



European Union Water Initiative Plus for Eastern Partnership Countries (EUWI+): Results 2 and 3

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SURFACE WATER SURVEY 2018



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Responsible EU member state consortium project leader

Michael Sutter, Umweltbundesamt GmbH (AT)

EUWI+ country representative in Armenia

Vahagn Tonoyan (AM)

Responsible international thematic lead expert

Kristina Schaufler, Umweltbundesamt GmbH (AT)

Responsible Armenian thematic lead expert

Prepared by: Environmental Monitoring and Information Centre (EMIC), Ministry of Nature Protection

Authors

Prepared by: Environmental Monitoring and Information Centre
Georg Wolfram, DWS-Hydro-Ökologie for Umweltbundesamt GmbH (AT)
Kristina Schaufler, Umweltbundesamt GmbH (AT)

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Umweltbundesamt GmbH	Office International de l'Eau (IOW)
Spittelauer Lände 5	21/23 rue de Madrid
1090 Vienna, Austria	75008 Paris, FRANCE

Responsible IOW Communication officer:

Yunona Videnina
y.videnina@oieau.fr

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Abbreviations

BMO.....	Basin Management Organization
CEPA.....	Comprehensive and Enhanced Partnership Agreement
CORINE.....	Coordination of Information on the Environment
DG NEAR	Directorate-General for Neighborhood and Enlargement Negotiations
DSS	Decision Support System
EC.....	European Commission
ENI.....	European Neighborhood Instrument
EU.....	European Union
EUR	Euro
EEA.....	European Environment Agency
ENP	European Neighborhood Policy
EUWI	European Union Water Initiative
GIS.....	Geographic Information Systems
GWB	Groundwater Body
IWRM.....	Integrated Water Resources Management
LTD	Limited Company
NGO.....	Non-Governmental Organization
RBD	River Basin District
RBMP	River Basin Management Plan
SEIS.....	Shared Environment Information System
USSR.....	Union of the Soviet Socialistic Republics
WFD.....	Water Framework Directive
WUA	Water Users' Association

1 EXECUTIVE SUMMARY

Within the project of “European Union Water Initiative Plus for the Eastern Partnership (EUWI+ 4Eap)” (Agreement number - AVH 10839-AM-EM-1) an ecological survey was carried out at 15 sampling sites in the Sevan and Hrazdan RBDs of Armenia, between 24th and 27th September 2018. Usually 4 or 5 sites could be sampled per day (2 sites on the last day).

The survey included the field documentation with photo documentation for each site, water and sediment sampling, chemical and biological analyses, a hydro-morphological description of the sampling sites and the reporting of the results. The present report provides a brief overview of the sampling campaign, while all raw data are presented in separate documents or summary tables as Annexes.

2 INTRODUCTION AND SCOPE

The objective of the survey in autumn 2018 was to form a sound methodological basis for future monitoring programs as essential part of river basin management planning.

The scope was to

- Train the experts on sampling and hydro-morphological site description;
- Provide data for the evaluation of the water body delineation;
- Provide data for the evaluation of the monitoring design in preparation of further surveys in 2019;
- Provide data for the pressure-impact assessment in order to evaluate existing assessment methods or develop new ones;
- Create a data base for the upcoming risk, status and trend assessment

3 GENERAL DESCRIPTION OF THE SURVEY

3.1 Selected pilot river basins and sampling sites

The sampling was done in 15 sampling sites of the Seven and Hrazdan river basins. Site names, numbers and coordinates are given in the Table 1.

Table 1: List of sampling sites with geographical coordinates

Basin	River name	Site name	Site No.	Latitude	Longitude
Hrazdan	Marmarik	0.5 km above Hankavan village	SW-01	40.636735	44.487391
Hrazdan	Marmarik	Below Marmarik Reservoir, near the village Artavazd	SW-02	40.623500	44.560826
Hrazdan	Marmarik	River mouth	SW-03	40.543557	44.757010
Hrazdan	Hrazdan	Below Hrazdan TPP	SW-04	40.545088	44.753417
Hrazdan	Hrazdan	Below Aghpyurak Reservoir	SW-05	40.500642	44.741317
Hrazdan	Hrazdan	Above Gyumush HPP	SW-06	40.361057	44.600813
Sevan	Argichi	River source, 0.5 km above village Lernahovit	SW-07	40.013267	45.216389
Sevan	Argichi	River mouth	SW-08	40.176354	45.282167
Sevan	Gavaraget	Above Tsaghkashen village	SW-09	40.300389	45.050222
Sevan	Gavaraget	River mouth	SW-10	40.381457	45.169855
Sevan	Sotk	5 km above mine	SW-11	40.200858	45.902115
Sevan	Masrik	1 km above the Nerkin Shorzha village	SW-12	40.108800	45.841067
Sevan	Masrik	River mouth	SW-13	40.223286	45.635889
Sevan	Drakhtik	0.5 km above the Drakhtik village	SW-14	40.574833	45.227694
Sevan	Drakhtik	River mouth	SW-15	40.544833	45.212111

Additional information is given in the Annexes 1 (Field protocols) and 3 (Hydro-morphological site description).



Figure 1: Surface water quality sampling sites of Hrazdan and Sevan RBDs during the survey autumn 2018

3.2 Sampling period

The sampling was done in September 2018. The detailed information on sampling dates and site descriptions metrological and hydrological conditions are presented in Table 2.

Table 2: Sampling dates and information on meteorological and hydrological conditions.

River Basin	Date	Site No.	Sampling team	Meteorology	Hydrology
Hrazdan	26.09.2018	SW-01	Tigran Arakelyan Harut Arakelyan	Light conditions: Sunny; Precipitation: Dry; Air temperature: Mild; Wind: Calm	River type: small Stream order: second Turbidity of water: no turbidity
Hrazdan	26.09.2018	SW-02	Tigran Arakelyan Harut Arakelyan	Light conditions: Sunny; Precipitation: Dry; Air temperature: Mild; Wind: Calm	River type: middle Stream order: second Turbidity of water: moderate
Hrazdan	26.09.2018	SW-03	Tigran Arakelyan Harut Arakelyan	Light conditions: Sunny; Precipitation: Dry; Air temperature: Mild; Wind: Slightly windy	River type: middle Stream order: second Turbidity of water: no turbidity

River Basin	Date	Site No.	Sampling team	Meteorology	Hydrology
Hrazdan	26.09.2018	SW-04	Tigran Arakelyan Harut Arakelyan	Light conditions: Sunny; Precipitation: Dry; Air temperature: Mild; Wind: Slightly windy	River type: middle Stream order: first Turbidity of water: no turbidity
Hrazdan	27.09.2018	SW-05	Tigran Arakelyan Harut Arakelyan	Light conditions: Covered; Precipitation: Dry; Air temperature: Mild; Wind: Slightly windy	River type: middle Stream order: first Turbidity of water: no turbidity
Hrazdan	27.09.2018	SW-06	Tigran Arakelyan Harut Arakelyan	Light conditions: Covered; Precipitation: Dry; Air temperature: Mild; Wind: Slightly windy	River type: middle Stream order: first Turbidity of water: no turbidity
Sevan	25.09.2018	SW-07	Tigran Arakelyan Harut Arakelyan	Light conditions: Sunny; Precipitation: Dry; Air temperature: Mild; Wind: Slightly windy	River type: middle Stream order: first Turbidity of water: no turbidity
Sevan	25.09.2018	SW-08	Tigran Arakelyan Harut Arakelyan	Light conditions: Sunny; Precipitation: Dry; Air temperature: Mild; Wind: Slightly windy	River type: middle Stream order: first Turbidity of water: no turbidity
Sevan	24.09.2018	SW-09	Tigran Arakelyan Harut Arakelyan	Light conditions: Sunny; Precipitation: Dry; Air temperature: Mild; Wind: Slightly windy	River type: small Stream order: second Turbidity of water: no turbidity
Sevan	24.09.2018	SW-10	Tigran Arakelyan Harut Arakelyan	Light conditions: Sunny; Precipitation: Dry; Air temperature: Mild; Wind: Slightly windy	River type: small Stream order: second Turbidity of water: no turbidity
Sevan	25.09.2018	SW-11	Tigran Arakelyan Harut Arakelyan	Light conditions: Sunny; Precipitation: Dry; Air temperature: Mild; Wind: Slightly windy	River type: small Stream order: second Turbidity of water: no turbidity
Sevan	25.09.2018	SW-12	Tigran Arakelyan Harut Arakelyan	Light conditions: Sunny; Precipitation: Dry; Air temperature: Mild; Wind: Slightly windy	River type: small Stream order: first Turbidity of water: no turbidity
Sevan	25.09.2018	SW-13	Tigran Arakelyan Harut Arakelyan	Light conditions: Sunny; Precipitation: Dry; Air temperature: Mild; Wind: Slightly windy	River type: middle Stream order: first Turbidity of water: no turbidity
Sevan	24.09.2018	SW-14	Tigran Arakelyan Harut Arakelyan	Light conditions: Sunny; Precipitation: Dry; Air temperature: Mild; Wind: Slightly windy	River type: small Stream order: first Turbidity of water: no turbidity
Sevan	24.09.2018	SW-15	Tigran Arakelyan Harut Arakelyan	Light conditions: Sunny; Precipitation: Dry; Air temperature: Mild; Wind: Slightly windy	River type: small Stream order: first Turbidity of water: no turbidity

3.3 Quality elements

Three quality elements have been chosen:

- Macroinvertebrates (= macrozoobenthos) as biological quality element;
- General physico-chemical parameters (no specific relevant pollutants such as heavy metals), list of parameters see Table 3;
- Hydromorphology for site description

Table 3: Parameters analyzed in the field and in the laboratory.

Parameter	Unit
Field measurements	
Water temperature (WT)	°C
Oxygen concentration (DO)	mg/L
Oxygen saturation (O ₂ -Sat)	%
pH	
Electric conductivity (EC)	µS/cm
Laboratory analyses	
Water temperature (WT, lab control)	°C
Oxygen concentration (DO, lab control)	mg/L
Oxygen saturation (O ₂ -Sat, lab control)	%
pH (lab control)	
Electric conductivity (EC, lab control)	µS/cm
Total suspended solids (TSS)	mg/L
Biological oxygen demand (BOD ₅)	mg/L
Chemical oxygen demand (K ₂ Cr ₂ O ₇) (COD)	mg/L
Ammonia-N (NH ₄ -N)	mg/L
Nitrate-N (NO ₃ -N)	mg/L
Orthophosphate, as P (PO ₄ -P)	mg/L
Total phosphorus (TP)	mg/L
Chloride (Cl)	mg/L
Sulphate, total ion (SO ₄)	mg/L
Calcium (Ca)	mg/L
Magnesium (Mg)	mg/L
Sodium (Na)	mg/L
Potassium (K)	mg/L

3.4 Responsibilities

For the properly work each part of the survey has its own responsible person and institution. The contacts of the responsible institutions and persons are represented in the table 4.

Table 4: Responsible institutions and persons in preparation and during the survey.

Responsibilities	Institution, contact person, email-address
General	
Responsible for the organization of surface water body sampling	Institute: "Environmental Monitoring and Information Centre" SNCO, Ministry of Nature Protection Contact person: Alina Zurnachyan (Head of Water monitoring department) E-Mail: alina.zurnachyan@gmail.com
Field work	
Responsible for field work (biological and chemical sampling, hydro-morphological site description)	Institute: "Environmental Monitoring and Information Centre" SNCO, Ministry of Nature Protection, "Service of Hydrometeorology and Active Impact to Atmospheric Phenomena" SNCO Ministry of Emergency Situations Contact person: Tigran Arakelyan (chemical), Harut Arakelyan (chemical), Vardan Qaryan (biological), Edgar Misakyan (hydro-morphological) UBA expert: Zornig Horst E-Mail: tigranarakelyan91@mail.ru, harut.Arakelyan.96@list.ru, sava03.vardan@gmail.com, e.misakyan@mail.ru
Responsible for functional check of sampling equipment	Institute: "Environmental Monitoring and Information Centre" SNCO, Ministry of Nature Protection Contact person: Tigran Arakelyan E-Mail: tigranarakelyan91@mail.ru
Responsible for calibration of on-site measuring equipment	Institute: "Environmental Monitoring and Information Centre" SNCO, Ministry of Nature Protection Contact person: Tigran Arakelyan E-Mail: tigranarakelyan91@mail.ru
Chemical analysis	
Overall responsible for the chemical analysis in the lab, including reporting and data delivery	Institute: Environmental Monitoring and Information Centre Contact person: Gayane Shahnazaryan (Deputy Director) E-Mail: shahnazaryangayane@gmail.com
Responsible for sample transport from the field to the laboratory	Institute: "Environmental Monitoring and Information Centre" SNCO, Ministry of Nature Protection Contact person: Tigran Arakelyan E-Mail: tigranarakelyan91@mail.ru
Analyzing laboratory and contact person	Institute: "Environmental Monitoring and Information Centre" SNCO, Ministry of Nature Protection Contact person: Alina Zurnachyan (Head of Water monitoring department) E-Mail: alina.zurnachyan@gmail.com
Biological analysis	
Overall responsible for the biological analysis in the lab, including reporting and data delivery	Institute: "Environmental Monitoring and Information Centre" SNCO, Ministry of Nature Protection Contact person: Vardan Karyan E-Mail: sava03.vardan@gmail.com

4 METHODS

4.1 Sampling methods

The sampling was done in 15 sampling sites of the Seven and Hrazdan river basins. The dates and time of the transport of the field survey were coordinated with the experts responsible for the sampling. The total field survey took about 4 days. The sampling was done by the field team (presented in Table 4). The surface water samples were transported to EMIC laboratory for the further processing and analysis. The handover was documented by using the “Protocol for the delivery and handover of samples” (see attached Annex 5).

All specimens were picked out of the sediment sample and kept for later validation. They were stored in vials with 70% ethanol.

4.2 Laboratory analyses

The EMIC laboratory analyses 19 physico-chemical parameters from each of the 15 water samples. In addition to the analyses in the laboratory, 5 parameters (Water temperature, Oxygen concentration, Oxygen Saturation, Electric conductivity and pH) were measured in the field by the sampling team (see Table 3). The data were provided to the chemical laboratory by the field team at the end of each sampling day and were included in the test report.

The physic-chemical parameters were measured by the appropriate ISO standard methods:

ISO 11923:1997 - Determination of suspended solids by filtration through glass-fiber filters

ISO 7888:1985 - Determination of electrical conductivity

ISO 10523:2008 - Determination of pH

ISO 6060:1989 - Determination of the chemical oxygen demand

ISO 5815-1:2003 - Determination of biochemical oxygen demand after n days (BOD_n) -- Part 1: Dilution and seeding method with allylthiourea addition

ISO 6878:2004 - Determination of phosphorus -- Ammonium molybdate spectrometric method

ISO 7150-1:1984 - Determination of ammonium -- Part 1: Manual spectrometric method

ISO 10304-2:1995 - Determination of dissolved anions by liquid chromatography of ions -- Part 2: Determination of bromide, chloride, nitrate, nitrite, orthophosphate and sulfate in waste water

ISO 17294:2016 - Application of inductively coupled plasma mass spectrometry (ICP-MS) -- Part 2: Determination of selected elements including uranium isotopes

The analyses record includes the sampling date and the analyses date ensuring compliance with the attached manual on sample preservation.

The invertebrates were separated to the major taxonomic groups and identified to the appropriate taxonomic level.

4.3 Quality assurance

All the analyses were done in a professional manner and in accordance with the laboratory accreditation procedures. The transport storage, preservation and the chemical analyses were undertaken according to the laboratory accredited procedures together with the application of internal analytical quality controls.

5 RESULTS

5.1 Field protocols

The sampling team prepared the field protocols for each of the 15 sample sites. The protocols include detailed information about river basin, name and type, site number and coordinates, sampling date and time, weather and water quality conditions, name of surveyor with signature and other comments.

The field protocols are presented in Annex 1.

5.2 Chemical analyses

After sample transportation direct to the chemical laboratory of EMIC the physical-chemical parameters from each of the 15 water samples were analysed. They include water temperature, oxygen concentration and saturation, pH, electric conductivity, total suspended solids, biological and chemical oxygen demand, ammonia, nitrate, orthophosphate, total dissolved phosphorus, total phosphorus, chloride and sulfate ions, calcium, magnesium, sodium and potassium.

The test reports are presented in Annex 4.

5.3 Biological analyses

Biological analyses were done from each of the 15 sites. Sorting of sediment samples was done according to the AQEM/STAR protocol. The invertebrates are separated to the major taxonomic groups and identified to the appropriate taxonomic levels.

The raw data are summered in Annex 7.

The sampling site assessment were summarized in Annex 8.

6 CONCLUSIONS AND LESSONS LEARNED

According to the process done in 2018 autumn we can conclude that during the project it was possible to train the experts on sampling and hydro-morphological site description. It was possible to implement biological analysis in Sevan RBD, in order to form a sound methodological basis for future monitoring programs as essential part of river basin management planning, to provide data for the assessment Hrazdan and Sevan RBDs, to provide data for the pressure-impact assessment in order to evaluate existing assessment methods or develop new ones, finally to create a data base for the upcoming risk, status and trend assessment.

For future survey, special attention should be drawn to the harmonisation of sampling site names / labels to avoid misunderstanding and confusion of sampling sites.

7 ANNEXES

Annex 1 Field protocols

Field Protocols for 15 sample sites are attached with separate files.

Annex 1.1 Summary Field protocols

Summary for field Protocols for 15 sample sites are attached with separate Excel file.

Annex 2 Photo documentation

See attached files (Annex 2).

Annex 3 Hydro-morphological site description

The protocols of the hydro-morphological site description are attached in separate files as Annex 3, which includes also a summary file according to section 1.4.2 of the ToR.

Annex 4 laboratory test reports

The laboratory test report (Annex 4) is attached in a separate Excel file.

Annex 5 protocols for sample delivery and handover

The surface water samples were delivered from 15 river sampling sites to EMIC laboratory. The protocols are attached in separate file (Annex 5).

Annex 6 MHS field tables and drawings

See attached separate files of MHS field tables and drawings (Annex 6).

Annex 7 Biological data

The biological data are attached as Annex 7 both as separate Excel files and – according to section 1.4.4 of the ToR – as summary file.



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