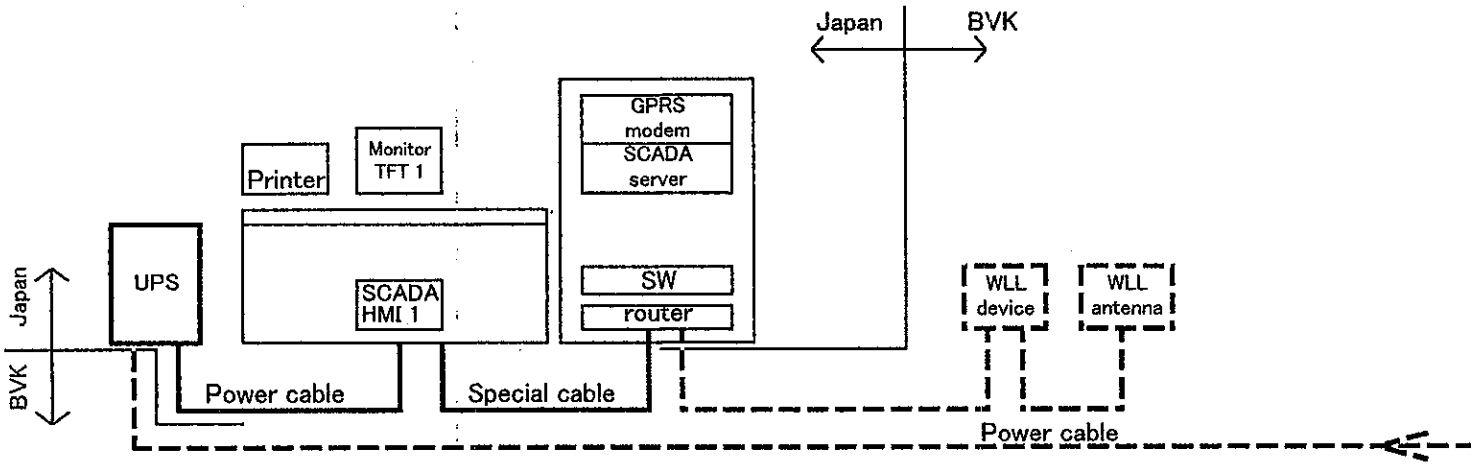
** Domain Controller server is provided for Banovo Brdo and Bezanja LCC only.

Work demarcation of Local Control Center (Type B)

Japan side: Supply, installation, connection and site test of the following equipment indicated by solid line below;

- GPRS modem
- SCADA server
- Layer 3 switch
- SHDSL Layer 3 router
- Monitor/ SCADA HMI
- Printer
- UPS

BVK side: 1. Procurement, installation and connection of materials indicated by dotted line below

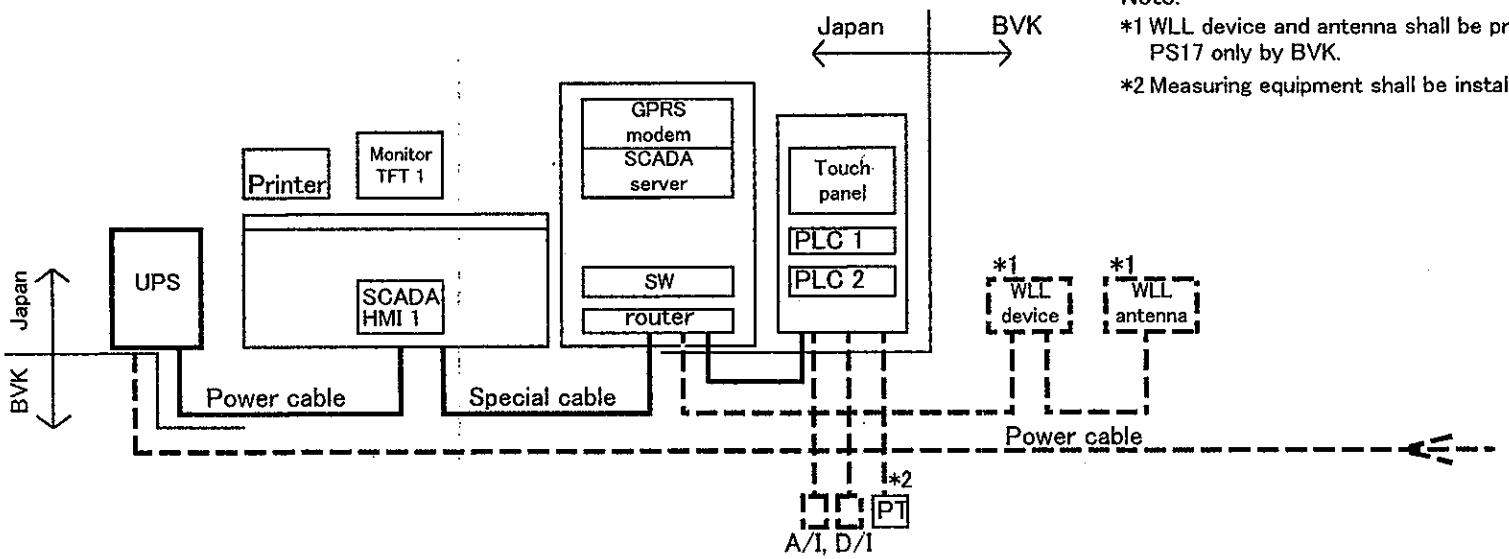


Work demarcation of Pumping station (Type A)

Japan side: Supply, installation, connection and site test of the following equipment indicated by solid line below;

- GPRS modem
- SCADA server
- Layer 2 switch
- SHDSL Layer 3 router
- Monitor/SCADA HMI
- Printer
- UPS
- Measuring equipment *2
- PLC
- Touch panel

BVK side: 1. Procurement, installation and connection of materials indicated by dotted line below

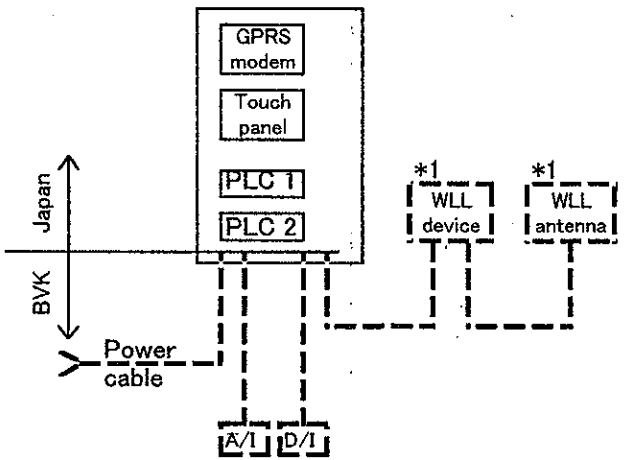


Work demarcation of Pumping station (Type B)

Japan side: Supply, installation, connection and site test of the following equipment indicated by solid line below.

- GPRS modem
- PLC
- Touch panel
- Layer 2 switch *2
- SHDSL Layer 3 router *2

BVK side: 1. Procurement, installation and connection of materials indicated by dotted line below



Note:

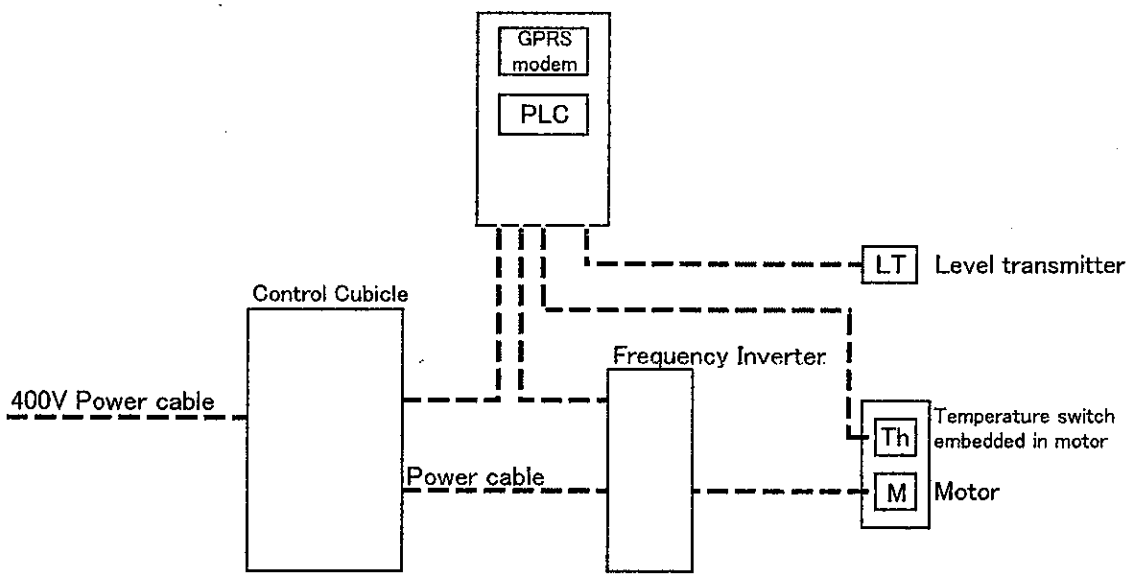
*1 WLL device and antenna shall be provided for PS22 only by BVK.

*2 Layer 2 switch and SHDSL Layer3 router shall be provided for PS1A, PS1B, PS19, PS5, PS22, and PS24

Work demarcation of Well equipment (99 wells)

Japan side: Supply of the following equipment;
- Freqency Inverter
- Level transmitter
- Control Cubicle
- PLC
- GPRS modem

BVK side: 1. Installation of equipment to be provided by Japan side.
2. Procurement, installation and connection of materials indicated by dotted line below..

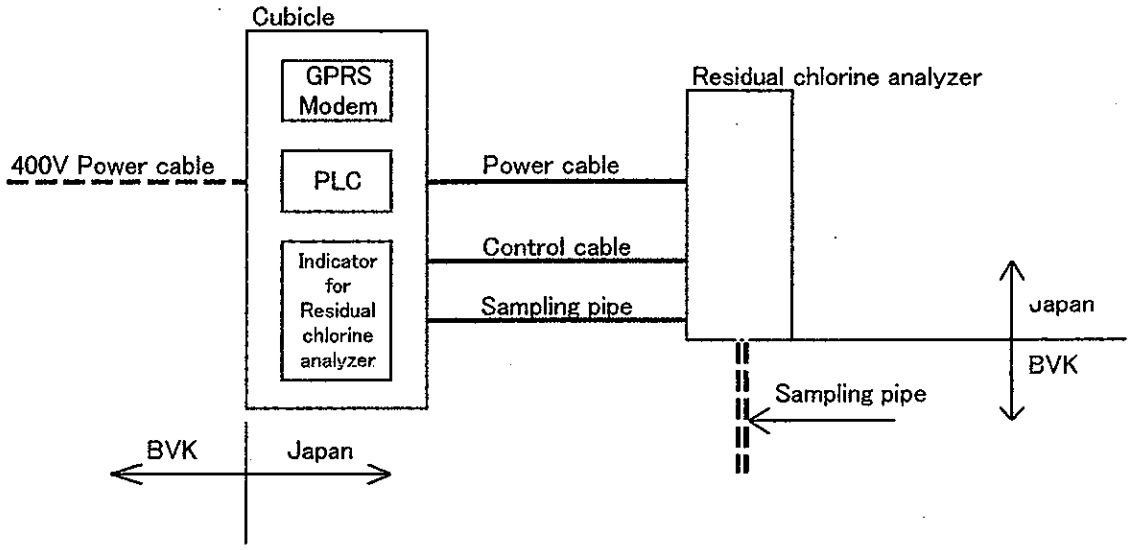


Work demarcation of measuring point(Residual chlorine) (28 points)

Japan side: Supply, installation and site test of the following equipment;

- Cubicle
- GPRS modem
- PLC
- Residual chlorine analyzer

BVK side: 1. Procurement, installation and connection of materials indicated by dotted line below



Work demarcation of reservoir equipment (20 points)

Japan side: Supply, installation and site test of the following equipment;

- Cubicle
- GPRS modem
- PLC
- Residual chlorine analyzer

BVK side: 1. Procurement and installation of materials indicated by dot line below.
2. Connection of cables and sampling pipe.

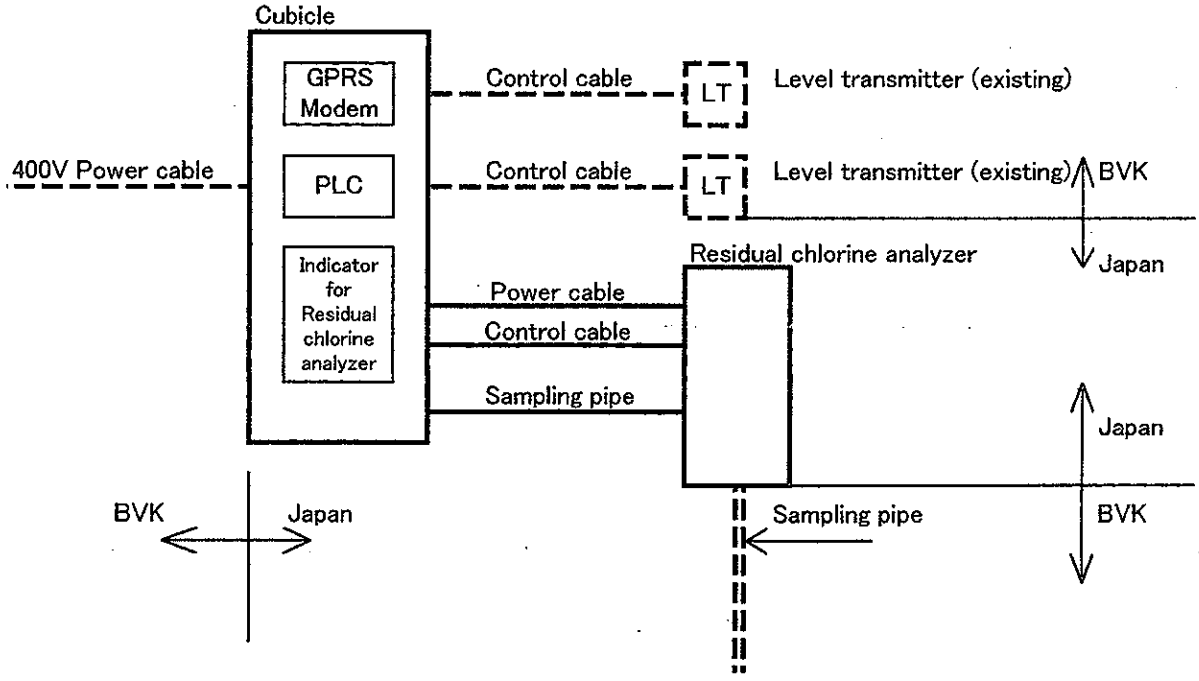


Table 4

Proposed Schedule works and procurement by BVK

	Year	2004				2005												2006												2007		
	Fiscal Year	2004							2005												2006											
		9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
No	Work item																															
1.	**Projecting phase**																															
1.1	PS																															
1.2	Well																															
1.3	Measure. Point																															
1.4	Reservoir																															
1.5	Telecom. Network																															
1.5.1	IP Cable network																															
1.5.2	IP WLL network																															
1.6	LCC, MCC infrastructure																															
2.	Contracting GSM/GPRS service																															
3.	**Procurement by BVK**																															
3.1	Transformers																															
3.2	WLL network components																															
3.3	Installation material																															
4.	**Preparation of objects**																															
4.1	Review and discuss on design material																															
4.2	Creating instruction for dissasembling of old equipment																															
4.3	Creating instruction for installation of new equipment																															
5.	**Installation works by BVK (aggregate, freq.regulator, control cubicle, flaps, valves, transformers)**																															
5.1	Wells																															
5.2	PS																															
5.2.1	PS-18 Tasmajdan																															
5.2.2	PS-17 Zvezdara																															
5.2.3	PS-20 Zeleznik																															
5.2.4	PS-21 Pionir																															

Proposed Schedule works and procurement by BVK

	Year	2004				2005															2006												2007		
	Fiscal Year	2004				2005															2006														
		9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		
No	Work item																																	
5.2.5	PS-19 Bezanija																																	
5.2.6	PS-4 Crveni krst																																	
5.2.7	PS-1A Bele Vode																																	
5.2.8	PS-23 Student.grad																																	
5.2.9	PS-1B Bele vode																																	
6.	**Installation works by BVK (measuring equipment, terminal equipment, telecom. Equipment)**																																	
6.1	Wells																																	
6.2	PS																																	
6.2.1	PS-18 Tasmajdan																																	
6.2.2	PS-17 Zvezdara																																	
6.2.3	PS-20 Zeleznik																																	
6.2.4	PS-21 Pionir																																	
6.2.5	PS-19 Bezanija																																	
6.2.6	PS-4 Crveni krst																																	
6.2.7	PS-1A Bele Vode																																	
6.2.8	PS-23 Student.grad																																	
6.2.9	PS-1B Bele vode																																	
6.3	Reservoirs																																	
6.4	Measure. Points																																	
6.5	Telecommunication Network																																	
6.6	LCC, MCC																																	
6.7	System integration																																	
6.8	System function testing																																	

Basic Plan on SCADA System for BVK Water Supply

1. General

This basic plan shall apply to the SCADA system for BVK water supply to monitor the ninety-nine Reny well pumps, the twenty-six water distribution pump stations, the twenty reservoirs and the twenty-eight measuring points, and to operate remotely the ninety-nine Reny well pumps at the local control centers in Bezanija and in Banovo Brdo.

2. Scope of Work

The procurement and installation works for SCADA system including software shall be done by Japan side. However, the telecommunication system for SCADA system shall be made by BVK. The equipment for SCADA system to be provided by Japan side is shown in Table-1.

For detail of work demarcation between Japan side and BVK, please refer to table 3.

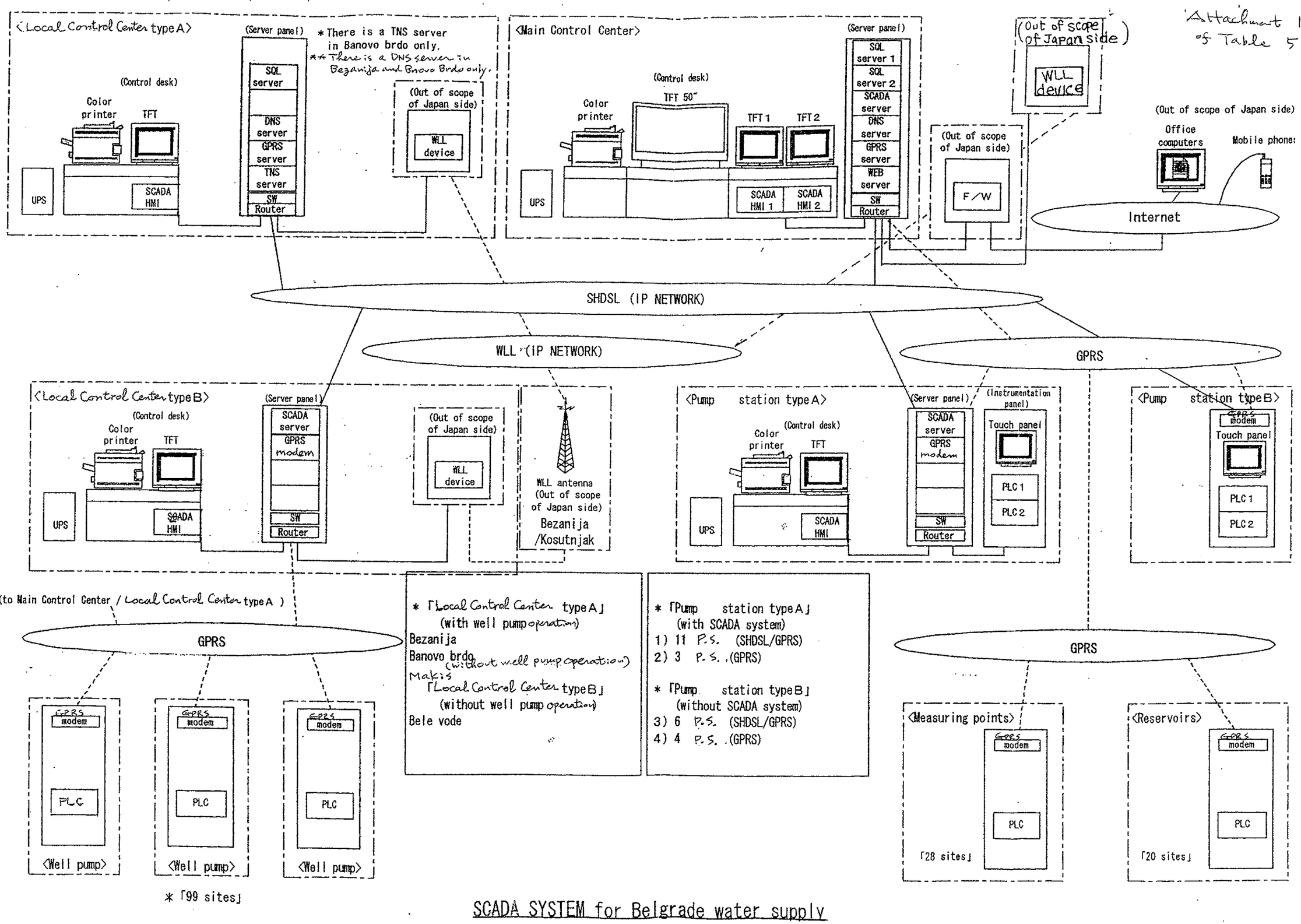
3. System Configuration

Overall SCADA system configuration is shown in Attachment 1.

4. Test

All hardware and software for SCADA system shall be tested at the factory before delivery to BVK.

Attachment 1 of Table 5



SCADA SYSTEM for Belgrade water supply

Sektor Održavanja - Služba Tehničke pripreme
Int.broj_____
Datum 04.08.2004.
Beograd

THE LEFT BANK OF RIVER SAVA RANNEY WELLS EQUIPMENT – PUMPS AND MOTORS

		EXISTING				REPLACEMENT				
It.No	RW	Q (l/s)	H (m)	Motor output (kW)	rpm	Q (l/s)	H (m)	Motor output (kW)	rpm	Remark
1.	98	30	75	30	3000	35	75	45	3000	
2.	95	70	75	90	3000	70	75	90	1500	
3.	94	70	75	90	3000	110	75	132	1500	*
4.	93	100	75	132	3000	70	75	132	1500	
5.	92	70	75	75	3000	70	75	90	1500	
6.	90	100	75	132	3000	110	75	132	1500	
7.	89	100	75	132	3000	70	75	90	1500	
8.	88	100	75	110	3000	70	75	90	1500	
9.	87	70	75	110	3000	70	75	90	1500	
10	86	70	75	90	3000	70	75	90	1500	
11	85	100	75	132	3000	110	75	132	1500	
12	84	130	75	160	3000	130	75	160	3000	
13	83	70	75	90	3000	70	75	90	1500	
14	81	35	75	45	3000	70	75	90	1500	*
15	80	100	75	132	3000	110	75	132	1500	
16	79	70	75	85	3000	70	75	90	1500	
17	78	70	75	90	3000	70	75	90	1500	
18	75	35	75	45	3000	35	75	45	3000	
19	73	30	75	48	3000	35	75	45	3000	
20	72	35	75	45	3000	35	75	45	3000	
21	69	30	75	48	3000	35	75	45	3000	
22	62	100	75	110	3000	110	75	132	1500	
23	61	70	75	90	3000	70	75	90	1500	
24	60	100	75	135	3000	110	75	132	1500	
25	59	70	75	80	3000	70	75	90	1500	
26	66	70	75	80	3000	70	75	90	1500	
27	65	70	75	90	3000	35	75	45	3000	**
28	64	30	75	40	3000	35	75	45	3000	
29	63	70	75	75	3000	35	75	45	3000	**
30	51	100	75	130	3000	110	75	132	1500	
31	50	100	75	132	3000	110	75	132	1500	
32	49	70	75	90	3000	130	75	160	3000	*
33	48	30	75	48	3000	30	75	45	3000	
34	47	100	75	110	3000	110	75	132	1500	
35	46	70	75	80	3000	110	75	132	1500	*
36	45	100	75	110	3000	110	75	132	1500	
37	44	70	75	85	3000	110	75	132	1500	*
38	43	70	75	85	3000	70	75	90	1500	
39	42	100	75	110	3000	110	75	132	1500	
40	41	70	75	90	3000	110	75	132	1500	*
41	40	70	75	85	3000	70	75	90	1500	
42	38	100	75	110	3000	110	75	132	1500	
43	37	100	75	132	3000	110	75	132	1500	
44	36	70	75	75	3000	70	75	90	1500	
45	35	100	75	132	3000	110	75	132	1500	
46	22/I	100	75	130	3000	130	75	160	3000	*
47	22/II	-	-	-	-	110	75	132	1500	
48	23/I	70	75	90	3000	70	75	90	1500	
49	21	130	75	158	3000	130	75	160	3000	

*- For wells we are requesting stronger aggregates then installed. Existing aggregates are working on 50Hz with high water level in well.
**- For wells we are requesting smaller aggregates then installed. Existing aggregates are working on frequencies close to minimal values recommended by manufacturer.
- Pump power is adopted according to frequency converter caracteristic.
- Submersible pump and motor manufacturers are recommending that the submersible motor power is min.10% higher then pump power. 1500 rpm submersible motor life time is 2.5 times longer then existing 3000 rpm motors and pumps are more reliable and persistent.

5-2 Confirmation of the pump specification for Distribution pump

(1) Pump head and delivery capacity

The specifications of the requested new pumps to be installed are designed on the bases of future demand (in year 2007).

Hydraulic calculation was based on the Colbruk White formula and calculated by computer with Info Works software. BVK has carried out hydraulic calculation by computer since 1981.

Estimate of motor output was confirmed by the formula. A(kW)=0.163x(Q m3/hr x H m)/p x 1.1. Here, p of pump efficiency is to be 70 to 80%.

Existing pump is sagging efficiency because of aging. These pumps run on 28 to 68 years. Discharge capacity and head are not enough to supply distribution water.

The specification of the requested pumps are accepted by the consultant team and basic design conditions are shown as follows,

Specification of the distribution pump with motor

Location	Pump No.	Existing pump specifications			Requested pump specifications			Remarks
		Capacity (L/s)	Head (m)	Output (kW)	Capacity (L/s)	Head (m)	Output (kW)	
PS-1a Bele Vode	1	150	142	315	167	160	400	Capacity: Increase population served 340L/s x 2pumps and 1stund by Head: based on hydraulic calculation
	2	150	142	315	167	160	400	
	3	150	142	315	167	160	400	
PS-1b Bele Vode	1	400	98	575	400	90	550	Capacity: Increased population served 800L/s 2pumps and 2 stand by Head: based on hydraulic calculation
	2	150	97	210	400	90	550	
	3	400	98	575	400	90	550	
	4	150	97	210	400	90	550	
PS-4 Crveni Krst	1	300	70	300	300	70	400	・Replacement
PS-18	1	400	60	400	400	65	400	・Capacity: Increase population served (1,400L/s to

Table 6

Trasmajdan	2	400	60	400	400	65	400	1,600L/s) ・Head: Due to hydraulic calculations
	3	240	60	250	400	65	400	
	4	400	60	400	400	65	400	
PS-19 Bezanija	1	200-250	88-65	210	200	65	200	・ Capacity: : As same as existing conditions ・ Head: Due to hydraulic calculations
	2	180	88	210	200	65	200	
	3	200-250	88-65	210	200	65	200	
PS-23 Stu.Grad	1	261	70	211	500	70	400	・ Capacity: Expansion of distribution network (New industrial area) with 1,700L/s. ・ Head: Based on the additional pipeline in future
	2	261	70	211	500	70	400	
	3	380	70	304	500	70	400	
	4	380	70	304	500	70	400	
	5	380	70	304	500	70	400	
PS-17 Zvezdara	1	200	82	188	120	80	160	・ Capacity: Reducing capacity due to construct new pump station (PS-17a) ・ Head: Due to hydraulic calculations
	2	200	82	188	120	80	160	
	3	200	82	188	120	80	160	
PS-21 Pionir	1	50	65	75	200	65	200	・ Capacity: Expansion to new water supply area such as Karaburma and Mirijevo ・ Head: Based on the additional pipeline.
	2	50	65	75	200	65	200	
	3	100	65	110	200	65	200	
PS-20 Zeleznik	1	80-140	166-130	320	240	150	600	・ Capacity: Expansion to South part of BG. ・ Head: Based on the new distribution network.
	2	80-140	166-130	320	240	150	600	

(2) Pump type

All pumps except PS-18,Torasmaijdan are design horizontal shaft type and pumps of PS-18 are vertical shaft type.

Appendix 4.3

Minutes of Discussions
(December 16, 2004)

MINUTES OF DISCUSSIONS
ON THE BASIC DESIGN STUDY ON THE PROJECT FOR IMPROVEMENT OF WATER SUPPLY SYSTEM IN BELGRADE IN SERBIA AND MONTENEGRO

(EXPLANATION ON DRAFT REPORT)

In July 2004, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a Basic Design Study Team on THE PROJECT FOR IMPROVEMENT OF WATER SUPPLY SYSTEM IN BELGRADE (hereinafter referred to as "the Project") to Serbia and 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 the Serbia and Montenegro on the components of the draft report, JICA sent to Serbia and Montenegro the Draft Report Explanation Team (hereinafter referred to as " the Team "), which is headed by Mr. Keiichi Muraoka, Resident Representative , JICA Austria Office, from 13th December to 21st December.

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

Belgrade, Serbia and Montenegro, 16th December 2004

Keiichi Muraoka
Leader
Draft Report Explanation Team
Japan International Cooperation Agency
Japan

Bojan Stanojevic
City Manager
City Assembly of Belgrade
Serbia and Montenegro

Vladimir Tausanovic
Managing Director
Belgrade Waterworks and Sewerage
Serbia and Montenegro

ATTACHMENT

1. Components of the Draft Report

The Government of Serbia and Montenegro agreed and accepted in principle the components of the draft report explained by the Team.

2. Japan's Grant Aid scheme

The Serbia and Montenegro side understands the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Serbia and Montenegro as explained by the Team and described in **Annex-3** and **Annex-4** of the Minutes of Discussions signed by both parties on 21st July 2004.

3. Schedule of the Study

JICA will complete the final report in accordance with the confirmed item and send it to the Government of Serbia and Montenegro by February 2005.

4. Other Relevant Issues

The following issues were discussed and confirmed by both sides.

4-1 Scope of Work

The both sides agreed each undertaking of procurement and installation between the Serbia and Montenegro side, and the Japanese side for the Project as shown in **Annex-1.**

4-2 The maintenance of SCADA system

The Serbia and Montenegro side agreed that BVK will guarantee the proper operation and maintenance using SCADA system, and continuous practical use. The chart for operation and maintenance organization is shown in **Annex-2.**

4-3 Suitable application of SCADA system

The Japanese side and the Serbia and Montenegro side agreed that BVK will draw up a more efficient and suitable operation plan based on the data acquired by SCADA system, which would be introduced in the Project.

4-4 Implementation schedule

The Serbia and Montenegro side agreed to complete its scope without any delay based on the installation schedule which the Japanese side presented.

Annex-1

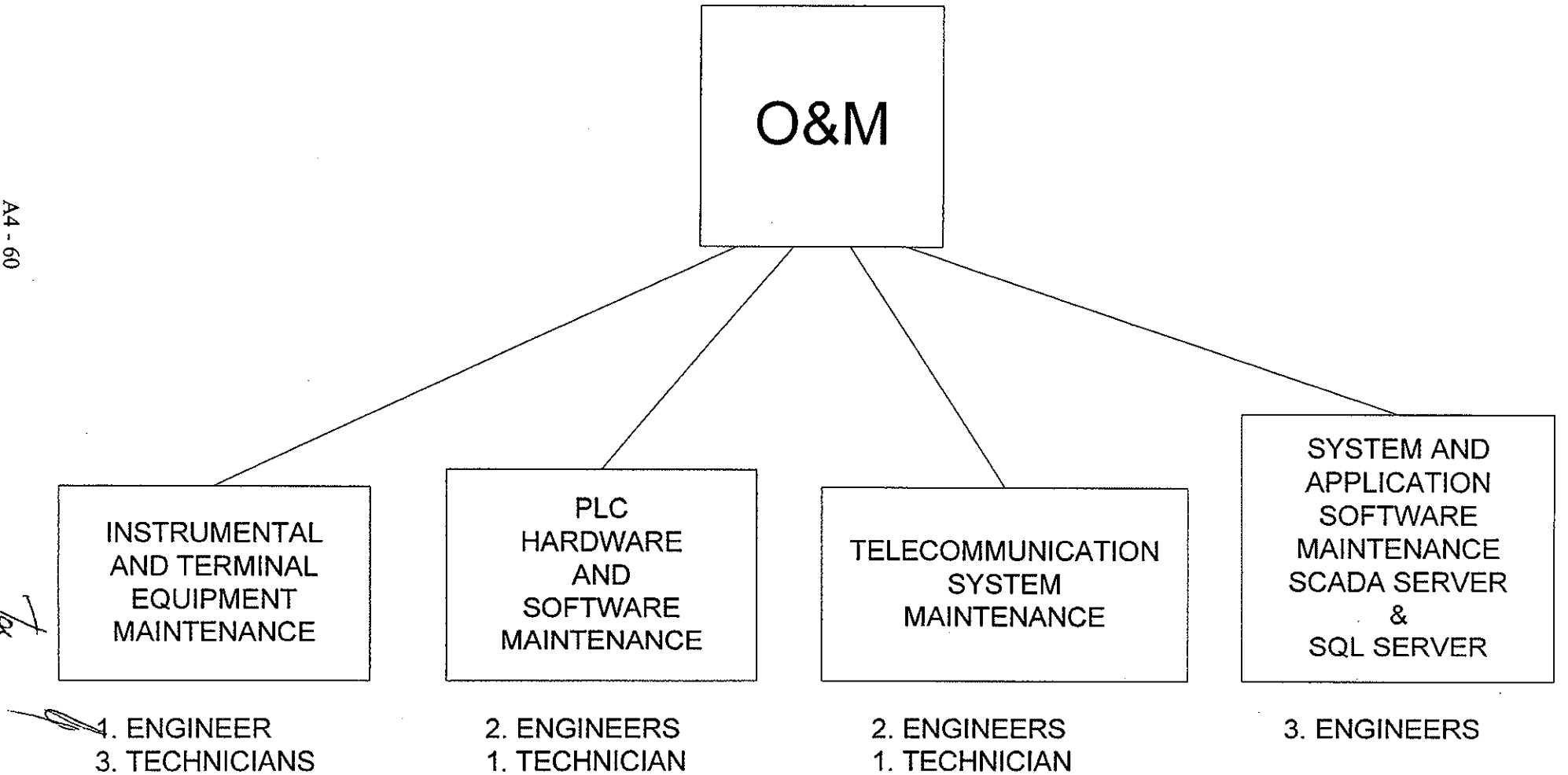
Scope of Work

Items	Procurement	Installation
1. Water Distribution Pump Station		
(1) Pump/Motor	**Japan**	**Serbia**
(2) Control Cubicles	**Japan**	**Serbia**
(3) Frequency Inverter/Soft Starter	**Japan**	**Serbia**
(4) Flap (Check Valve)	**Japan**	**Serbia**
(5) Pressure Transmitter	**Japan**	**Serbia**
(6) Electrical and Instrument Wiring	**Serbia**	**Serbia**
(4) Piping for Pump	**Serbia**	**Serbia**
2. SCADA System		
(1) SCADA System	**Japan/Serbia**[*1]	**Japan/Serbia**[*3]
(2) PLC/Radio Modem (except for well pumps)	**Japan/Serbia**[*2]	**Japan/Serbia**[*4]
(3) PLC/Radio Modem (for well pumps)	**Japan/Serbia**[*2]	**Serbia**
(4) Residual Chlorine Analyzer	**Japan/Serbia**[*5]	**Japan/Serbia**[*6]
(5) Telecommunication System	**Serbia**	**Serbia**
3. Laboratory Equipment	**Japan**	**Serbia**

Note: *1 Serbia and Montenegro side shall carry out procurement for power cable.
*2 Serbia and Montenegro side shall carry out procurement for power cable and signal cable.
*3 Serbia and Montenegro side shall carry out installation for power cable.
*4 Serbia and Montenegro side shall carry out installation for power cable and signal cable.
*5 Serbia and Montenegro side shall carry out procurement for sampling pipe.
*6 Serbia and Montenegro side shall carry out installation for sampling pipe.

ORGANISATION CHART FOR O&M

ANNEX-2



Annex-3

JAPAN'S GRANT AID

1. Japan's Grant Aid System

(1) Grant Aid Procedures

1) Japan's Grant Aid Program is executed through the following procedures.

- Application (Request made by a recipient country)
- Study (Basic Design Study conducted by JICA)
- Appraisal & Approval
  (Appraisal by the Government of Japan and Approval by the Cabinet)
- Determination of the implementation
  (The Notes exchanged between the Governments of Japan and the recipient country)
- Implementation (Implementation of the Project)

2) Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study), using Japanese consulting firms.

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Programme, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

(2) Basic Design Study

1) Contents of the Study

The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on a requested project (hereinafter referred to as "the Project"), is to provide a basic document necessary for the appraisal of the Project by the Government of Japan. The contents of the Study are as follows:

i) Confirmation of the background, objectives and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation;
ii) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme
from a technical, social and economic points of view;
iii) Confirmation of items agreed on by both parties concerning the basic concept of the Project;
iv) Preparation of a basic design of the Project; and
v) Estimation of costs of the Project.

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

The Government of Japan 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 Study, JICA uses a registered consulting firm. JICA selects a firm based on proposals submitted by interested firms. The firm selected carries out a Basic Design Study and writes a report, based upon terms of reference set by JICA.

The consultant firm used for the Study is recommended by JICA to the recipient country to also work in the Project's implementation after the Exchange of Notes, in order to maintain technical consistency and also to avoid any undue delay in implementation should the selection process be prepared.

(3) Japan's Grant Aid Scheme

1) What is Grant Aid?

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

2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

3) "The period of the Grant" means the one fiscal year which the Cabinet approves the project for. Within the fiscal year, all procedure such as exchanging of the Notes, concluding contracts with consulting firms and contractors and final payment to them must be completed.

However, in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

4) Under the Grant, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However, the prime contractors, namely consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

5) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by

the Government of Japan. This "Verification" is deemed necessary to secure accountability of Japanese taxpayers.

6) Undertakings required to the Government of the recipient country

In the implementation of the Grant Aid project, the recipient country is required to undertake such necessary measures as the followings:

i) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction;

ii) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the site;

iii) To secure buildings prior to the procurement in case the installation of the equipment;

iv) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid;

v) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts;

vi) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts such as facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work;

vii) "Proper Use"

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

viii) "Re-export"

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

ix) Banking Arrangement (B/A)

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

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

x) Authorization to Pay

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

Annex-4

Major Undertakings to be taken by Each Government For the Procurement

NO.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To bear the following commissions to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
2	To ensure unloading and customs clearance at port of disembarkation in recipient country		
	1) Marine (Air) transportation of the products from Japan to the recipient country	●	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		●
	3) Internal transportation from the port of disembarkation to the project site	(●)	(●)
3	To accord Japanese nationals, whose services may be required in connection with the supply of the products and the services under the verified contact, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
4	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts.		●
5	To maintain and use properly and effectively the facilities constructed and/or equipment provided under the Grant Aid		●
6	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for the transportation and installation of the equipment		●

(B/A: Banking Arrangement, A/P: Authorization to Pay)

FLOW CHART OF JAPAN'S GRANT AID PROCEDURES