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LABORATORY ASSESSMENT REPORT GEORGIA

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Abbreviations

AFS ..... Atomic fluorescence spectroscopy
BC ..... Beneficiary country
BQE ..... Biological quality element
CI ..... Chemical ionisation
CW ..... Coastal waters
DOA ..... Description of action
DOC ..... Dissolved organic carbon
EaP ..... Eastern Partnership
EC ..... European Commission
EECCA ..... Eastern Europe, Caucasus and Central Asia
ENP ..... European Neighbourhood Policy
EPIRB ..... Environmental Protection of International River Basins
EQS ..... Environmental Quality Standards
EU ..... European Union
EUWI+ ..... European Union Water Initiative
GC ..... Gas chromatography
HPLC ..... High-performance liquid chromatography
IEC ..... International Electrotechnical Commission (international standards and conformity assessment for all electrical, electronic and related technologies)
ISO ..... International Standards Organisation
LLE ..... Liquid-liquid extraction
LOD ..... Limit of detection
LOQ ..... Limit of quantification
MS ..... Mass spectrometry
NFP ..... National focal point
NEA ..... National Environmental Agency
NPD ..... National policy dialogue
PTS ..... Proficiency testing scheme
QA ..... Quality assurance
QC ..... Quality control
QM ..... Quality management
RBMP ..... River Basin Management Plan
TOC ..... Total organic carbon
TW ..... Transitional waters
USAID ..... United States Agency for International Development
WB ..... World Bank
WFD ..... Water Framework Directive
WSS ..... Water supply and sanitation
WTP ..... Water treatment plant
WUA ..... Water Users Association

Country Specific Abbreviations – Georgia

MENRP..... Ministry of Environment and Natural Resources Protection

NEA ..... The National Environment Agency

NWP ..... National Water Partnership

1 PROJECT SUMMARY

The Eastern Partnership (EaP) is a policy initiative launched at the Prague Summit in May 2009. It aims to deepen and strengthen relations between the European Union and its six eastern neighbours: Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine.

In recent years, the countries of the Eastern Partnership have demonstrated a willingness to align their water policies and practices with the general principles and specific requirements of the EU Water Framework Directive (WFD), as well as other thematic and sectoral water directives and UN Multilateral Environmental Agreements (MEAs). Moreover, Georgia, Moldova, and Ukraine have assumed commitments to reform water policies and implement the EU water *acquis* as part of the Association Agreements signed with the EU in 2014.

It is within this context that the *European Union Water Initiative Plus for the Eastern Partnership* (EUWI+) for Eastern Partnership Countries was initiated by the Directorate-General for Neighbourhood and Enlargement Negotiations (DG NEAR) of the European Commission.

The *European Union Water Initiative Plus for the Eastern Partnership* (EUWI+) was launched in September 2016 to assist the six Eastern Partnership countries to approximate to the EU Water Framework Directive and its associated directives. Its objective is to improve the sustainable management of water resources with a focus on trans-boundary river basin management.

EUWI+ focuses on five thematic areas:

- Legislation, policy development and institutional consolidation
- Laboratory and monitoring system enhancement
- River Basin Management Plan development
- River Basin Management Plan implementation
- Public awareness, communications, and data/information management

The OECD and UNECE are implementing activities under thematic area 1. Thematic areas 2–5 are being undertaken by a consortium of EU member states comprised of the Environment Agency Austria (UBA) and the International Office for Water (OIEau/IOWater) of France. Experts from other EU member states will also be involved in project activities.

The budget for these thematic areas for all six countries amounts to a total of EUR 24.6 million and is financed by the European Union with contributions from the governments of Austria and France. Its planned period of operation is from September 2016 until August 2020 (48 months).

A website has been created (http://euwipluseast.eu/en/) for the publication and dissemination all the data, information and services developed and used within the framework of this project.

2 EXECUTIVE SUMMARY

The *European Union Water Initiative Plus for the Eastern Partnership* (EUWI+) was launched in September 2016 to assist the six Eastern Partnership countries in approaching the EU Water Framework Directive and its associated directives. The project objective is to improve the sustainable management of water resources with a focus on trans-boundary river basin management.

In order to establish project priorities and targets, an assessment of the current laboratory situation for the hydro-chemical testing of water was carried out during the second and third quarters of 2017 with the aim of identifying gaps and fields of improvement in the following areas, as defined in the description of the action (DOA) to the Grant Contract.

The assessment of laboratory infrastructure, personnel capacities, analytical quality assurance, accreditation status, WFD-relevant sampling and testing methods, and documentation were completed in the third and fourth quarters of 2017.

Laboratory infrastructure: The Department for Environmental Pollution and Monitoring of the National Environmental Agency (NEA) in Tbilisi, acts as the main partner of the EUWI+ project and maintains a laboratory for hydrochemical analyses. The laboratory performs chemical, physical-chemical, microbiological and hydrobiological analyses on surface and ground water, as well as wastewater, soil, sediments and precipitation. There are also two local laboratories associated with the NEA in Kutaisi and Batumi and an assessment of their general infrastructure (building, premises) revealed that improvements are needed in order to meet ISO/IEC 17025:2005 requirements. Both of the laboratories in Kutaisi and Batumi have a similar analytical scope and are equipped for this purpose. However, some equipment is partly damaged and needs to be replaced. In a parallel move to the assessment of the laboratories with regard to chemical parameters, one NEA laboratory was selected and assessed in connection with transitional and coastal water monitoring. The laboratory has a sufficient number of trained staff and basic analytical equipment. However, some instruments require servicing, or should be replaced and there is still a need for “fine tuning” through technical and advisory support from the EUWI project.

General staff capacities: The laboratory personnel in Tbilisi consist of twelve staff members with a university degree in chemistry or ecology. The personnel are well educated, receive regular training and are committed and motivated to perform their assignments. The personnel capacity needs are therefore met. The laboratory personnel in Kutaisi consist of two staff members with master’s degrees in chemistry and in Batumi of three persons, one with a PhD and two with master degrees in chemistry. The laboratory for TW and CW monitoring has a relatively low staff capacity, but this is still sufficient for the planned monitoring activities.

WFD-relevant testing and sampling methods: Several WFD-relevant testing methods for water are already established in the laboratory in Tbilisi. They are performed and have actually been accredited since June 2017. The laboratories in Batumi and Kutaisi are not accredited, but use procedures from the main laboratory in Tbilisi. Owing to the fact that most of the biological scientists have participated in previous or current EU projects (EPIRB and EMBLAS), applied sampling and determination techniques, the use of “Black Sea suitable” indices, result evaluation and status reporting are generally in line with WFD requirements. However, there is still room for improvement through technical and advisory support from the EUWI project.

New equipment: The additional equipment required for the analysis of new parameters and a move towards WFD has been identified and agreed with all the NEA laboratories with regard to chemical parameter and CW and TW analysis.

Accreditation status: The NEA laboratory in Tbilisi is accredited for heavy metals (18) and for pH. In addition, SOPs for other analyses exist and are fully compliant. The laboratory in Kutaisi is not accredited, but SOPs and standards provided by the central laboratory in Tbilisi are being used. This applies equally to the laboratory in Batumi. Training has already been carried out in connection with progress towards accreditation or reaccreditation.

Training: Three different training courses should be provided for all the laboratories: (i) General laboratory training that can be conducted independently on equipment, (ii) Hands-on training with existing equipment and (iii) Training on new equipment. The general training curriculum has been prepared and harmonised. In addition, the supply of the relevant ISO- and chemical reference standards for existing equipment is foreseen, as well as method validation and the training of laboratory personnel. A list of parameters and methods has been drawn up for the new equipment and the related ISO testing methods. As soon as the equipment has been successfully installed, training can begin.

Recommendation: Most of the laboratory equipment represents expensive investments and in order to achieve valid results, requires consumables (gases, chemicals, solvents etc.), maintenance, servicing, spare parts and a budget for establishing new methods, as well as a number of cost-intensive supportive procedures. For this reason, the drafting of a laboratory strategy would help to identify critical items and establish methods for the overcoming of bottlenecks. Therefore, the authors of this report recommend the development of a laboratory strategy for the NEA water laboratory for a period of ten years.

3 INTRODUCTION

The European Neighbourhood Policy (ENP) provides a framework for closer relations between the EU and its neighbouring countries. The European Union Water Initiative Plus for Eastern Partnership Countries project (EUWI+) aims to furnish the neighbouring countries with further support in improving their water quality and has a special focus on trans-boundary river basin management in the light of the WFD principles.

The EUWI+ action is built on the lessons learned from several development initiatives of the European Union in the water sector in Georgia, consisting primarily of the EUWI EECCA and EPIRB projects.

This overall project objective addresses existing challenges with regard to both the development and implementation of efficient water resource management.

One key, outstanding challenge is the further enhancement of water monitoring capacity, ranging from the geographical coverage of monitoring networks, to laboratory infrastructure and the methodological basis for sampling, (physical-)chemical analyses, and ecological as well as hydro-morphological status determination.

Capacity building and increased regular national budgets for monitoring activities are often more urgently needed than sampling or laboratory equipment and is especially true of Georgia.

Monitoring and appropriate laboratory capacities play a central role in the implementation of the WFD. Therefore, the WFD's daughter directive on technical specifications for chemical analyses and the monitoring of water status (Commission Directive 2009/90/EC[1] – QA/QC Directive) duly addresses quality assurance and the comparability and reliability of analytical results. Accreditation provides government bodies and regulators with confidence in the technical competence and quality of the data generated by the laboratories carrying out testing. For the accurate determination of the ecological status of surface waters, inadequate national methods should be replaced by inter-calibrated methods.

Consequently, the main objective of the EUWI+ project is to strengthen the monitoring infrastructure (monitoring network and laboratory infrastructure, sampling, measurement and laboratory equipment incl. maintenance thereof), which is closely related to and goes hand-in-hand with activity 2.2.1 on capacity building through staff training (sampling, analytics, QA/QC, accreditation and ecological status or potential determination), which also contributes to output from activity 2.3, the implementation of RBMPs.

The assessment was carried out by visiting the laboratories involved in person in order to examine existing equipment, personnel, infrastructure and the laboratory premises, and by studying the list of required parameters in the WFD and checking their degree of implementation.

The main focus of this assessment report is on chemical analyses, including the physical-chemical parameters and priority substances according to the Commission Directive 2013/39/EC[2] and corresponding QA/QC topics, as well as the determination of BQEs, their supporting physico-chemical elements and hydro-morphological elements. During the assessment phase, it became apparent that according to ISO/IEC 17025:2005[3] requirements, in general the laboratories' infrastructure (buildings, premises) is inadequate. Moreover, there is no research vessel available and trained staff do not cover all the requested BQEs.

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[1] COMMISSION DIRECTIVE 2009/90/EC of 31 July 2009, which, pursuant to Directive 2000/60/EC of the European Parliament and of the Council, lays down technical specifications for chemical analysis and monitoring of water status.
[2] Directive 2013/39/EU of the European Parliament and of the council amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy.
[3] ISO/IEC 17025:2005, General requirements for the competence of testing and calibration laboratories, International Standard Organisation, Switzerland.

Even before the inception phase, the NEA conceded the need to relocate the general laboratory in Tbilisi and a new building was in the planning phase. During the assessment, the progress of the construction work was followed with great interest. It is planned to move the laboratory to the new facility in in Q1/2018. The assessment, however, was carried out at the existing laboratory in Tbilisi and builds on information regarding methods, infrastructure and QA/QC performance. The laboratories in Kutaisi and Batumi were assessed in the standard manner.

4 ASSESSMENT OBJECTIVES OF THE CHEMICAL LABORATORIES

4.1 Objective

In order to establish project priorities and targets, an assessment of the current laboratory situation for the hydro-chemical testing of water was carried out to identify gaps and areas of improvement in the following fields, as defined in the description of the action (DOA) of the grant contract:

- Appropriate analytical equipment, laboratory infrastructure and consumables (feeds into Act. 2.1.2)
- (Further) needs for technical support for accreditation (feeds into Act. 2.1.3)
- Needs for training (feeds into Act. 2.2.1)
- Needs for a (further) increase in capacities and the enhancement of the technical competence of the administrative bodies' personnel (feeds into Act. 2.1.3 and 2.2.1)

The current report summarises the findings of the laboratory assessment, which are described in detail in the mission reports and are an essential part of the assessment activities. The mission reports also provide some specific technical recommendations for the individual laboratories, which can be easily implemented within the daily routine. These recommendations are not subject to the summarised assessment report.

Moreover, the assessment report identifies gaps and proposes measures aimed at the sustainable implementation of the WFD within the EUWI+ project, and offers a strategic outlook on the further action needed beyond the time frame of the EUWI+ project.

5 ASSESSMENT METHODOLOGY

During the inception phase there was already an opportunity for short visits to selected laboratories involved in regulatory water monitoring. In addition, laboratory questionnaires were distributed in order to gather relevant information in a systematic manner, i.e. a brief description of the laboratory, general personnel capacities, laboratory facilities, equipment, test methods, analytical quality assurance, documentation, reporting and the support needed for the EUWI+ project. Together with the country priorities and results from the previous EPIRB project, this information provided an initial indication of the current status and the basis for the in-depth, on-site assessment of selected candidate laboratories under project activity 2.1.1.

Beginning in June 2017 two assessment missions took place. During these missions the following aspects were covered via direct interviews with the responsible personnel:

- General staff capacities
- Laboratory facilities and infrastructure
- Analytical equipment, spare parts and consumables
- WFD-relevant testing and sampling methods (detailed methodology see Figure 1)
- Status of accreditation (based on the ISO/IEC 17025 requirements)
- Training needs

5.1 Parameter assessment approach

Figure 1 illustrates the general procedure for the in-depth assessment of the current laboratory scope of analysis for WFD parameters. The Commission Directive 2013/39/EC[4], "As regards priority substances in the field of water policy" not only defines the 45 priority substances, but also indicates the EQS values of the corresponding parameters in the relevant matrix (inland and other surface water and biota). Current analytical methods were compared with state of the art analytical methods for the determination of priority substances in surface water.[5] Analytical methods for the determination of priority substances in biota were compared with the methods indicated in the guidance document 33.[6] Apart from the assessment of priority substances in surface water, the WFD defines six physico-chemical quality elements (thermal conditions, oxygenation, salinity, nutrient status, acidification status, other pollutants). However, the EU member states are responsible for the selection of the relevant parameters for physico-chemical monitoring. Therefore, the guidance document published by the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management was used for the current physico-chemical parameter assessment.[7]

[4] DIRECTIVES DIRECTIVE 2013/39/EU OF THE EUROPEAN PARLIAMENT AND OF THE OUNCIL of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy.
[5] R. Loos, 2012, Analytical methods relevant to the European Commission's 2012 proposal on Priority Substances under the Water Framework Directive, European Commission – Joint Research Centre (JRC), Institute for Environment and Sustainability (IES), Italy.
[6] European Union, Common implementation strategy of the water framework directive (2000/60/EC), 2014, Guidance document No. 33 on analytical methods for biota monitoring under the water framework directive, technical report 2014-084, Luxembourg.
[7] K. Deutsch et al., 2010, Leitfaden zur typspezifischen Bewertung gemäß WRRL, allgemein physikalisch-chemische Parameter in Fließgewässern, Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, Sektion VII, Wien

The core parameters (oxygen content, pH value, conductivity, nitrate, and ammonium) to be analysed for the groundwater parameter assessment are listed in Annex V of the WFD. Additional groundwater parameters (e.g. heavy metals and pesticides), which are mandatory for compliant WFD groundwater monitoring, are laid down in the groundwater directive 2006/118/EC.[8] In addition, EU member states are responsible for defining the limit values of the corresponding groundwater parameters. In this case, the Austrian Quality Target Ordinance for Groundwater was used as a basis for limit values for the current groundwater parameter assessment.[9]

The assessment determines if the (WFD) parameter is within the scope of the analysis, is accredited according to ISO 17025 and the LOD and LOQ of the corresponding parameter. Moreover, it evaluates if the LOQs are compliant with WFD EQS values, current instruments and the methods used for analysis.

The assessed data will lead to an identification of actions such as method adaptation (e.g. when LOQs need to be reduced in order to comply with WFD-EQS values, ISO technical standards require implementation instead of national standards), method expansion (e.g. when the parameter is not yet in scope of analysis), the procurement of equipment and consumables and laboratory personnel training.

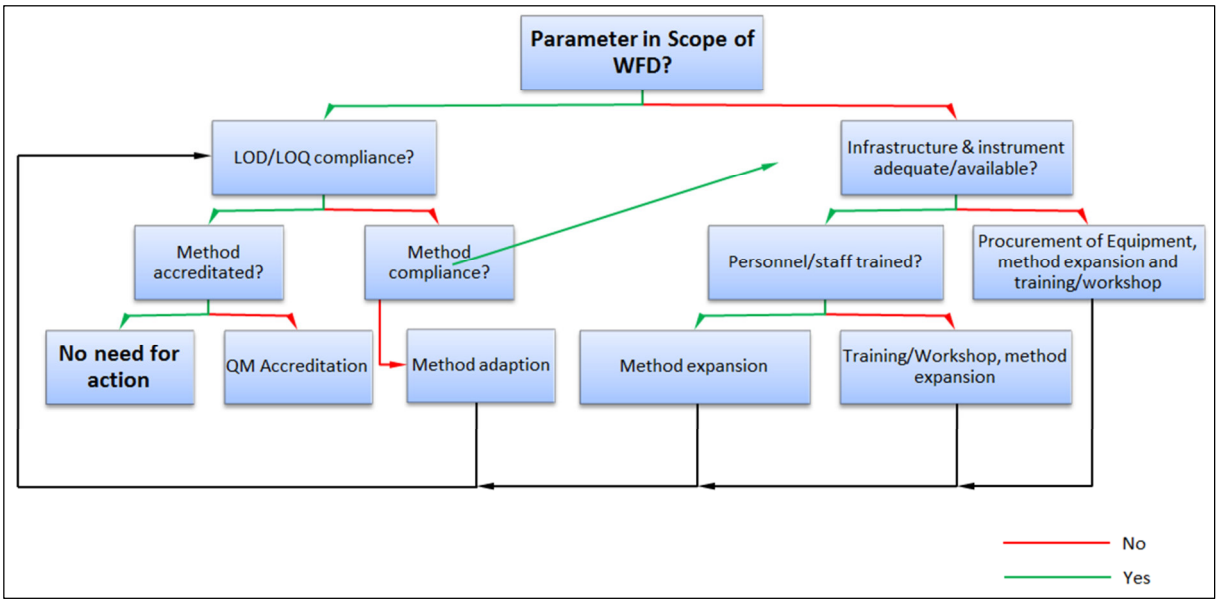

Figure 1: Flowchart illustrating the detailed hydro-chemical parameter assessment according to WFD requirements

[8] Directive 2006/118/EC of the European Parliament and the Council on the protection of groundwater against pollution and deterioration.
[9] BGB II Nr. 89/2010: Bundesgesetzblatt für die Republik Österreich, 2010, Qualitätszielverordnung Chemie Grundwasser, Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über den guten chemischen Zustand des Grundwassers.

5.2 Chronology

Two assessment missions took place and are summarised in the following chronology with the main assessment milestones.

Questionnaire during the inception phase:

- 1st laboratory assessment mission 25 – 30.6.2017
- 2nd laboratory assessment mission 23 – 28.7.2017

6 LABORATORY SELECTION

There is one laboratory in Georgia, which is responsible for water analysis and in the charge of the National Environmental Agency (NEA). The NEA Environmental Pollution and Monitoring Department acts as the main partner and maintains a laboratory for hydro-chemical analyses in Tbilisi. All types of water analyses (surface and ground water etc.) are carried out in this laboratory. In addition, chemical analyses of air and soil samples are completed using the laboratory infrastructure on its premises. There are also two local laboratories associated with the NEA in Kutaisi and Batumi.

The National Focal Point in Georgia agreed the laboratory selection.

6.1 Laboratory facilities and infrastructure

6.1.1 Tbilisi

As the new building is at present under construction, the technical assessment took place in the current laboratory premises, which are located on the 8th floor of the NEA's main building. For this reason, the assessment refers to the existing instrumentation, methods used and personnel working under the present conditions. An assessment of the premises did not take place.

The laboratory performs chemical, physical-chemical, microbiological and hydro-biological analyses on surface-, ground-, wastewater, soil, sediments and precipitation.

6.1.2 Kutaisi

The NEA laboratory in Kutaisi consists of three work rooms and it was evident that the laboratory is in a poor infrastructural condition. Fundamental prerequisites for a laboratory, including fume extractors, a water supply and electricity, were not guaranteed. The present, outdated extractor led to the main ventilation shaft of the apartment building and has since been repaired. The current conditions do not match the criteria of the EN ISO 17025:2005 standard regarding premises and in order to achieve international accreditation require improvement.

In addition, the general water supply situation in Kutaisi is poor. During our mission we learned that there were 3-day water supply shortages. As a stopgap, an old, corroded metal water tank has been installed and used for water storage.

6.1.3 Batumi

The NEA also runs a hydro-physical and -chemical laboratory in Batumi on the Black Sea. Two large rooms are used for chemical analyses, which are in good condition and sufficient for the scope of analyses. Separate offices are missing. There are a number of other rooms, which are used for the storage of materials and are in a very dilapidated condition. The building provides a solid impression but belongs to the municipality of Batumi. An extension of the contract for other rooms and their adaptation proved to be impossible.

6.2 General staff capacities

6.2.1 Tbilisi

The laboratory personnel consist of twelve staff members with academic (chemistry and ecology) and high school degrees. The head of laboratory and a quality manager provide management. The personnel are well trained and motivated and there would seem to be sufficient manpower.

6.2.2 Kutaisi

The laboratory personnel consist of two staff members with a master's degree in chemistry.

6.2.3 Batumi

The laboratory personnel consist of three persons; one with a PhD and two with master's degrees in chemistry.

6.3 Analytical equipment, spare parts and consumables

6.3.1 Tbilisi

An ICP-OES for heavy metal analysis, two ion chromatography lines for ion analyses, a spectro-photometer and two GC lines (MS and ECD) are in place. Further laboratory equipment (physical-chemical measurements, turbidity, titrators, balances, etc.) is also available.

Problems with the supply of gases for GC measurement (He, Ar, methane) were reported. Procurement procedures for spare parts, etc. foresee the extensive involvement of laboratory experts in the provision of specifications for the materials.

6.3.2 Kutaisi

The analytical scope of the laboratory covers physical/chemical measurement and nutrient analysis. Equipment for this purpose is available, but some items appear obsolete. The fume extractor is out of service and needs to be replaced, along with the water reservoir (shortages of supply) and the water purification system. Basic glassware is outdated or partially damaged and should be replaced. The thermostat does not work and must be replaced.

The local laboratories are also responsible for water sampling. In view of the long distances and difficult climatic conditions, cooling devices and basic sampling materials (bottles, boxes etc.) are urgently needed. The field equipment for on-site measurements (pH, conductivity, O_2 etc.) should be updated.

6.3.3 Batumi

The analytical scope of the laboratory is similar to that in Kutaisi. The fume extractor is inoperative and the photometer is not working. Cartridges for water purification and the thermostat, etc. are needed. A UPS is required to guarantee the proper function of the Skalar nutrient analyser. Auto-titrators could replace traditional manual measurements.

Major support is needed for sampling and on-site measurement and sampling. In view of the long distances and difficult climatic conditions, cooling devices and basic sampling materials (bottles, etc.) are urgently needed.

6.4 WFD relevant testing and sampling methods

(see Table 1 for the detailed methodology)

6.4.1 Tbilisi

Several of the WFD-relevant testing methods for water are already established and are being performed. Moreover, they have been accredited since June 2017. Organochloro pesticides are under development and PAH analyses are carried out. Several additional priority substances could be added to the scope of the parameters by adapting existing methods. Approximately 250 samples per parameter are analysed annually.

6.4.2 Kutaisi

Several WFD-relevant testing methods for water are already employed by order of the main laboratory in Tbilisi. Taking water samples at nearby sites and the measurement of in-situ chemical and physical parameters is one task. Samples for heavy metals and other relevant parameters are sent to the main laboratory in Tbilisi.

6.4.3 Batumi

In the main, physical/chemical and nutrient parameters are analysed here. The laboratory is responsible for taking samples in the region, performing on-site measurements and shipping the samples to Tbilisi for further analysis.

6.5 Status of accreditation (based on the ISO/IEC 17025 requirements)

6.5.1 Tbilisi

The NEA laboratory in Tbilisi is accredited for heavy metals (18 metals) and pH. In addition, SOPs for all other analyses exist and are fully compliant. A list of SOPs and instructions exists, as well as forms, protocols and documented procedures. The quality assurance measures are clearly described (replicates, blanks, recovery analysis, uncertainty determination) and the laboratory takes part in international laboratory inter-comparisons once a year. A quality manual is available.

In terms of the requirements regarding laboratory premises, the laboratory is going to move from its current location to a new building in 2018.

6.5.2 Kutaisi

The laboratory is not accredited, but SOPs and standards provided by the central laboratory in Tbilisi are used. The main analytical focus is on anions, cations, physical-chemical ("on-site") parameters and nutrients.

6.5.3 Batumi

The laboratory is not accredited, but SOPs and standards provided by the central laboratory in Tbilisi are used. The main analytical focus is on anions, cations, physical-chemical ("on-site") parameters and nutrients.

6.6 Laboratory selection for the determination of BQE supports (TW & CW) and the status quo

During one assessment mission (13.9.-17.9.2017) the chemical laboratory of the NEA's Fisheries and Black Sea Monitoring Department in Batumi was inspected with regard to its staff capacities, available sampling and analytical equipment, and methodology for the determination of BQE supporting elements in TW & CW.

The results obtained indicate that this laboratory has a sufficient number of trained staff, basic analytical equipment and uses appropriate methods. The laboratory is currently involved in a national monitoring programme (Chorokhi River and Batumi coastal strip), but was also a partner laboratory in EU projects (EPIRB and EMBLAS II). Taking into account the fact that the NEA Fisheries and Black Sea Monitoring Department in Batumi does not have a suitable research vessel, adequate and sufficient water samplers are needed for work in the TW & CW pilot area of the Chorokhi River estuary and the adjacent coastal waters from Batumi to the south of Poti. Furthermore, some analytical equipment requires servicing, or should be replaced. Therefore, financial assistance from the EUWI+ project is necessary (Table 4 and Table 5). Apart from financial assistance, a need for technical and advisory support from the EUWI+ was also determined, especially for activities such as monitoring planning and performance, and result evaluation. This assistance could be provided through workshops (Chapter *"General training workshops on WFD-relevant issues (TW & CW) for the chemical and biological labs of the NEA Fisheries and Black Sea Monitoring Department in Batumi"*, Page 29).

6.7 Assessment methodology, objectives and established needs for the biological laboratories (TW & CW)

The applied assessment methodology for the biological labs in the NEA's Fisheries and Black Sea Monitoring Department in Batumi was of a general nature (staff capacities, facilities, analytical equipment, data handling, reports, etc.), but also of WFD relevance (appropriate sampling and determination techniques, monitoring frequencies, quality assurance, inter-calibration exercises, national reference conditions, use of indices, etc.). The acquired insights from the first assessment mission in September 2017, as well as from the "Biological Monitoring Questionnaire", indicate that the biological labs generally cover the required BQE's for TW & CW, with the exception of BQE fish in TW.

To ensure the successful involvement of the biological labs of NEA's Fisheries and Black Sea Monitoring Department in the EUWI+ project activities, two main objectives were established:

a. The identification of the laboratories' needs for sampling and analytical equipment, equipment service and consumables, which feeds into Act. 2.1.2;

b. The identification of the laboratories' needs for additional training on methods, quality assurance, reference condition, the EQR concept and other WFD relevant issues (feeds into Act.2.2.1).

The laboratory assessment revealed that in addition to (a), the available sampling and analytical equipment in the labs is generally in an operational condition, but some items require servicing, or should be replaced with the help of EUWI+ financial support (Table 4 and Table 5).

In addition to (b), the laboratories' staff capacity is relatively low, but still sufficient for planned monitoring activities. All of the labs are located in the same building, which ensures close cooperation amongst them, as well as the possibility of basic equipment sharing. Due to the fact that most of the biological scientists have participated in previous or current EU projects (EPIRB and EMBLAS), applied sampling and determination techniques, the use of "Black Sea suitable" indices, result evaluation and status reporting are generally in line with WFD requirements. However, there is still a need for "fine tuning" through technical and advisory support from the EUWI project. The same support is also needed for setting up the BQE monitoring frequencies, the improvement of quality assurance, and the organisation of inter-calibration exercises and the determination of national type specific reference conditions (Chapter *"General training workshops on WFD-relevant issues (TW & CW) for the chemical and biological labs of the NEA Fisheries and Black Sea Monitoring Department in Batumi"*, Page 29).

7 ACTIVITIES

7.1 Activity 2.1.2 – Equipment procurement

The main focus in the assessment phase was on the strengthening of the NEA's Environmental Pollution and Monitoring Department. The laboratory head, Dr. Elina Bakradze, is highly motivated and dedicated to the new building, which will clearly be an improvement upon the current situation.

Apart from specific training on methodologies, adequate analytical instruments and tools, an upgrade of existing equipment is needed to fulfil the requirements of chemical monitoring. As a result of the assessment missions to Georgia, the following tables of requirements have been drawn up and summarise the identified needs and desired support expressed by the beneficiary. The list of equipment is a draft and will be agreed with the beneficiary.

7.1.1 NEA laboratory in Tbilisi (Environmental Pollution and Monitoring Department)

Table 1: Suggested list for the procurement of equipment and consumables for the NEA lab in Tbilisi

WFD relevance	Substance name/parameter	Equipment & consumables	Estimated costs
Equipment list			
Yes	Capable of analysis below WFD-EQS values of given parameters	(Triple quadruple) gas chromatograph/MSMS with automatic sampler	€ 200,000
Yes	Sample preparation for metal analysis of biota and sediments	Microwave digestion system	€ 20,000
Yes	Sampling of water for organic priority substances	50 amber glass bottles with conical shoulders (1L) 25 amber glass bottles with conical shoulders (2L)	€ 2,000
	Cooling boxes for sample transport	15 units á 100 L	€ 2,500
List of consumables			
Yes	Organochlorine pesticides	Pesticide grade solvents	€1,000
Yes	Alachlor, isodrin, hexachlorbutadiene, delta-hexachlorocyclohexane, pentachlorobenzene, trichlorobenzene, dicofol, bifenox, heptachlor, aclonifen	Purchase of chemical reference materials for expanding the current analytical methods	€ 500
Yes	atrazine, chlorfenvinphos, chlorpyrifos (chlorpyrifos-ethyl), simazine, trifluralin, cybutryn, cypermethrin, dichlorvos, terbutryn, benzene, carbon tetrachloride, trichloroethylene, tetrachloroethylene, 1,2-dichloroethane, dichloromethane, trichlormethane, bis(2-ethyl-hexyl)phthalat (DEHP), 4-tert-octylphenol, nonylphenol (4-nonylphenol, hexabromocyclododecane (HBCDD)	Purchase of chemical reference materials for method adaption	€ 2,500
Yes	Organochlorine pesticides	GC capillary column	€ 700

WFD relevance	Substance name/parameter	Equipment & consumables	Estimated costs
Yes	EN ISO 10695, EN ISO 15680, EN ISO 22032, EN ISO 10301, ISO 12010, ISO EN 18856, EN ISO 11369, EN ISO 18857-1, EN ISO 12673, EN ISO 17353, EN ISO 25101, EN ISO 11369, ISO/NP 21677, ISO 5667-12	Technical standard methods (ISO, EN) for the determination of priority substances	€ 200
Yes	Sampling of water for organic priority substances	50 amber glass bottles with conical shoulders (1L) 25 amber glass bottles with conical shoulders (2L)	€ 2,000
Total (consumables)			**€ 231,400**
Total (equipment and consumables for NEA laboratory in Tbilisi)			**€ 231,400**

7.1.2 NEA laboratory in Kutaisi

Table 2: Suggested list for the procurement of equipment and consumables for the NEA laboratory in Kutaisi

WFD relevance	Substance name/parameter	Equipment & consumables	Estimated costs
	General support	Basic glassware, laboratory equipment	€ 1,500
Yes	Dissolved oxygen, pH, conductivity, temperature	Multimeter for determination of conductivity, pH-values and dissolved oxygen incl. calibration standards (buffer solutions, …)	€ 5,000
Yes	Deionised water	Water purification system with cartridges	€10,000
Yes	Sampling of water for organic priority substances	50 amber glass bottles with conical shoulders (1L) 25 amber glass bottles with conical shoulders (2L) Cooling boxes	€ 1,000
		Total	**€ 17,500**
		Placeholder to € 30.000	**€ 12,500**

7.1.3 NEA laboratory in Batumi

Table 3: Suggested list for the procurement of equipment and consumables for the NEA laboratory in Batumi

WFD relevance	Substance name/parameter	Equipment & consumables	Estimated costs
Yes	Dissolved oxygen, pH, conductivity, temperature	Multimeter for determination of conductivity, pH-values and dissolved oxygen incl. calibration standards (buffer solutions, …)	€ 5,000
	Nutrient analysis	UPS	€ 5,000
	General equipment	Automated titrators, pipette dispensers 1, 5, 10, 20 mL	€ 750
Yes	Deionized water	Water purification system with cartridges	€ 10,000
Yes	Sampling of water for organic priority substances	50 amber glass bottles with conical shoulders (1L) 25 amber glass bottles with conical shoulders (2L) Cooling boxes	€ 1,000
		Total	**€ 21,750**
		Placeholder to € 3,.000	**€ 8,250**

Table 4: Suggested EUWI+ financial assistance for the NEA chemical and biological laboratories in Batumi

Laboratory	Activity	Status	Suggested EUWI+ assistance	Estimated costs (EUR)
Chemical (BQE supporting elements)	Research cruises	Missing research vessel	Purchase	< 40,000
	TW & CW monitoring surveys (3 years)	Planning	Finance	50,000
	Water sampling	Inadequate samplers	Purchase	< 2,000
	T, S Probe	Inadequate	Purchase	< 3,000
	Autoanalyzer	Needs servicing	Finance	< 5,000
	Dissolved oxygen titrator	Out of service	Finance	< 1,500
	Various lab equipment and nutrient standard solutions	Insufficient or missing	Purchase	< 3,000
Biological (BQE (TW & CW)	Chl a standards	Missing	Organise	< 200
	Plankton nets	Needs replacement	Purchase	< 1,000
	Van Veen grab	Needs replacement	Purchase	3,000 – 5,000
	Microbalance	Needs servicing	Finance	< 1,000
	Underwater camera with housing			< 5,000
	Fishing nets (TW)	Missing	Purchase	< 1,000
			Total	**117,700**

For Batumi and Kutaisi, placeholders are indicated to give a total support of EUR 30,000 for each laboratory.

Table 5: Suggested EUWI+ financial assistance for the planned activities of the chemical and biological laboratories in the NEA's Fisheries and Black Sea Monitoring Department in Batumi

Topic	Timeline	Estimated costs
Participation in proficiency testing schemes (PTS) in water analysis (seawater, estuarine water) for dissolved oxygen, nutrients and Chl a Programmes: http://www.quasimeme.org/gfx_content/documents/Brochure%20quasimeme%202017.pdf http://www.association-aglae.fr/en/tags/proficiency-tests	One round of PTS: one participation in 2018, the second in 2019	€ 3,000

7.2 Technical support of laboratories for accreditation (Activity 2.1.3)

This activity deals with the preparation of training plans and the organisation of hands-on training and trainer training with regard to monitoring and laboratory analyses, as well as the support of laboratories for accreditation, as indicated in the DOA.

The following training needs were identified as a result of visits during the inception phase and the in-depth analysis of the current status of the technical capacity of the laboratories. Efforts were made to differentiate between hands-on training directly in the laboratory premises using both existing equipment and the equipment to be purchased in the course of the project, and more general training, which can be held independently.

The dates indicated are preliminary and subject to the availability of MS experts, BC experts and coordination with other project activities.

7.2.1 NEA laboratory in Tbilisi (Environmental Pollution and Monitoring Department)

Table 6: Planned activities for the NEA laboratory in Tbilisi (Environmental Pollution and Monitoring Department)

Topic	Timeline	Costs
Participation in proficiency testing schemes (PTS) for the water analysis of selected groups of parameters Programme: http://www.umweltbundesamt.at/interlaboratory_comparison/ic_wateranalysis/	Two different rounds of PTS: one participation in 2018, the second in 2020	€ 2,500
Study tour of selected laboratories and administrative bodies of the consortium partners by one laboratory staff member	2019	--

In addition, the following technical support of laboratories for accreditation under Activity 2.1.3 is planned:

Table 7: Suggested technical support for the NEA laboratory in Tbilisi (Environmental Pollution and Monitoring Department)

Substance name/parameter	Equipment, consumables & services	Estimated costs
PCB (7unit) (28, 52,101,118, 138, 153,180), conc.100 ug/ml, min. volume 5 ml in isooctane, organochlorine pesticides, arochlor 1260, 1242 and 1254, perfluorotributylamine (PFTBA), Cu+Cr+Pb+Cd+Mn+Ni p/u AAS, 1g/l, 100 ml, reference material for heavy metals (Cu, Zn, Ni, Pb, Cd, Mn)	Purchase of chemical reference materials for existing accredited test methods	€ 3,000

All training is summarised under Activity 2.2.1. (chapter 7.3)

7.2.2 NEA laboratory in Kutaisi

The following steps of implementation are planned:

Table 8: Planned activities for NEA laboratory Kutaisi

Topic	Timeline	Costs
Participation in proficiency testing schemes (PTS) for water analysis for selected groups of parameters Programme: http://www.umweltbundesamt.at/en/services/laboratory_services/interlaboratory_comparison/ic_wateranalysis/	One round of PTS: one participation in 2018, the second in 2020	€ 1,250
Study tour of selected laboratories and administrative bodies of the consortium partners by one laboratory staff member	2019	--

All trainings are summarised under Activity 2.2.1. (chapter 7.3)

7.2.3 NEA laboratory in Batumi

The following steps of implementation are planned:

Table 9: Planned activities for NEA laboratory Batumi

topic	timeline	costs
Participation in proficiency testing schemes (PTS) for water analysis for selected groups of parameters Programme: http://www.umweltbundesamt.at/en/services/laboratory_services/interlaboratory_comparison/ic_wateranalysis/	One round of PTS: one participation in 2018, the second in 2020	€ 1,250
Study tour of selected laboratories and administrative bodies of the consortium partners by one laboratory staff member	2019	--

All training is summarised under Activity 2.2.1. (chapter 7.3)

7.3 Preparation of training plans and organisation of hands-on trainings and trainer training with regard to monitoring and laboratory analyses and the support of laboratories for accreditation (Activity 2.2.1)

The following training needs were identified as a result of visits during the inception phase and the in-depth analysis of the current status of the technical capacity of the laboratories. We differentiated between hands-on training on existing equipment and the equipment to be purchased in the course of the project, and more general training, which can be held independently.

7.3.1 Equipment-dependent training for the NEA laboratories

Tbilisi

Training is required for QA/QC activities, as is specific practical training on analytical methods using the instruments to be procured in the project's next phase. In particular, method development and training on the use of chemical ionisation (CI) methods on GC is foreseen. Sampling training is also planned.

Kutaisi

The involvement in the EUWI+ project will focus on in-situ devices and participation in selected technical and QM training, which will include refresher courses on sampling and QA procedures.

Batumi

The involvement in the EUWI+ project will focus on in-situ devices and participation in selected technical and QM training, which will include refresher courses on sampling and QA procedures.

7.3.2 Existing equipment – method extension, adaption and validation

As method extension, adaption and the validation of priority substances are to be completed by NEA's laboratory in Tbilisi (Environmental Pollution and Monitoring department), within this context we refer to the laboratory in Tbilisi.

For the following parameters, method adaption, the purchase of the relevant ISO- and chemical reference standard equipment (see chapter 7.1.1), method validation and laboratory staff training will be provided directly in the laboratory premises.

Table 10: Suggested implementation of parameters with existing equipment

Priority	Substance name/parameters	Comment (suggested techn. ISO standard)	Method description	Dates
1	PAH	DIN 38407-39	GC-MS	Q2/2018
1	Ion chromatography	EN ISO 10304	Ion chromatography	Q2/2018

For the Kutaisi and Batumi laboratories, training on the spectrophotometers and skalar nutrient analyser will be organised for the local staff with the involvement of experts from NEA Tbilisi in order to update these methods.

New equipment – method expansion, adaption and validation

For the equipment procured under activity 2.1.2 (chapter 7.1.1) method validation is planned after successful installation and test runs for the following groups of compounds and related ISO standard methods indicated in Table 9:

Table 11: Suggested implementation of parameters with new equipment

Priority	Substance name/parameters	Comment (suggested techn. ISO standard)	Method description	Dates
1	Atrazine, chlorfenvinphos, chlorpyrifos (chlorpyrifos-ethyl), simazine, trifluralin, cybutryn, cypermethrin, dichlorvos, terbutryn	EN ISO 10695	LLE with dichloro-methane and detection by GC-NPD or GC-MS	Q1/2019
1	Bis(2-ethylhexyl)phthalate (DEHP)	ISO EN 18856	C18-SPE and detection by GC-MS	Q1/2019
1	4-tert-octylphenol, nonylphenol (4-Nonylphenol	EN ISO 18857-1	LLE with toluene and detection by GC-MS	Q1/2019
2	Pentachlorophenol	EN ISO 12673	Derivatisation with acetic anhydride, extraction with n-hexane and detection by GC-MS	Q3/2019
2	Tributyltin compounds (tributyltin-cation)	EN ISO 17353	Derivatisation with sodium tetraethylborate, extraction with n-hexane, silica gel clean-up and detection by GC-MS	Q3/2019

General training for laboratory personnel from the NEA laboratories in Tbilisi, Kutaisi and Batumi

- **Training for QA/QC and method validation (Q4/2017)**
  - Method validation (LOD, LOQ, measurement uncertainty)
  - QA/QC measurements (e.g. blank values, control samples, recoveries)
  - Use of control charts
  - Improvement of LOQ
  - Measurement traceability
- **ISO 17025: 2017 new edition** – training on new, changed requirements and the exchange of experience for implementation (Q4/2018 as earliest, or Q1/2019)
- **Training of internal auditors** based on the ISO 19011 guideline for auditing management systems and the specific requirements of the ISO 17025 (Q3-4/2018)
- **Training on ISO-conform sampling for NEA's sampling division**; align sampling with the methods and standards of the (to be accredited) laboratory (asap)

General training workshops on WFD-relevant issues (TW & CW) for the chemical and biological labs of the NEA Fisheries and Black Sea Monitoring Department in Batumi

- **Delineation workshop (timeframe: February 2018)**
  - Common implementation strategy
  - Identification of TW & CW water types and water bodies
  - Artificial and heavily modified water bodies
- **TW & CW monitoring preparatory workshop (timeframe: March – June 2018)**
  - BQE monitoring frequencies
  - Final check of sampling and determination methodologies
  - Protocols
- **TW & CW monitoring results and ecological status reporting (timeframe: October – December 2018)**
  - Type-specific threshold values
  - Evaluation of results
  - GIS application

8 RELATED ISSUES

8.1 Laboratory waste management

At present, used chemicals, organic solvents and other hazardous laboratory waste are collected and stored in the laboratories. Sooner or later, the maximum storage capacities will be reached. In particular, an increase in technical capacity will also lead to a rise in the production of hazardous waste. An alternative solution for the handling of hazardous chemical waste needs to be found.

8.2 Import regulations

Restrictions on the import of goods, consumables, services and spare parts to Georgia were not discussed during the assessment phase. However, several issues relating to the ordering of spare parts and consumables were mentioned during the discussion. These matters have to be clarified in advance of the procurement phase.

Organochlorine pesticides are forbidden in Georgia. However, at the moment there are no implications with regard to the availability of standard substances for scientific purposes.

8.3 Data security

A thorough check of the data infrastructure has yet to be carried out.

For this reason, we recommend the establishment of network or server-based data handling applications in the laboratory. We trust in the awareness of the laboratory management to deal with this issue, as there is a high degree of awareness with respect to the critical items and prerequisites laid down in ISO 17025.

9 INSTITUTIONAL SUSTAINABILITY OF SELECTED LABORATORIES

In order to run a laboratory properly, a basic budget for infrastructure maintenance and the purchase of essentials is needed. Essentials are seen as including standards (norms), reference materials, consumables, equipment and a budget for servicing of instruments and equipment, etc. Sustainable laboratory work needs a sustainable budget, which according to the information provided basically exists. The laboratory has a budget, which is split into several cost units. Upon the determination of a need, there is a possibility for applying for extra positions (i.e. instrument purchase, internal projects etc.).

Nevertheless, we must mention that modern analytical work demands high-end instrumentation and the appropriate quality management procedures. However, high-end instruments, are costly investments and require subsidies for use (energy), consumables (gases, chemicals, solvents etc.), maintenance, servicing, spare parts, the expense for the establishment of new methods and the various cost-intensive support procedures needed to achieve valid results. These aspects have also to be taken into account in the conceptualisation phase. It is imperative that this aspect is also mentioned and appropriate budgeting be considered in order to guarantee sustainable performance beyond the timeframes of funded projects. For this reason, the drafting of a laboratory strategy would help identify critical items and determine actions to overcome bottlenecks.

10 RECOMMENDATIONS AND STRATEGIC OUTLOOK

During this assessment a few selected laboratories were assessed. This assessment can therefore not be seen as representative for the situation of all the laboratories throughout the country.

As stated in the previous chapter, the authors recommend the preparation of a laboratory strategy for the selected laboratories for a period of 10 years.

11 NEXT STEPS

With respect to this report, the following steps need to be implemented as soon as possible:

- A review of the final draft assessment report by the beneficiaries
- The start of the procurement procedure (see section 6.2)
  - The purchase of consumables
  - Drafting of technical specifications for the new equipment by the beneficiaries in-line with WFD requirements in the English language
  - A review of the technical specifications by Environment Agency Austria experts
- Planning of technical support for the laboratories (see section 6.3)
- Planning of training activities (see section 6.4)
- A visit to the NEA laboratory by an IOW expert to assess the data security status

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