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The European Union

Environmental Protection of International River Basins Project



A project implemented by a Consortium
led by Hulla & Co. Human Dynamics KG

Annex 1

TERMS OF REFERENCE

Refurbishment of Groundwater Monitoring Network in Armenia and Moldova

1. Background and Objectives

Two EPIRB pilot projects – one in Armenia and one in Moldova- are related to the refurbishment of groundwater monitoring networks.

In Ararat valley, **Armenia** a large number of fish farms have been established since 2006. All of them are using groundwater for the development of fish industries. The total groundwater consumption in 2013 was 1.6 times the level approved (in 1984) by the State Committee on Reserves. Groundwater use by fish farms alone exceeded this level. Thus, due to artesian groundwater depletion, the conflicts with other artesian groundwater uses – irrigation, domestic, industrial, and cooling waters – are increasing, and there is a high concern with the government, academia, non-governmental organizations and citizens on a risk of depleting these resources if this use trend continues.

To address the problem it was proposed to refurbish the groundwater monitoring in the basin in order to collect more accurate information on the level of over-exploitation and at the same time improve decision-making on water allocation. Refurbishment of the groundwater monitoring network started from construction of the new borehole which needs to be equipped with modern electronic water level and temperature meters and telemetric station for data transfer to the databases of responsible groundwater institution- Hydrogeological Monitoring Center.

The total duration of the pilot groundwater project in Armenia is 18 months and it is expected to complete it by October 2015.

During the groundwater field surveys in **Moldova**, Prut pilot basin in 2013-2014 high level of groundwater salinity was detected in the main production aquifers. In order to find out whether increased salinity is caused by groundwater abstraction or is related to natural hydro-chemical conditions of the aquifers, groundwater monitoring network in the Prut river basin will be equipped with modern electronic groundwater monitoring devices.

Fifteen groundwater observation wells installed into main groundwater bodies which are used for public water supply will be equipped with electronic data loggers. Automatic water level, temperature and conductivity meters will be installed in five monitoring wells and 10 more observation wells will be equipped with electronic water level and temperature meters. Moldova has one electronic conductivity meter and one water level meter which were rented by the project for data collection and training purposes. These units will also be installed into monitoring wells. Installation of automatic data loggers will ensure frequent data recording and provide an opportunity to achieve a greater understanding of the aquifer response to natural and anthropogenic events. Telemetric station will be installed into the newly drilled monitoring well for the direct transfer of information to

the home-based computer of the State Enterprise Moldavian Hydro-Geological Expedition. It is expected to complete the refurbishment of monitoring network in Moldova by December 2015.

For purchasing and installation of modern groundwater monitoring equipment (electronic loggers and telemetric stations) a simplified international tender will be organised.

2. Scope of work

2.1. Armenia. Installation of telemetric station in the newly drilled monitoring well in Aknashen village.

As part of the pilot project a new 100 m deep monitoring well has been drilled in the Aknashen village in the yard of local observer to ensure protection of monitoring well from vandalism.

EPIRB project task: to purchase and install telemetric station in the Aknashen monitoring well and also train local experts on use and maintenance of the station. Local experts will be hydrogeologists from the Beneficiary institution – Hydrogeological Monitoring Center which is responsible for groundwater monitoring at the national scale.

2.2. Moldova. Refurbishment of groundwater monitoring network installing modern electronic monitoring equipment.

15 representative groundwater observation wells installed into main groundwater bodies will be selected and equipped with electronic data loggers. Before that special well heads will be manufactured by the State Hydrogeological Expedition for the protection of monitoring equipment from vandalism.

EPIRB project task: to purchase and install 4 automatic water level, temperature and conductivity meters, 9 electronic water level and temperature meters, 7 devices for atmospheric pressure compensation and telemetric station. Train local experts on use and maintenance of the telemetry. Local experts will be hydrogeologists from the Beneficiary institution – State Hydrogeological Expedition which is responsible for groundwater monitoring at the national scale. For purging observation wells before sampling submersible pump with generator will be also purchased as part of the tender.

3. Duration and schedule

3.1. Armenia. Installation of telemetric station will start after selection of equipment supplier and delivery of equipment to Armenia in summer 2015. Training of Armenian experts on maintenance and use of the station will take 2 days and will be performed by international consultant- equipment supplier. It is planned to finalise installation of telemetric station and have it fully operational by September 2015.

3.2. Moldova. Installation of telemetric station will start after selection of equipment supplier and delivery of equipment to Moldova in summer 2015. Training of local experts on maintenance and use of the station will take 2 days and will be performed by international consultant- equipment supplier. Installation of water level and conductivity meters will be carried out by the EPIRB project KE on groundwater together with local hydrogeologists. It is planned to finalise installation of telemetric station and have it fully operational by end October 2015.

ANNEX A. TECHNICAL SPECIFICATION OF EQUIPMENT

TECHNICAL SPECIFICATION OF TELEMETRIC STATION

1. The GSM/ CDMA telemetric station shall be powered by a 12V battery and dedicated to data loggers. It shall work at the ambient temperature from -20°C to +50°C.
2. The station shall allow connection of at least 4 data loggers.
3. The warranty period for all equipment of telemetric station (except for batteries) shall be at least 1 year.
4. Data sampling rate of the telemetric station shall be from 10 seconds to 99 hours with a possibility to change this frequency.
5. The data transfer frequency of the telemetric station shall be not less than 1 time in 1 hour with a possibility to change this frequency.
6. The station must have alarm notification, remote diagnostic reporting and firmware updating.
7. The software shall provide graphical interface, set up remote sites, specify communication intervals, define sampling rates for attached dataloggers, determine alarm settings, and perform remote diagnostic tests and remote firmware updates.
8. The station shall have additional solar trickle charger
9. The station shall be equipped with Direct Read Communication Package

Additionally will be purchased at the local provider:

- 12 V-30 AHR deep-cycle, rechargeable sealed lead-acid battery which fits into the box of telemetric equipment and
- solar panel to charge the battery, not bigger than A3 size (to reduce possibility of damage and vandalism).

WATER LEVEL AND TEMPERATURE LOGGERS:

| | |
|-------------------------------------|--|
| Level Sensor: | Piezoresistive Silicon with Hastelloy Sensor |
| Accuracy: | ± 0.05% Full scale (FS) |
| Stability of Readings: | Superior, low noise |
| Units of Measure: | m, cm, °C. |
| Automatic Temperature Compensation. | |
| Temperature Compensation Range: | 0° to 50°C |
| Temperature Sensor: | Platinum Resistance Temperature Detector |
| Temperature Sensor Accuracy: | ± 0.05°C |
| Temperature Sensor Resolution: | 0.003°C |
| Battery Life: | 10 Years - based on 1 reading/minute |
| Clock Accuracy: | ± 1 minute/year (-20°C to 80°C) |
| Operating Temperature: | -20°C to 80°C |
| Maximum Readings: | 40,000 readings |
| Memory: | Slate and Continuous |
| Communication: | Optical Infrared Interface. Conversion to USB, SDI-12. Serial at 19,200 bps, 38,400 bps with USB |
| Size: | 22 mm x 159 mm |
| Weight: | 129 grams |
| Corrosion Resistance: | Titanium based PVD coating |
| Sampling Modes: | Linear, Event & User-Selectable with Repeat Mode, Future Start, Future Stop, Real-Time View |
| Measurement Rates: | 1/8 sec to 99 hrs |
| Barometric Compensation: | Software Wizard and one Barologger in local area (approx. 30 km radius) |

WATER LEVEL, TEMPERATURE AND CONDUCTIVITY LOGGERS

| | |
|--------------------------|---|
| Level Sensor: | Piezoresistive Silicon with Hastelloy Sensor |
| Accuracy: | 0.1% Full scale (FS) |
| Normalization: | Automatic Temp Compensation |
| Temperature Sensor: | Platinum Resistance Temperature Detector |
| Accuracy: | ± 0.1°C |
| Resolution: | 0.1°C |
| Conductivity Sensor: | 4-Electrode Platinum |
| Full Range: | 0 - 80,000 µS/cm |
| Calibrated Range: | 500 µS/cm - 50,000 µS/cm |
| Accuracy: | 2% of reading or 20 µS/cm |
| Resolution: | 1 µS |
| Normalization: | Specific Conductance @ 25°C |
| General: | |
| Battery life: | 5 Years (5 minute sampling rate) |
| Clock Accuracy: | ± 1 minute/year from 0 to 40°C |
| Operating Temperature: | - 20°C to 80°C |
| Maximum # Readings: | 16,000 sets of readings |
| Communication: | Optical Infra-Red to USB |
| Size: | 22 mm x 190 mm |
| Weight: | 200 grams |
| Sampling Mode: | Linear, (5 sec to 99 hrs), Real Time View, Future Start |
| Barometric Compensation: | Software Wizard |

Submersible pump

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|---------------------|-----------------|
| Rated pumping depth | ~100 meters |
| Flow rate | At least 1 m3/h |
| Diameter | 2 inch |
| Power | 220 V |