Energy Audit of Water and Wastewater Utilities
in 6 towns of Moldova

Supply and Installation
of Plant and Equipment

TECHNICAL SPECIFICATIONS

for

SCADA SYSTEM FOR ORHEI WATER UTILITIES

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Contents:

ABBREVIATIONS

Selected Definitions:	Abbreviation / Synonym Definition
PMM	Primary Measuring Means - meters, transducers
AMS	Automatic Monitoring System
PS	Pumping Station
PLC	Programmable Logic Controller

TECHNICAL SPECIFICATIONS

SCADA REQUIREMENTS

1 OVERVIEW

1.1 Purpose

The purpose of the document is to establish Supervisory Control and Data Acquisition (SCADA) control system for Apa Canal Orhei.

The use of proven techniques, approved equipment, and a functional commonality of hardware and software will result in overall benefits for the water utility of control strategies, screen displays, reports and logs, process calculation and optimisation, and improvement in overall efficiency.

The centralised control and monitoring shall increase the flexibility of operational resources and visibility of the operations in the integrated manner.

Analysis of the operational effectiveness of technological process of the Orhei water utility (IM ”Regia Apa Canal Orhei”) resulted as appropriate, installation of equipment at all pumping stations to accomplish remote transmission of data provided by measuring equipment in order to identify in real-time any damage or flaws.

Currently Orhei water utility does not have a clear system to monitor the consumption of electricity, distribution of drinking and waste water at each facility (deep wells, pumping stations, etc.). Data are collected manually and in the absence of computerised tools for data processing, errors may be committed.

1.2 Scope

These specifications aim to establish minimum requirements for the equipment which require to be installed at the pumping stations to collect the technical parameters of technological process. Software requirements shall be met in terms of the functioning of the algorithm, logical operation, structure, operation mode, the necessary interfaces for monitoring and display, as well as the hard requirements on which the software is implemented in order to be able to follow up and verify the data provided by equipment used in technological objects within Orhei water utility, in accordance with the technical rules in force.

These specifications have been developed to serve as technical documentation and reference for the procurement of equipment for the aquisision and processing of data provided by the primary measurement means of technological process parameters.

The supplier shall commision the system by installing the software, realizing of data transmission under conditions imposed by the tender documentation, processing and storing them and demonstrating the operation of the entire system, simulating the crash incidents, etc.
Installation works of the equipment on technological objects, will be performed by the Beneficiary with its own forces in the presence of the Supplier’s representative.

1.2 Description of pumping stations

Currently, three (3) underground water sources are used to supply the Town, as follows:

- Jeloboc Natural Spring, located some 9 km east of the town;
- Gradina Publica Wellfield, located in the Town Center;
- Mitoc Wellfield, located some 1 km north-west of Orhei.

Jeloboc Water intake is built over a natural spring and is located on the left bank of the Raut River. The intake area is located at ground elevation of some 40 m a.s.l. The spring water is led to the PS5 inlet reservoirs, located at the intake area across the River. The total capacity of the reservoirs is 2 x 125 m^3. From reservoirs, the water is pumped by PS5 and PS6 into the PS3 town reservoirs.

The length of pressure main from the PS5 to PS3 is some 12 km. Taking into consideration that the water main is built of 2 parallel pipelines, the total length of existing pipelines is 24 km. In 2006, the main pipelines were replaced with new HDPE DN200 pipes under the Pilot WSSP, financed by the World Bank.

Gradina Publica wellfield includes three (3) deep wells, out of which only two wells are in regular use and the third well is used as reserve. All submersible pumps in use lift water at a constant pressure head directly into two (2) existing water tanks from the PS1, having the total capacity of 2x125 m^3.

Mitoc wellfield includes fourteen (14) deep wells, out of which only three are in regular use and two (2) wells are used as reserve. The wellfield is located along the road Orhei – Balti. All submersible pumps in use lift water at a constant pressure head directly into three (3) existing water tanks from the PS2, having the total capacity of 1300 m^3 (2x500m^3, 1x300m^3).

Design parameters of the existing pumping equipment at the water intakes in Orhei

#	Well No	Model	Design Flow rate	Design Head	Design Motor Data					Opera-ting	Depth of instal-lation	Year of instal-lation
					P	Voltage	Speed	cosϕ	In			
			m^3/h	m	kW	V	rpm		A	hrs /day	m	
Gradina Publica Wellfield												
1	1	ЭЦВ - 8/25/100	25	100	11	380	3000	0,83	24,2			2005
2	2	ЭЦВ - 8/25/100	25	100	11	380	3000	0,83	24,2			2007
3	3	MK 615 - 8N460	60	60	15.5							2006
Mitoc Wellfield												
4	10	ЭЦВ 8/25/100	25	100	11	380	3000	0,83	24,2			2002
5	11	ЭЦВ 8/25/100	25	100	11	380	3000	0,83	24,2			2003
6	12	TWI 06.30-11-NB	25	106	12,5	380	2900		27,5			2002
7	13	NR615-8 NU60	25	70	9.5	380			19,8			2007
8	14	WILO TWU-6R 31-8-11	25	80	9.5	380						2002

PS1 is used to provide water to the central service area from Gradina Publica wellfield. Water is stored into two reservoirs, having total capacity of 2x125 m^3. Pumping equipment includes one main pump group built of 2 parallel pumps of type CO-2 MVI 3207. A number of old stand-by pumps are used as reserve. The pumps intake water from the water tanks located at the PS1 territory and pump water to the service area. Also, PS8 tanks are supplied from the PS1.

PS8 is used to provide water to the western supply area from Gradina Publica wellfield. Water is stored into two reservoirs, having total capacity of 2x150 m^3. Pumping equipment includes two main pump groups - first built of 2 parallel pumps of type CO-2 MVI- 3204, and second is formed of 2 pumps of type K20/30 and K50/50. The second group is used as reserve. First group of pumps intake water from the tanks located at the PS8 territory and pump water to the service area.

Design parameters of the existing pumping equipment at the PS1 and PS8 in Orhei

Pump No	Model	Qty	Design Flow rate	Design Head	Design Motor Data					Control Panel	Operating	Year of instal-lation
					P	Voltage	Speed	cosϕ	In			
			m^3/h	m	kW	V	rpm		A		hrs /day	
					PS1							
1	CO -2 MVI 3207	2	30	95	15	380	2950	0.93	26.5	Y	12	2006
2	ЦНСГ -38/176	1	38	176	30	380					as reserve	2000
3	K20/30	1	20	30	4	380	1410	0.84	8.7		as reserve	2002
4	K 45/30	1	40	30	7.5	380	2900		15		4	2001
					SP8							
1	K 20/30	1	20	30	4	380	1410	0.84	8.7		as reserve	2002
2	K 50/50	1	50	50	15	380					as reserve	2003
3	CO -2 MVI- 3204	2	24	60	7.5	380	2950	0.91	15.9	Y		2007

Water from Jeloboc Intake is delivered to the town reservoirs through two pumping stations, PS5 and PS6, and is distributed using PS3 and partially PS2 and PS4. PS7 was used for intermediary pumping from PS6 to PS3. However, in 2006 Orhei water utility optimized the hydraulic system through construction of a new by-passing water main and consequently PS7 was taken out of operation.

PS5 is used to pump water to PS6 from Jeloboc Intake. Water is stored into two reservoirs, having total capacity of 2x125 m^3. Pumping equipment includes one main pump group built of 2 parallel pumps of type NR 80/250-75-75/2a. Two stand-by pumps are used as reserve. The pumps intake water from the water tanks located at the PS5 territory and pump water to the PS6 tanks. Also, a separate group of pumps at PS5 is used to provide water to a neighboring village of Piatra.

PS6 is used to pump water to PS3. Water is stored into two reservoirs, having total capacity of 2x250 m^3. Pumping equipment includes one main pump group built of 2 parallel pumps of type NRG 100/315A-90/2. A separate stand-by pump is used as reserve. The pumps intake water from the water tanks located at the PS6 territory and pump water to the PS6 tanks.

PS3 is used to provide water to the southern supply area and partially to the northern area (through PS2 and PS4). Water is stored into one reservoir with total capacity of 2,000 m^3. It shall be mentioned that most of stored water is supplied to the southern part of the city by gravity directly from the reservoir. Also, a part of this gravity water is led to the PS2 located in the northern part of the town. Pumping equipment includes several pump groups - first built of 2 parallel pumps of type CO -2 MVI- 808, and second is formed of 2 pumps of type CO-2 MVI-1608. Two stand-by pumps are used as reserve.

Design parameters of the existing pumping equipment at the PS5, PS6 and PS3 in Orhei

Pump No	Model	Qty	Design Flow rate	Design Head	Design Motor Data					Control Panel	Operating	Year of instal-lation
					P	Voltage	Speed	cosϕ	In			
			m^3/h	m	kW	V	rpm		A		hrs /day	
					PS3							
1	K20/30	1	20	30	4	380	1410	0.84	8.7		as reserve	1988
2	ЦНСГ -38/176	1	38	176	30	380					as reserve	2004
3	CO -2 MVI-808	2	10.8	60	3	380	2910	0.84	6.4	Y		2006
4	CO -2 MVI-1608	2	15	120	7.5	380	2920	0.9	14.6	Y		2006
					PS5							
5	MVI 810 - Piatra	1	4	160	3	380	2840	0.84	7.8	Y		2006

Pump No	Model	Qty	Design Flow rate	Design Head	Design Motor Data					Control Panel	Operating	Year of instal-lation
					P	Voltage	Speed	cosϕ	In			
			m^3/h	m	kW	V	rpm		A		hrs /day	
6	ЦНС -180/212	1	180	212	160	380					as reserve	1994
7	D 200/95	1	200	95	90	380					as reserve	2003
8	NP 80/250V-75/2a	1	200	90	75	380	2970	0.9	134	Y		2006
9	NP 80/250V-75/2a	1	200	90	75	380	2970	0.9	134	Y		2006
					PS6							
10	ЦНС -180/212	1	180	212	160	380					as reserve	1994
11	NPG 100/315A-90	1	200	100	90	380	2960	0.9	161	Y		2007
12	NPG 100/315A-90	1	200	100	90	380	2960	0.9	161	Y		2007

In total, there are four (4) wastewater PSs in use in Orhei Town. General data on installed wastewater pumps in use are presented in the following Table.

Design parameters of the existing sewage pumping equipment

PS	Model	Qty	Design Flow rate	Design Head	Design Motor Data					Operating	Instal-lation
					P	Voltage	Speed	cosϕ	In		
			m^3/h	m	kW	V	rpm		A	hrs /day	
District SPS1	CD -250/22,5b	1	250	16	22	380					1988
	FA10.78Z-FK202-6/17	1	80	15	6.5	380	950	0,78	15,3		2007
	FA10.78Z-FK202-6/17	1	80	15	6.5	380	950	0,78	15,3		2007
District SPS2	CD -145/46	1	145	46	37	380					1988
	FA15.77Z-FK 34,1-4/42	1	303,8	51	80	380	1450		155		2007
	FA15.77D-FK 34,1-4/42		303,8	51	80	380	1450		155		2007
Main SPS	CD 450/95-2b		450	95	250	380					1995
	FA 15.99D-FKT49-4/42		434	91,8	165	380			315		2006
	FA 15.99D-FKT49-4/42		430	90	165	380			315		2007

The following pumping stations are included into SAM:

PS	Note
Mitoc Intake	3 PLC
PS1/Gradina Publica Intake	1 PLC
PS2	1 PLC
PS3	1 PLC
PS4	1 PLC
PS5	1 PLC
PS6	1 PLC
PS8	1 PLC
Main SPS	1 PLC
Local SPS1	1 PLC
Local SPS2	1 PLC
TOTAL	**13 PLC**

1.3 Philosophy of Operation

This section defines the general control and monitoring philosophy for the control room.
Basic guidelines for control system hierarchy from local equipment control methods to the top level of operator interface are defined.

1.3.1 Operation of Facilities

The control room will use SCADA system primarily for monitoring the status of remote pump stations. All the pump control strategy shall be executed at the remote pump station. The SCADA alarm paging interface will send designated alarm messages to on call personnel 24 hours per day.

1.3.2 Control Hierarchy

Process control systems must be organized in a logical control hierarchy in order to provide a standard format for monitoring/control of the overall facility. This standard approach provides operators and maintenance staff a uniform interface which improves their understanding of how to monitor/control the equipment, the control modes the equipment can attain, and how to override the controls when necessary due to failures or when required for routine maintenance.

The control system hierarchy can be viewed as a pyramid structure with three layers:
• Field sensors and specific control devices (bottom layer).
• Local PLC control/monitoring.
• SCADA monitoring/control.

1.3.2.1 Field Sensors and Special Control Devices

All control and monitoring must originate and terminate at this level. All the components specified at this level can be interfaced with the local PLC.

1.3.2.2 Local PLC monitoring/control

All pumping stations local PLC will be primarily used for monitoring only. In some instances especially on bigger pump stations it may be used for control and monitoring.
PLC for pump station shall have the capability to control the pump station if required with minor changes. At all well/tank sites the PLC shall control the pumps and other equipment.

PLC's shall be furnished completely configured, programmed and tested providing the specified communication, monitoring, display, input/output, annunciation, computational and other requirements for operation of the SCADA system. Any additional components required for operation, whether specifically referenced herein or not, shall be provided.

The PLC system shall be based on a scalable modular multi-use open architecture platform that can be efficiently applied to perform the necessary functions at each location. Each controller/telemetry unit shall be a modular hardware style PLC consisting of a CPU with adequate memory and instructions, power supply, local and remote input/output modules, communications ports, and all other components required to make the unit perform all of the functions required in this specification.
The PLC system shall support true system open architecture allowing use of various hardware and software and full integration of other third party generic hardware/software devices. The architecture

shall meet the requirements as herein defined and allow economical expansion of function and features based on new and evolving technologies.

Systems using non-scalable and/or closed proprietary architectures shall not be acceptable.

1.3.2.3 SCADA Control

Control at this level shall be based on operators using SCADA to monitor and control the remote pump stations. At least one SCADA server/node shall be located in the Utilities Operation Team's office as a central point for the generation of alarm reports, historical data archiving and retrieval, scheduled reports, and system maintenance.

1.3.3 Alarms

If, during the data transmission, a problem occurs, the icon representing the PS, will flash as follows:

- If the values of all parameters are in the normal range
- If the parameter value is over the limits
- If there are no radio communication
- If there's GPRS communication, but the PLC does not respond

If, during the transmission of data, an abnormal situation occurs, the value of the parameter displayed in the synopsis – scheme of technological object, will flash as follows:

- If the value of the parameter is in the normal range
- If the parameter value is over the limits
- If the parameter value is below the limits
- If it is an error reading the package which includes the parameter

2. REMOTE STATION HARDWARE AND SOFTWARE

PLC system for water and wastewater SCADA system shall be based on SCADA server located in the central utilities office and a PLC at each remote pumping station.

The primary functions of SCADA server is poll the remote sites over GPRS signals and collect data from each site. This data typically includes pumping pressure, pumping flow, power status, gas consumption, alarms etc.
Communication failure with remote PLC shall create an alarm for SCADA. SCADA server shall also synchronize PLC clocks at the remote pump stations.

2.1 PLC Panels

PLC Panels shall be NEMA 4X, fibre glass enclosures. Enclosures shall be provided with swing out panels to allow mounting the local operator interface units (OIT) inside the enclosure. PLC panels shall have individual circuit breakers for each device in the panel.

PLC panels shall also be provided with uninterruptible power supplies (UPS) to back up the PLC and telemetry hardware for at least 1 hour of power loss.

2.2 PLC Hardware Requirements

PLC at remote sites shall be with adequate memory and instruction sets required to make the unit perform all of the functions required by this specification. It is required that the same model PLC device be used throughout the SCADA system providing a complete solution with one common technology. This is to insure complete system continuity, compatibility between like devices, enhancing overall system efficiency by the reduced need to learn, maintain, support and carry spare parts for multiple technologies.

All control signals, status signals, alarm and process variable data shall be transmitted and received between the central location and the remote sites via the GPRS.

The master and remote PLCs shall be capable of stand-alone control to maintain programmed logic. Remote pump stations PLC's shall be provided with discrete input modules and relay output modules. Analog input and output modules shall be provided with 0/4-20 mA range.

The following PLC technical requirements shall be met:

- to communicate with the PMM using PMM transmission interface;
- to allow hardware to create a local network to communicate with at least 2 other local electronic equipment using the communication interfaces and protocols provided by the beneficiary;
- to have at least 4 analog signals (0/4-20mA);
- to have at least 4 pulse signals (below 3 kHz);
- to have not less than 4 digital outputs (relay);
- to store the events of the thresholds acquired signals;
- to support a 100% duty cycle (24/24 hours);
- to be protected by overvoltage;
- to work without errors in the temperature range -10 ... 55 °C;
- to have the degree of protection IP54
- be provided with independent supply, at least 1 hour in case of power loss (220V), with battery protection from discharge under 30% of the nominal voltage value;
- to be fitted with 24V DC power supply for analog sensors;
- to have the Real Time Clock (RTC) controller with independent power supply unit;
- to provide the required documentation issued by the manufacturer certifying the quality of equipment.

2.3 PLC Communication with PMM

The collection of data from the PMM and analog inputs shall be made cyclical by connecting to each PMM. The obtained data will be stored in files with the current and historical data of PS PLC. The query will be achieved by transmitting a signal to all PS PMM signal, containing the address of the associated PS PMM, which will transmit the data to the PLC.

The data acquisition sequence from PS PMM will be set by the software program. Software of PS PLC will acquire and store current data files of PS PMM. Current data are transmitted to the Dispatch Center for each communication session. Software of PLC will acquire and store consecutively historical data in a row with a time of history at least 40 days.

Historical data are transmitted to the Central dispatcher station once upon request.
If errors appear in the collection of data (communication, extinction voltage supply) the software will report these errors to Central Dispatch computer.

2.4 PLC Communication Central Server

The collection of data from the PS PLC will be made cyclical by GPRS connection. The query will be achieved by transmitting a signal to all PS equipment, the signal, which will contain the address for the SP equipment subsequent to transmit the data.

Software for data acquisition will run on the Dispatch Center computer and will query each PS equipment. By command from the console, will be possible to primary query the a PLC equipment from PS.

Historical data are acquired by a Central dispatcher station via a procedure that is responsible for completing the historical reports on Central Dispatcher Server.

To accomplish synchronization of the real-time clock of data acquisition PS equipment if the query shows a difference of more than 5 minutes beside the time of the Central Dispatcher computer.

In case of a modem failure at some technological objects, technical and software measures should be provided, which will prevent the blocking of the radio data collection system.

2.5 Telemetry

Central server at Orhei Water Utilities office shall communicate with remote site over GPRS (General packet radio service).

2.6 Energy/Electricity meters

Electronic electricity meters must be certified and metrological verified as established by the Law of metrology and included in the State Register of measuring instruments of the Republic of Moldova, and the technical characteristics of electricity meters must to comply with the provisions of the standards in force.

- Electronic electricity meters must memorize the recorded values for at least 45 days, that their measuring accuracy may be affected.
- Reading of the electricity meter indications, local and remote, must not be conditioned by the presence of voltage to be measured.
- Electrical energy meters shall record the electricity values in one or in both directions and for one or for both types of electricity (active or reactive).
- The measurement is made using the voltages and currents on all three phases.
- Current transformers and voltage transformers that connects electronic electricity meters must be certified and metrological verified and included in the State Register of measuring instruments of the Republic of Moldova, and the technical characteristics of transformers must comply with the provisions of the standards in force and technical conditions issued by the network operator.
- Accuracy Class of active meters will not be lower than 0.5S. For the reactive energy meters accuracy will not be lower than 1. Accuracy class of the current transformers and voltage transformers will not be lower than 0.5.
- Protective elements that are provided with electricity Meters must be designed so as to prevent the alteration of records by external action.
- External binding of the meter, as type of interface, protocols, structure of the signal transmission speed, etc. shall be in accordance with the standards in force.
- Electricity meters shall allow the acquisition of the stored data on the printer, computer or other electronic equipment by optical reader: RS232/485 interface. Optional, mshall allow equipment with M-bus radio module and output for a distance of not less than 100 m.
- Warrantee period – at least 12 months.

2.7 Flow meters

Flow meters shall be included in the State Register of measuring instruments of the Republic of Moldova and have an updated model approval certificate issued by the National Institute of Standardization and Metrology of the Republic of Moldova (NISM).

As a method for measurement, ultrasonic and/or electromagnetic flow meters are accepted.

- Flow meter components shall be protected in relation to environmental factors, as follows:
- Flow transducer – minimum IP 55;
- PC (Flow Integrator) – minimum IP 54;
- Components that are in direct contact with the fluid shall be compatible with it that is to support the working medium: water, working medium parameters: T = 5°C ... 40°C, P = 16 kgf/cm2 without exceeding the maximum allowable errors.
- Elements of protection shall be designed so as to prevent the alteration of records by external actions;
- Connecting cables of the subassemblies flow-meters must satisfy the requirements of the model certificate of approval.
- Flow rate will be shown in m3, m3/h or decimal multiples of these units. The measure unit symbol shall be displayed.
- Flow meters shall be able to display the values of the flow (flows, in the case of meters equipped with two flow meters), and total values on the flows.
- Indication of flow-meters should not be lost in case of a failure in the power supply and remain accessible for a minimum of one year.
- External binding of the meter, as type of interface, protocols, structure of the signal transmission speed, etc. shall be in accordance with the standards in force. The supplier shall make available the communication protocol.
- The flow meters shall allow the acquisition of the data stored on the printer, computer or other electronic equipment by optical reader: RS232/485 interface. Optional, must allow equipment with M-bus radio module and output for a distance of not less than 100 m.
- Warrantee period – at least 12 months.

2.8 Pressure transducer

- Measuring range – according to table from 2.9 List of Primary Measuring Means
- Operating conditions: water
- Operating Temperatures: 3 … 40°C
- Output Signal: 0(4) – 20 mA
- DC power supply: 10-30V
- Accuracy: < 0.5% of the nominal measurement value
- Resistant to pressure of 4 times higher than the nominal measurement value
- EEx ib IIC T6 Certification

2.8 Natural gas meters

Natural gas meters shall be included in the State Register of measuring instruments of the Republic of Moldova and have an updated model approval certificate issued by the National Institute of Standardization and Metrology of the Republic of Moldova (NISM).

- Gas meters are from category of volumetric type measuring means and are intended to measure the gas consumptions (natural gas and LPG).

- Operating Temperatures: -20°C… +50°C
- Maximum Working Pressure: 1.5 bar
- Range of measurement: Q_{min} = 0.04 $m^3/_h$, Q_{max} = 6.0 m^3/h
- Accuracy: ± 2 % $2Q_{min} \leq Q < Q_{max}$; ± 3 % $Q_{max} \leq Q < 2Qmin$
- Pulse Transmitter: standard 0.01 $m^3/_{impuls}$

2.9 List of Primary Measuring Means

No	Meter Type	Quantity	Note
1.	Electricity meter		
	380V, 50Hz	11	All PSs
2.	Flow meter (water meter)		
	Qn=250m3/h	4	Main SPS, SPS 1
	Qn=150m3/h	4	PS5, PS6
	Qn=100m3/h	4	PS2, SPS 1
	Qn=40m3/h	2	PS1, Well no. 10
	Qn=25m3/h	8	PS1, PS4, Well no. 8, Well no. 12, Well no. 13, Well no. 14
	Qn=15m3/h	2	PS3, PS7
4.	Pressure transducer		
			All PSs
	-1 … 1,6 bar	10	
	0 … 6 bar	4	
	0 … 10 bar	3	
	0 … 16 bar	19	
5.	Gas meter		
	0.04 … 6 m3/h	4	All PSs

3. SCADA SOFTWARE

The software must provide monitoring of 13 pumping stations (PSs), making communication with PMM via PLC for every technological facility, acquisition of data, store data, processing and displaying data. The software will be installed on a central computer located in the Central Dispatch of Orhei water utility and will allow the transmission of data to the other not less than 10 computers (workstations).

3.1 Software features

The following features shall be provided for each pump stations:

• Graphical display screen indicating status of pump stations. For pumping stations the screens typically show the instantaneous station flow, instantaneous pressure, pump status etc., power status, gas

consumption status, etc. Running pump status shall be shown in red color and stopped pump status shall be shown in green color.

• SCADA shall be configured to display real time trends of various parameters. A minimum of four variables may be trended in the Trend window at a time. All the real time data shall also be achieved for producing historical trends. The operator shall be able to scroll backwards and forwards in time for the complete period of data storage without entering dates and times, etc. Data for historical trends shall be stored for minimum 6 months.

• SCADA shall display process and systems alarms read from the central server. Each of alarms shall be prioritized in the SCADA as per their importance. Alarm screen shall have soft button for operator to acknowledge alarms. Active, Inactive, Acknowledge and Unacknowledged alarms shall be identified with different colors.

• SCADA system shall display telemetry status for every pump station. Any communication failures shall display be displayed on the telemetry screen and shall create alarm in SCADA. SCADA will display and archive the up time and down time of each site for at least 14 months.

• SCADA system shall provide reports of pump station data as per the requirements of operators.

3.2. Software structure

The software structure shall have the following modules:

- the Central Dispatch computer data acquisition;
- acquisition of data from PS equipment to the Central Dispatch computer;
- data processing for displaying and printing of synthetic reports (software that will allow to the beneficiary to change the data processing algorithms);
- storage of data and events of the thresholds values;
- display of data and emergency events (at working stations).

Software for data processing:
Each parameter shall have the following adjustable features:

- mediation-interval (minutes);
- instantaneous values display (yes/no);
- upper and lower alarm limits (numbers);
- linear scaling coefficients (Ax B, A and B numbers);
- delta maximum alarm value between the two readings (number);
- the name of the parameter (text);
- displayed unit of measure (text).

Software for data storage shall be competitive SGBD, which must ensure denied access to the database. Storing data on the HDD will be for a period of at least 14 months. On the 1st of each month will be saved on a tape drive for backups of the database.

Displaying data on other workstations with Windows XP OS or newer and shall be made using a compatible web browser IE6 which will connect over the network to your computer from the dispatcher. The information will be displayed with the aid of configurable schems with the following features:

- a background image;
- a number of minimum 500 fixed parameters display in;
- a number of minimum 500 links to other schemas, displayed in fixed

Schemes configuration will be possible in a separate module.

The following additional information shall be available:
- current queried address, query result;
- weather map;
- technological scheme of each object;
- alarm information;
- missing GPRS connection statistics of the status of communications lines;
- predefined reports on a time period chosen by the operator.

The data displayed by default will be the last reading carried out, with the possibility of choosing and displaying of the parameters, as graphics evolution, for a period of time chosen by the operator, or graphic will display the latest readings of the update parameter, with the update not more than 15 minutes.

The values indicated on the evolution parameter diagram starting with zero must be with the time stamp of the data collection unit and to not depend on the user's operating system settings.

3.2. Software submittals

- Program (software) for data acquisition and communication;
- Program (software) for storage, processing and displaying of Windows-compatible data. The data format must be compatible (for the purposes of export and the possibility of further processing) with one of the programs from Microsoft Office package (preferably MS Excel);

All written materials, and documentation will be in Romanian language (or English) including technical manuals.

4. CENTRAL SERVER HARDWARE

Hardware equipment from the Central Dispatch (server) shall be provided by the supplier, and consists of IBM compatible PC computer with color monitor, with the following configuration and minimum technical characteristics:
- basic configuration based on standard INTEL microprocessors;
- DDR PC3200 2GB System Memory;
- standard communication interfaces: 4 COM, LPT, USB, PS2, DV;
- video interface with 3D accelerator hard-ware, minimum 128 MB memory;
- data storage: RAID HDD 160 GB, 7200 rpm, minimum access time;
- DVD-RW 16X + 20 DVD9 BLANK;
- multimedia 19-inch LCD monitor (speaker and microphone);
- software Windows 2003 Server and Microsoft Office, licensed;
- 1Gbps MB/s LAN interface;
- audio interface;
- operation period: 100%