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

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WATER MONITORING ASSESSMENT REPORT – UKRAINE

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CONTENTS

List of Tables

Abbreviations

DOA ..... Description of action
DOM ..... Dissolved organic matter
EC ..... European Commission
EaP ..... Eastern Partnership
EECCA ..... Eastern Europe, Caucasus and Central Asia
EU ..... European Union
EUWI+ ..... European Union Water Initiative Plus
EPIRB ..... Environmental Protection of International River Basins
EQS ..... Environmental quality standards
GW ..... Groundwater
GWB ..... Groundwater body
IBBS ..... Institute of Biology of the Southern Seas
IMB NAS UKRAINE ..... Institute of Marine Biology of the NAS of Ukraine
ISO ..... International Standard Organisation
IWRM ..... Integrated Water Resources Management
MENR ..... Ministry of Ecology and Natural Resources
NPD ..... National Policy Dialogue
POM ..... Particulate organic matter
QA ..... Quality assurance
QC ..... Quality control
QM ..... Quality management
RBMP ..... River Basin Management Plan
SGS ..... State Geological Service
SIGF ..... State Informational Geological Fund
SW ..... Surface water
UkrSCES ..... Ukrainian Scientific centre of Ecology of the Sea
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 Ukraine

MENR ..... Ministry of Ecology and Natural Resources
NAAU ..... National Accreditation Agency of Ukraine
SAWR ..... State Agency of Water Resources
SEMS ..... State Environment Monitoring System
UkrHMC ..... Ukrainian Hydrometeorological Center

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:

1. Legislation, policy development and institutional consolidation
2. Laboratory and monitoring system enhancement
3. River Basin Management Plan development
4. River Basin Management Plan implementation
5. 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 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.

This assessment report summarises the current state of knowledge regarding the existing water monitoring and management systems in Ukraine and takes into account the findings of the forerunner EPIRB project and existing River Basin Management Plans. It indicates the needs identified for capacity building in Ukraine, which are necessary in order to bring the country's water management into line with the Water Framework Directive (WFD).

Assessment focused primarily on the current status of ground- and surface water (identification and delineation of water bodies and preliminary identification of main pressures) and gaps in the light of the requirements of the WFD. The secondary focus was on the current situation of the quantitative and chemical groundwater monitoring network, as well as the monitoring of the biological quality elements in surface and coastal waters, and some general indications of areas of improvement.

The Ukrainian institutions currently involved in surface water issues and monitoring are the Institute of Hydrobiology of the National Academy of Science and the Central Geophysical Observatory of Hydromet in Kyiv. Additional meetings with experts from the Institute of Marine Biology of the National Academy of Science of Ukraine (IMB NAS UKRAINE) and the Institute of Biology of the Southern Seas (IBBS) were held in Odessa. The State Geological Service and the State Informational Geological Fund are the institutions responsible for groundwater monitoring.

The state monitoring network was established in the 1950s and 1960s with 8,000 wells. There are different types of monitoring, evaluations, wells (exploration wells, wells used for forecasting, etc.) and monitoring frequencies. The national groundwater experts have a very good general overview of the conditions relating to the use and exploitation of groundwater that dates from Soviet times. Moreover, the legal basis, administrative responsibilities and water management organisation and monitoring are currently being restructured in a move towards WFD compliance. Parallel to the legislative activities, the State Informational Geological Fund plans a review of monitoring stations at state level.

Some groundwater bodies were already identified and delineated during the EPIRB project. The next step forward in nearing the WFD is the identification, delineation and characterisation of groundwater bodies throughout the Dnipro basin.

Four Ukrainian institutions were assessed with regard to surface water activities. The Institute of Hydrobiology of the National Academy of Sciences of Ukraine in Kyiv has 17 years of work experience in the field of hydrobiology and the institution's specialists are able to cover all the biological quality elements with their expertise. The Central Geophysical Observatory, Hydromet (SES) in Kyiv has a small team with experience from working on various scientific projects. However, there is an urgent need for increased personnel capacity, training and equipment inventory. The Institute of Marine Biology of the NAS of Ukraine (IMB NAS UKRAINE) in Odessa was founded in 1954. The Black Sea is its main research priority along with the marine strategy tackled by the EMBLAS project. Nonetheless, transitional waters (e.g. Danube Delta) and some monitoring activities have also been a research focus. The Ukrainian Scientific Centre of Ecology of the Sea (UkrSCES), Odessa participates in national and international cooperations and works on various parameters, including biological quality elements. It possesses expertise in phytoplankton, macroinvertebrates, meiobenthos, microphytobenthos, makrozooplankton and chlorophyll a. The various WFD methods and parameters relating to these four institutions will be assessed in more detail during the project.

In order to facilitate the development of River Basin Management Plans and build respective capacity in the Ukrainian administration, a clear and pragmatic step-by-step procedure regarding the delineation of water bodies and the development of monitoring networks (based on the existing guidance of the Common Implementation Strategy of the Water Framework Directive and of the EPIRB project) should be developed. This procedure will include draft templates for water body characterisation and a template for the characterisation of monitoring sites (based on the EPIRB Water Body at Risk Report and EU and Austrian experience). These will be introduced in a series of workshops and via work packages completed in the interim periods, which will be complemented by theoretical and practical training on sampling in close coordination with field surveys.

3 INTRODUCTION

The European Neighbourhood Policy (ENP) provides a framework for closer relations between the EU and its neighbouring countries Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine. The European Union Water Initiative Plus for Eastern Partnership Countries project (EUWI+) aims to furnish these states with further support in improving their water quality and has a special focus on transboundary 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 Ukraine, consisting primarily of the EUWI EECCA and EPIRB projects.

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

One key, outstanding challenge is the further enhancement of water monitoring capacity through the geographical coverage of monitoring networks, laboratory infrastructure and the methodological basis for sampling and biological and (physico-)chemical analyses. In view of limited resources and the necessity for effectiveness and efficiency, ground- and surface water monitoring must to be carried out where it is most urgently required. The data generated has to be transformed into the information needed to acquire and use the knowledge necessary for risk-based and targeted water management, as stipulated by the WFD. A second key challenge is therefore the strengthening of water management capacities within the framework of River Basin Management Planning and its implementation.

Groundwater is often a major source of drinking water and an important resource for industry (food processing etc.), agriculture (e.g. irrigation, fish farming) and thermal water supply (balneology, heating purposes). Furthermore, it plays a vital role in the hydrological cycle, as it is critical for the maintenance of wetlands and feeding of river flows. It acts as an important buffer during dry periods and provides the base flow to many surface water systems.

Restricted water quantity is one of the many threats posed to surface waters and therefore aquatic organisms. Pollution ranging from chemicals and pesticides (e.g. agricultural runoff) to organic waste, and morphological alterations can impact water quality and ecological status.

Surface water systems are amongst the most threatened, but precious habitats, as they are subject to multiple pressures. They account for less than 0.01% of the planet's total surface area, but support more than 100,000 species. Continuous monitoring of the ecological status of rivers and lakes that takes pressure-impacted relationships into account represents a platform for sustainable water management and thus provides a basis for many human lives.

The WFD aims to achieve good chemical status of all water bodies, good ecological status or potential of all surface waters, and good quantitative status of groundwater bodies. Achieving these objectives requires the implementation of various steps and both the identification and delineation of water bodies, and targeted and cost-efficient monitoring are essential. These basic steps subsequently help to focus the implementation of the most appropriate measures in a cost-efficient manner and thereby achieve the greatest possible benefit from the resources available.

This report covers the water-related aspects of the following activities:

- Activity 2.1.1 Assessment of monitoring and laboratory infrastructure, capacities and needs;
- Activity 2.1.2 Purchase of equipment, including hydrological and water quality monitoring stations and rehabilitation and upgrade of existing equipment and existing laboratories;
- Activity 2.2.1 Preparation of training plans and organisation of hands-on training and training of trainers with regard to monitoring and laboratory analyses and to support laboratories for accreditation;

- Activity 2.3.1 Assessment of the needs and identification of priorities in implementation of the RBMPs;
- Activity 2.3.2 Technical Support in the elaboration and implementation of the pilot RBMPs.

These activities are closely related to Activity 2.2.1 regarding capacity building in the laboratories (equipment, analytics, QA/QC, accreditation) and Activities 2.3.1 to 2.3.7, which involve the development and implementation of RBMPs.

In order to define and target the exact water-related steps to be taken within each activity of Result 2 of the EUWI+ project, it was necessary to conduct a thorough assessment of the status quo and the related trajectories of the partner country administrations. This ground- and surface water management assessment report summarises the current state of knowledge on the existing water monitoring and management systems. It indicates the needs identified for capacity building along with the step-by-step approach of the WFD to cyclical ground- and surface water management. This extends from the delineation and characterisation of water bodies, including the anthropogenic pressures to which they are subjected, to the resultant risk to the achievement of the WFD's environmental objectives, the definition of a suitable and feasible monitoring network, sampling at the monitoring sites, the analysis of the generated data, the assessment of water body status, the definition of measures to ensure the adequate protection of water resources and biological quality elements, and the required implementation of these steps.

This report also has links to the rehabilitation and/or procurement and installation of monitoring equipment. The assessments presented in this report are preliminary, information having been gathered and elaborated through meetings between the responsible technical and management staff in the Ukrainian administration and the UBA water team. The assessments are subject to constant revision, as the teams working in the Ukrainian administration and the member state consortium continue to develop the activities foreseen under the EUWI+ project.

4 ASSESSMENT OBJECTIVES

4.1 Objectives

In order to establish project priorities and targets, an assessment of the current state of ground- and surface water management and the monitoring situation was carried out with the aim of identifying potential gaps and areas of support via the project. According to the step-by-step approach of the WFD, as management units water bodies have first to be identified and delineated before a monitoring network can be developed in line with the directive's principles.

The WFD typology for surface waters (Annex II, section 1) is organised by initially classifying water bodies in broad categories (rivers, lakes, transitional, coastal waters, artificial water bodies, heavily modified water bodies) and secondly, by differentiating water body types within these categories. This is achieved using fixed typologies: System A, which is based on an eco-region, altitude, catchment area and geology, and an alternative typology, System B, which consists of a mixture of obligatory and optional factors.

Due to this dependency, at this stage the assessment focused primarily on the current status of ground- and surface waters (identification and delineation of water bodies and preliminary identification of the main pressures), and the gaps in the light of WFD requirements.

The secondary focus was on the current situation of the groundwater monitoring network and the monitoring of biological quality elements, as well as some general indications of areas of improvement. The detailed assessment of the groundwater monitoring infrastructure and capacities will be completed once the groundwater bodies are established. The following aspects required assessment:

- The need for a review of existing delineation methodology and groundwater bodies in EPIRB pilot basins (feeds into Activity 2.3.1);
- The need for hands-on training to delineate groundwater bodies in the river basin districts newly included in the EUWI+ project (feeds into Activities 2.2.1 and 2.3.2);
- The current status of groundwater monitoring and initial indications with respect to training, infrastructure and equipment requirements (feeds into Activities 2.1.1 and 2.1.2).

The assessment of the surface water monitoring infrastructure was completed during six missions. Corresponding questionnaires in the respective countries were prepared with a focus on:

- The current status of surface water monitoring (feeds into Activity 2.1.1):
  - Qualified staff numbers and their respective fields of expertise
  - The existing monitoring of biological quality elements and available expertise
  - Monitoring and reference sites
  - Data availability
- Equipment needs (feeds into Activity 2.1.2):
  - On-site assessment of sampling/monitoring equipment
  - Identification of equipment needs
- Training needs (feeds into Activity 2.2.1):
  - Initial indication of training needs for sampling and identification
  - Sampling and identification training for additional biological quality elements

This assessment report summarises the findings described in detail in the mission reports, which are an essential part of the assessment activities. Moreover, the assessment report identifies gaps and proposes steps aimed at the sustainable implementation of the WFD within the EUWI+ project, as well as providing a strategic outlook on the further needs for action beyond the time frame of the EUWI+ project.

4.2 Assessment methodology

During the inception phase and the assessments at the beginning of the implementation phase of the EUWI+ project, meetings were held with representatives of the responsible administration and relevant international projects. The Ukrainian institutions working in groundwater management and involved in the present project include the MENR (Ministry of Ecology and Natural Resources), the State Agency for Water Resources, the State Geological Service and the State Informational Geological Fund. In order to collect the required information, meetings took place with both management and technical staff from the administration.

The following aspects were discussed:

- Existing EPIRB methodologies, e.g.
  - Guidelines on identification, characterisation and delineation of groundwater bodies
  - Guidelines on sampling
- The existing (draft) River Basin Management Plan(s)
  - The identified, delineated and characterised groundwater bodies
  - The pressure analysis methodology for groundwater
  - The pressure data employed
  - The risk and status assessment methodology and the results
- The existing and planned groundwater monitoring activities:
  - The legal basis, existing rules and responsibilities
  - The distribution and location of monitoring points
  - The monitored parameters and monitoring frequency

The administration's experts were asked to provide their opinions regarding the following:

- Are the EPIRB methodologies understandable, logical, tailored to the local situation and easily applicable in other areas? What needs to be improved? What should be better explained? Who are the readers/users?
- Have gaps or problems with regard to the groundwater aspects of the existing (draft) RBMP(s) already been identified. Is there a need for updates?
  - Are you happy with the identified groundwater bodies, or might a re-delineation be necessary and helpful?
  - Are you happy with the methods and procedures applied in the RBMPs? Are they clearly explained, understandable and logical? Can they be easily applied to other river basins?
  - Have all pressures been considered (e.g. land use, urban areas, forests, location of industrial sites, dump sites, groundwater abstractions, ...)? Have all potential pollutants been identified and considered?

- According to your instincts and experience does the RBMP identify those areas, which should be prioritised for action?
- Do you think that the results of the risk and status assessment reflect the actual situation? If not, is this because of the assessment methodology or the fact that certain data is incomplete or completely missing?
- Who is responsible for groundwater monitoring network/sampling? What kind of quality assurance is considered? Who receives the monitoring data results and what is the data used for?

The aim of these discussions with the national administration was to understand:

- Who will actually be responsible for the various steps of WFD implementation and who will be our counterparts for the single aspects.
- Which aspects of the EPIRB methodologies need to be improved in order to become more user-friendly and better tailored to the national situation/needs, as well as what needs to be improved for alignment with the WFD.
- Which additional (pressure) data needs to be explored and compiled for the next working steps.
- What are the next steps and who is doing what.

The Ukrainian institutions currently working on surface water issues and monitoring are the Institute of Hydrobiology of the National Academy of Science and Central Geophysical Observatory and Hydro-met in Kyiv. In addition, meetings were held with experts in Odessa, the NAS Institute of Marine Biology Ukraine (IMB NAS UKRAINE) and the Institute of Biology of the Southern Seas (IBBS)

A questionnaire was sent to and completed by our Ukrainian partners after the surface water mission, in order to summarise and supplement the knowledge gathered. The assessment team also met the coordinators of APENA, an ongoing international project with ground- and surface water-related links to EUWI+ with the aim of discussing the possibilities for cooperation and synergies.

4.3 Chronology

The aforementioned assessments were carried out during the following missions:

- 1st groundwater assessment mission 15 – 16 June 2017
- 2nd groundwater assessment meeting (APENA) 10 – 11 July 2017
- 3rd groundwater assessment meeting (APENA) 20 – 26 September 2017
- 1st surface water assessment mission: 16 – 20 September 2017
- A questionnaire on surface water monitoring was sent out to the institutions visited at the end of October 2017
- Completed questionnaires were returned by the:
  - Institute of Hydrobiology, National Academy of Sciences of Ukraine, Kyiv
  - Central Geophysical Observatory (SES),Kyiv
  - NAS Institute of Marine Biology Ukraine (IMB NAS UKRAINE), Odessa
  - Ukrainian Scientific Centre of the Ecology of the Sea (UkrSCES), Odessa

5 ACTIVITIES

In conjunction with the review of the deliverables from the previous EPIRB project, the discussions with representatives of the responsible administration and the APENA project revealed the following current status and areas for support through the EUWI+ project.

5.1 Activities regarding groundwater

5.1.1 Activity 2.1.1 Assessment of monitoring and laboratory infrastructure, capacities and needs

Discussions concerning the current status of the monitoring infrastructure, capacities and needs were held with the technical and management staff of the State Geological Service and the State Informational Geological Fund.

The state monitoring network was established in the 1950s and 1960s with 8,000 wells. There are different types of monitoring, evaluations, wells (exploration wells, wells used for forecasting, etc.) and monitoring frequencies. There was also a network dealing with the use and exploitation of groundwater, but this collapsed following a reduction in funding during the 1990s. The assessment methodologies no longer functioned and the state GW monitoring network, which covers everything, was reduced by 120 wells (from 1,150). In 2008, the network included 929 monitoring wells (quantity), but only in theory.

Eight state enterprises carry out monitoring together with seven regional units. They send data to the umbrella information centre, which prepares annual reports and forecasts. In 2016, information on 171 quantity sites and 38 chemical monitoring sites was reported from the regions. There are 356 wells in the Dnipro basin, but only 50 were active in 2016 and 150 in 2015. For 2013 to 2015 there is no information available for several regions and in 2015 virtually no data was reported. There is one database with data from the past 30-40 years, but unfortunately there is no data from the last five years owing to a lack of funding.

The legal basis, administrative responsibilities and water management organisation and monitoring are currently being restructured in a move towards WFD compliance. The preparation of a legal basis for GW delineation and monitoring is being supported by the APENA project and EUWI+ provided substantial comments and input regarding methodologies. In the course of close cooperation, EUWI+ furnished input for the APENA groundwater workshops held in Lviv and Odessa in September 2017 which also focused on groundwater monitoring. They covered the legal background, an introduction to CIS methodologies, the UA approach and experiences from EU member states.

The overriding target is that all RBMPs must be presented to the cabinet of ministers for approval by 1 September 2024. The UA administration responsible for groundwater is clear about the importance of these WFD implementation steps in connection with the EU-UA Association Agreement and seriously committed to continue and implement the necessary steps (delineation and network design) within the timeframe given by the MENR.

Parallel to the legislative activities, an inventory of the monitoring stations at state level by the State Informational Geological Fund is planned in order to identify functioning sites and provide information about the refurbishing or cleaning needed for sites that are in poor condition and therefore no longer monitored. The representatives of the regional state enterprises have been requested to inform the State Geological Enterprise in written form of the number of boreholes and those requiring restoration. It would be sensible not to change the boreholes used for this prognosis.

Further EUWI+ support with a continuation of the APENA project would be highly appreciated by the responsible national GW experts. The design of the monitoring network must be seen in conjunction with the delineation of the groundwater bodies (GWB). Once the GWBs reach a final stage, definitive network design can be completed. Naturally, the main priority is to make use of the entire existing monitoring infrastructure and keep the boreholes for prognosis. In the case of significant gaps, Activity 2.1.2 offers a possibility for network expansion through new monitoring sites or the cleaning of existing ones. Moreover, monitoring equipment upgrading is to be discussed.

According to the overall roadmap, state monitoring has to be ready in 2019 because the development of an RBMP requires three years of monitoring data and therefore, at the latest, monitoring has to start in 2021.

5.1.2 Activity 2.1.2 Purchase of equipment, including hydrological and water quality monitoring stations and rehabilitation and upgrade of existing equipment and existing laboratories

Decisions on the rehabilitation and upgrading of existing monitoring sites, and the purchasing and installation of equipment for new groundwater monitoring sites will be taken when GWB delineation is in its final stage on the basis of a sound understanding of the pressures on the GWBs, and once the planning of the groundwater monitoring network has been finalised and the monitoring frequency and parameters determined.

Some groundwater bodies have already been identified and delineated in the EPIRB pilot basin. Under Activity 2.3.2, this work will be continued in the EUWI+ pilot basins. Once the existing monitoring infrastructure is fully assessed in all the pilot basins and can be assigned to the newly identified, delineated and characterised groundwater bodies, and in addition the gap between the status quo and the newly developed plan for the monitoring network is known, it will be possible to determine if, where, and how the rehabilitation of existing sites and the installation of new sites will be necessary, most suitable and possible with the resources available in order to implement the revised groundwater monitoring network. The selected equipment will influence the content of the training to be carried out under Activity 2.2.1. For further details see the groundwater roadmap for Ukraine in chapter 7.2.

5.1.3 Activity 2.2.1 Preparation of training plans and organisation of hands-on trainings and training of trainers with regard to monitoring and laboratory analyses and to support laboratories for accreditation

The preliminary training plans for groundwater monitoring will be based on the insights obtained during the stepwise implementation of the groundwater roadmap for Ukraine in chapter 7.2. Similarly, the individual training and the field survey(s) will be developed over the course of the EUWI+ project in order to allow maximum targeting on the needs of the Ukrainian administration. Training material and the groundwater survey manual will be based on EPIRB manuals, which will be revised if necessary. Sampling training and field survey(s) will be carried out once groundwater bodies have been identified, delineated and characterised, and after the design of the monitoring network, including frequencies and parameters as part of Activity 2.3.2. The surveys will serve the validation of conceptual understanding and the gathering of the data necessary for enabling risk and status assessment. The exact content of training will also depend upon the equipment purchased, or to be purchased under Activity 2.1.2. Possibilities for conducting some of the monitoring training and the field surveys as regional workshops and trans-boundary exercises, and thereby fostering an exchange of experience between administrations and the establishment of working relations on a technical level, will be evaluated with all the stakeholders involved. For further details see the groundwater roadmap for Ukraine in chapter 7.2.

5.1.4 Activity 2.3.1 Assessment of the needs and identification of priorities in implementation of the RBMPs

During the EPIRB project, the first GWB delineation exercises were carried out in the Upper Dnipro and Prut basins. At that time there was insufficient ownership and with very few exceptions (e.g. Natalia Zaritovska, Natalia Pyshna), the State Geological Service experts were not involved. The training participants were often unable to continue and implement what they had learned, simply because they had to work on different topics and GWB delineation did not have the same level of priority as it has now. The EPIRB only developed a general approach, but what the UA GW experts needed was a detailed methodology tailored to the UA situation.

The national groundwater experts have a very good general overview of GW conditions dating from Soviet times. Geological and hydrogeological information is available for the whole Dnipro basin. Information on land use, landfill and wastes might be available at the MENR. Pesticide statistics (t/ha) should also exist. A cadastre of water abstractions in the UA is available and annual reports for each water abstraction site are available from GeoInform. A hydrological database exists. An official request and payment are required for data acquisition. Strategic enterprises can obtain the data free of charge. A new document will regulate free data access. Since 1980, data on the interaction between GW and SW has been available (study) and this should be utilised. Every region has to provide an environmental passport (profile) and 10–15 such reports should be available.

As already mentioned under Activity 2.1.1, the legal basis, administrative responsibilities and the setup of water management and monitoring are currently being restructured in the direction of WFD compliance. The preparation of the legal basis for GW delineation is also being supported by the APENA project and the EUWI+ provided substantial comments and input regarding the methodologies. In the course of close cooperation, EUWI+ furnished input for the APENA groundwater workshops in Lviv and Odessa in September 2017 which also focused on GWB delineation.

During the APENA workshops in Odessa and Lviv, all the relevant Ukrainian GW experts (about 50) from the regional state enterprises were hands-on trained in the delineation of GWBs. Geological maps and profiles were distributed during the workshop and the experts had to delineate GWBs, which were then discussed.

The State Geological Service and the State Informational Geological Fund understand clearly the importance of these WFD implementation steps in connection with the EU-UA Association Agreement and are seriously committed to continue and implement the necessary steps towards delineated GWBs within the timeframe given by the MENR.

The workshop concluded that the (50) GW experts throughout the country would read all the relevant draft legislation when the new approach and minimum requirements are defined, study the methodologies, start their implementation and carry them out in a proper manner. All the relevant CIS guidance documents were translated into Ukrainian, but in view of some translation difficulties, should doubts arise, the experts were told to consult the original versions wherever feasible.

By end of next year (31.12.2018) all the entities/organisations will present the offers/suggestions regarding the names of groundwater bodies to the ministry in the form of a table, which will also mean that each GWB will have at least one monitoring site.

EU support is highly appreciated. The focus of the APENA, which ends in 2018, is purely on methodology and not on implementation and equipment. Therefore, EUWI+ will assume this role and provide support in terms of implementation and equipment, and thus continue the significant and successful support of the APENA project.

A general procedure regarding possible EUWI+ support of the local experts was discussed and roughly established (see chapter 7.2). EUWI+ is focusing solely on the Dnipro basin and will provide hands-on training and support to the local GW experts at their premises and with their materials. A repetition of all the theoretical training is not foreseen, but rather work on GWB delineation. The content of the

training will depend greatly upon the needs identified and the difficulties to be solved. At the same time, the GW experts will continue their work between the workshops and should questions arise, communications can take place via emails or phone. Furthermore, the national GW experts will simultaneously document all their deliberations, literature and references. This will generate a guidance document that could be used to train further experts.

It is also recognised that GWB delineation has to be completed throughout the whole country and therefore GW experts from other basins will also start work.

5.1.5 Activity 2.3.2 Technical Support in the elaboration and implementation of the pilot RBMPs

This activity focuses on the development of a first generation RBMP for the Dnipro basin.

A clear and pragmatic step-by-step procedure on how to identify aquifers, delineate GWBs and design monitoring networks (based on existing CIS and EPIRB guidance) is currently under development. This procedure will include a draft template for GWB characterisation (based on the EPIRB Water Body at Risk Report and EU and AT experience) and a template for the characterisation of monitoring sites (based on EU and AT experience). These documents and templates will form a basis for further tailoring and national adaptation during the implementation process.

In a continuation of the process that was stipulated and supported by the APENA project, the UBA GW team will provide input on important aspects that require consideration when identifying, delineating and characterising GWBs. All the relevant Ukrainian GW experts from the regional state enterprises were already trained with regard to the background of the WFD implementation steps and practical matters during the APENA groundwater workshops in Odessa and Lviv during September. This momentum will be maintained by EUWI+ in the form of further hands-on training with the Ukrainian GW experts at their offices.

There is plenty of (hydro)geological information available, which provides a solid basis for the next steps. Together with information on anthropogenic pressures, the national experts can start drafting GW bodies and prepare inventories of their monitoring networks.

There will be three key hands-on workshops regarding the development of GWBs and the corresponding monitoring network. The workshops will represent joint efforts by the GW experts from the regional enterprises and the UBA GW team. They will feed into the RBMP work led by the IOW. Before and after the workshops, NEA hydrologists (possibly with support from external consultants) will work through the clearly defined steps necessary for the preparation of the next event. This will allow continuous and well-paced progress towards the RBMPs, with capacity being accumulated within the administration in order to ensure the institutional sustainability of WFD groundwater management.

The first workshop will focus on the:

a. Discussion of draft GWBs and hands-on revision
b. Discussion of the template for GWB characterisation
c. Discussion/finalisation of identified GW-relevant pressures
d. Discussion of draft monitoring networks and hands-on revision
e. Presentation and discussion of a characterisation template for monitoring sites
f. Discussion/finalisation of monitoring frequency and relevant (chemical) indicator parameters
g. Discussion of investment needs
h. Planning of sampling training and potential surveys

The second workshop will consist of:

a. Further discussion and hands-on training/finalisation of GWB delineation
b. Further discussion and hands-on training/finalisation of the characterisation of GWBs (template and description);
c. Further discussion and hands-on training/finalisation of the monitoring network
d. Further discussion and hands-on training/finalisation of the characterisation of monitoring sites (template)
e. Further discussion/finalisation of investment needs including the specifications

The focus of the third workshop will depend upon the progress made thus far:

a. Finalisation of GWB delineation
b. Finalisation of GWB characterisation
c. Finalisation of the monitoring network.
d. Finalisation of monitoring site characterisation
e. Finalisation of investment needs and specifications

These workshops will be followed by theoretical and practical training on sampling in close coordination with the field survey(s), and possibly within a regional or trans-boundary context, as explained in chapter 5.1.3. For further details see the groundwater roadmap for Ukraine in chapter 7.2.

5.2 Activities regarding surface water

5.2.1 Activity 2.1.1 Assessment of monitoring and laboratory infrastructure, capacities and needs

The following four institutions provided lists of available equipment (incl. brand, date of first operation and status), as well as capacities (number of staff and level of knowledge) and assessment methods (e.g. parameters, intervals, WFD compliance):

The Institute of Hydrobiology of the National Academy of Sciences of Ukraine, Kyiv

The academy of science has 17 years of experience working in the field of hydrobiology and with their expertise the institution's experts are able to cover all biological quality elements.

The Academy of Science has offered to act as a centre for training for environmental monitoring specialists. Laboratories and equipment are in place and rooms for training and workshops could be provided.

The available equipment at the Institute of Hydrobiology of the National Academy of Sciences of Ukraine is mostly operational and functional (but some equipment is still needed (see 5.2.2 Activity 2.1.2).

78 highly trained staff supported by 22 trainees/postgraduates are currently working on surface-water related topics at the Institute of Hydrobiology of the National Academy of Sciences. Training needs are specified in Chapter 5.2.3 Activity 2.2.1.

Table 1: Existing monitoring expertise of Institute of Hydrobiology of the National Academy of Sciences of Ukraine, Kyiv according to the questionnaire

Fields of expertise	**Level of knowledge** trainee/experienced/advanced	**Nr. of staff**
Fish	Experienced and advanced	12 (5*)
Macroinvertebrates	Experienced and advanced	15 (3)
Phytobenthos	Experienced and advanced	5
Phytoplankon	Experienced and advanced	13 (2)
Macrophytes	Experienced	2 (2)
Hydromorphology	Experienced	2
Hydrology	Experienced and advanced	2 (1)
Other, *please specify:* Specific pollutants, new emerging contaminants	Experienced	3 (1)
Radionuclide contamination	Experienced and advanced	8 (2)
Biotesting procedures	Experienced and advanced	7 (2)
Parasites of water animals	Experienced and advanced	5 (3)
Microbiology		4 (1)

** trainee – postgraduates*

At present, the following biological quality elements are investigated together with hydrology and hydromorphology at the Institute of Hydrobiology of the National Academy of Sciences: Hydromorphoplogical monitoring will be implemented from 2019.

Table 2: Existing assessment methods of Institute of Hydrobiology of the National Academy of Sciences of Ukraine, Kyiv according to the questionnaire

Method	**Parameter/s**	**Interval**	**Site type** • Monitoring site • Reference site • Project based site selection	**Number of samples**	**WFD compliance**
Macro-invertebrates sampling „AQEM/STAR ” method	Species richness, frequency of occurrence, taxonomic, quantity and biomass structures, biotic indices including saprobic, water pollution and ecology status determination	Commonly seasonally, but not less than yearly	All three	Not less than triply in all types of biotopes	Yes, based on reference approach and five-phase assessment scale
Phytobenthos sampling	The same, diatomaceous index	The same	The same	The same	The same
Phytoplankton sampling	The same, diatomaceous index	The same	The same	The same	The same
Macrophytes	Species richness, projective cover, plant association, quantity parameters	The same	The same	The same	The same
Hydro-morphology/ Hydrology	According to CEN River 14614: 2004 EN 15843: 2010 Lake EN 16039: 2011 EN 16870: 2017	-	-	-	-
	According to CEN 14614: 2004	-	-	-	-

The evaluation of the different methods in terms of WFD-compliance has yet to be completed together with the Institute of Hydrobiology of the National Academy of Sciences of Ukraine.

Central Geophysical Observatory, Hydromet (SES), Kyiv

Since the first visit of the surface water team on 7 February during the inception phase, new legislation on water monitoring has been implemented (in 2019), which involves the Central Geophysical Observatory (only physical-chemical). Motivated staff is in place, but there is a need for personnel and financial support.

Currently there are 116 sampling sites in place in Ukraine, but different parameters are investigated at the various sites. Due to the lack of staff, at present, sampling is not only carried out by hydrobiologists, but also by chemists and hydrologists.

Phyto- and zooplankton data is available in digital form, as well as on an SQL-database with limited functions. Software, sampling and identification training needs are described in more detail in chapter 5.2.3 Activity 2.2.1.

Table 3: Existing monitoring expertise of CGO/SES according to the questionnaire

Fields of expertise	**Level of knowledge** trainee/experienced/advanced	**Nr. of staff***
Fish	-	-
Macroinvertebrates	advanced	1
Phytobenthos	experienced	1
Phytoplankton	trainee/experienced	2
Macrophytes	trainee	1
Hydromorphology	-	-
Hydrology	-	-
Zooplankton	experienced	3
Bioassay	experienced	2

** Some specialists work with more than one biological quality element*

The small team has experience from working on various scientific projects and is very interested in improving the Ukrainian monitoring approach. However, there is an urgent need for personnel and equipment support, as well as sampling and identification training.

Table 4: Existing assessment methods of CGO/SES according to the questionnaire

Method	**Parameter/s**	**Interval**	**Site type** Monitoring site only	**Number of samples**	**WFD compliance**
Pantle and Buck Saprobity index (Slade-chek mod.)	Biota	• 4 times a year • 4 times a year • 2 times a year • 1 times a year	• phytoplankton, • zooplankton, • phytobenthos, • macrophytes	• 522 • 320 • 88 • 20	No
Trent biotic index	Biota	2-4 times a year	macrozoobenthos	250	No
Bioassay	Surface water	2-9 times a year	test object (*Ceriodaphnia affinis, Daphnia magna*)	210	No

At present, phytoplankton, zooplankton, phytobenthos, macrophytes, macrozoobenthos are investigated at the Central Geophysical Observatory, but the methods are not yet WFD-compliant.

Institute of Marine Biology of the NAS of Ukraine (IMB NAS UKRAINE), Odesa

The institute has existed since 1954, for a decade as the Institute of OSSR, then as the main Ukrainian institute (Odessa branch) and from 2014 as OBIBSS with the status of the Institute of Marine Biology NAS Ukraine (IMB NASU). The main priority is Black Sea research and the marine strategy is that tackled by the EMBLAS project, but transitional waters (e.g. Danube Delta) have also been a research focus and some monitoring activities are conducted.

In the summer and autumn phyto-, zooplankton, macrophytes, nitrogen, phosphorus, oxygen, POM and DOM are measured twice a week. The water quality lab has established 42 monitoring sites where sampling takes place during 1-4 monitoring expeditions per year. Phytoplankton is monitored regularly in the coastal zone.

Table 5: Existing monitoring expertise of IMB NAS according to the questionnaire

Fields of expertise	**Level of knowledge:** trainee/experienced/advanced	**Nr. of staff**
Fish	experienced	3
Macroinvertebrates	trainee	18
Phytobenthos	trainee	4
Phytoplancton	trainee	5
Macrophytes	trainee	3
Hydromorphology	experienced	3
Hydrology	experienced	3
Other, *please specify* • Zooplankton • Mammals • Microbiology • Biotest • Hydrochemistry	 • trainee • trainee • experienced • trainee • experienced	 • 5 • 1 • 2 • 3 • 4

The IMB NAS UKRAINE has four departments with a total of 49 staff members:

- Department of Ecological Integration of Biocycles (20 staff)
- Department of Marginal Community Ecology (14 staff)
- Department of Water Quality (incl. Applied Hydroecology lab) (9 staff)
- Department of Morphological and Functional Ecology of Aquatic Vegetation (6 staff)

Table 6: Existing assessment methods of IMB NAS according to the questionnaire

Method	**Parameter/s**	**Interval**	**Site type** • Monitoring site • Reference site • Project based site selection	**Number of samples**	**WFD compliance**
Methods of study and methodology for measuring phytoplankton according to "Guidelines for Methods of Biological Analysis of Seawater and Bottom Deposits" "Black Sea Monitoring Guideline: Phytoplankton",2014	Floristic composition, abundance, biomass, morpho functional parameters	Two time per month	• Monitoring site • Project based site selection	About 50-80 samples per year	Correspond to WFD and MFSD

Method	Parameter/s	Interval	Site type • Monitoring site • Reference site • Project based site selection	Number of samples	WFD compliance
Methods of study and method of measuring phytobenthic according to "Guidelines for Methods of Biological Analysis of Seawater and Bottom Deposits" "Black Sea Monitoring Guideline: Phytobenthos",2015	Floristic composition, biomass, morpho functional parameters (specific surface of population, index surface of phyto-senouses)	Monthly or one time in season	• Monitoring site • Reference site • Project based site selection	200-250 samples per year	Correspond to WFD and MFSD
Methods of study and methods of measuring zooplankton according to "Guides on methods of biological analysis of sea water and bottom sediments" "Black Sea Monitoring Guideline: Zooplankton",2014	Fauna composition, abundance, biomass	Monthly	• Monitoring site • Project based site selection	60-80 samples per year	Correspond to WFD and MFSD
Methods of study and methods of measuring zoobenthos "Guidelines for Methods of Biological Analysis of Seawater and Bottom Deposits" "Black Sea Monitoring Guideline: Zooplankton",2013	Fauna composition, abundance, biomass, size-age structure of population	Monthly or one time in season	• Monitoring site • Reference site • Project based site selection	100-150 samples per year	-

The evaluation of the different methods in terms of WFD-compliance has to be assessed together with the NAS Institute of Marine Biology Ukraine.

Ukrainian Scientific Centre of Ecology of the Sea (UkrSCES), Odesa

The Ukrainian Scientific Centre of Ecology of the Sea is involved in national (Institute for Marine Ecology, university) and international teamwork (e.g. trans-boundary projects with Romania focusing on the Danube, OSCE collaboration regarding the Dniester).

Table 7: Existing monitoring expertise of UkrSCES according to the questionnaire

Fields of expertise	Level of knowledge: trainee/experienced/advanced	Nr. of staff
Macroinvertebrates	experienced	2
Meiobenthos	experienced	1
Macrophytobenthos	experienced	2
Microphytobenthos	experienced	1
Phytoplancton	experienced	2
Mesozooplankton	experienced	2
Macrozooplankton	experienced	1
Chlorophyll and other pigments	experienced	1
Bioassay by mytilus larvae	experienced	1
Bioassay by microalgae	experienced	1
Mammals monitoring	experienced	2
Marine Litter	experienced	2
Comprehensive assessment methods	advanced	2

Twenty staff members are currently working on various parameters, including biological quality elements and there is expertise with regard to phytoplankton, macroinvertebrates, meiobenthos, microphytobenthos, makrozooplankton and chlorophyll a.

Table 8: Existing assessment methods of UkrSCES according to the questionnaire

Method	Parameter/s	Interval	Site type • Monitoring site • Reference site • Project based site selection	Number of samples (per year)	WFD compliance
1	2	3	4	5	6
Bottle sampling, light microscopy	Phytoplankton	once a week	Monitoring site	100	+
Bottle sampling, light microscopy	Phytoplankton	spring, summer, autumn	Monitoring site – “hot spots”	18	+
Bottle sampling, light microscopy	Phytoplankton	spring, summer	Project based site selection	18-24 (4 stations)	+
Bottle sampling, light microscopy	Phytoplankton	once a year	Project based site selection	120	+
Net sampling, light microscopy	Phytoplankton	once a year	Project based site selection	12	+
Bottle sampling, spectrophotometric measurement	Phyto pigments	once a week	Monitoring site	100	+
Bottle sampling, spectrophotometric measurement	Phyto pigments	spring, summer, autumn	Monitoring site – “hot spots”	18	+
Bottle sampling, spectrophotometric measurement	Phyto pigments	spring, summer	Project based site selection	18-24 (4 stations)	+
Bottle sampling, in situ fluorescence, spectrophotometric measurement	Phyto pigments	once a year	Project based site selection	120	+
Satellite observations	Chlorophyll	daily	Monitoring site	360	+
Net sampling, light microscopy	Mesozooplankton	once a week	Monitoring site	100	+
Net sampling, light microscopy	Mesozooplankton	spring, summer, autumn	Monitoring site – “hot spots”	18	+
Net sampling, light microscopy	Mesozooplankton	spring, summer	Project based site selection	10 (4 stations)	+
Net sampling, light microscopy	Mesozooplankton	once a year	Project based site selection	70	+
Net sampling, visual observation	Macrozooplankton	once a year	Project based site selection	25	+
Benthic frame sampling, light microscopy	Macrozoobenthos	spring, summer, autumn	Monitoring site – “hot spots”	18	+
Benthic frame sampling, Van Veen grab sampling, light microscopy	Macrozoobenthos	spring, summer	Project based site selection	11	+

Method	Parameter/s	Interval	Site type • Monitoring site • Reference site • Project based site selection	Number of samples (per year)	WFD compliance
Van Veen grab sampling, light microscopy	Macrozoobenthos	once a year	Project based site selection	3	+
Benthic frame sampling, light microscopy	Meiobenthos	spring, summer, autumn	Monitoring site – “hot spots”	40	+
Benthic frame sampling, Van Veen grab sampling, light microscopy	Meiobenthos	spring, summer	Project based site selection	22	+
Van Veen grab sampling, light microscopy	Meiobenthos	once a year	Project based site selection	18	+
Bottle sampling, DNA extraction in the lab	Environmental DNA	once a year	Only Project based site selection	60	+
Net sampling, DNA extraction in the lab	Environmental DNA	once a year	Only Project based site selection	24	+
Van Veen grab sampling, DNA extraction in the lab	Environmental DNA	once a year	Only Project based site selection	12	+
Net sampling, light microscopy	Ichthyoplankton	spring, summer	Only Project based site selection	52	+
Benthic frame sampling, light microscopy	Macrophytobenthos	spring, summer, autumn	Monitoring site – “hot spots”	30	+
Benthic frame sampling, Van Veen grab sampling, light microscopy	Macrophytobenthos	spring, summer	Project based site selection	11	+
Van Veen grab sampling, light microscopy	Macrophytobenthos	once a year	Project based site selection	6	+
Benthic frame sampling, light microscopy	Microphytobenthos	spring, summer, autumn	Monitoring site – “hot spots”	18	+
Benthic frame sampling, Van Veen grab sampling, light microscopy	Microphytobenthos	spring, summer	Project based site selection	11	+
Van Veen grab sampling, light microscopy	Microphytobenthos	once a year	Project based site selection	6	+
Standardization methods of biotesting in laboratory cultures of marine and freshwater single-celled algae of different systematic groups	Biotesting by microalgae	4 per year	Monitoring site – “hot spots”	60	+
Bioassay on mussels larvae (Protocol for bivalve embryo bioassay. (Produced during the TACIS Bioligical Training Workshop, Ukraine, May 1999). – Odessa, 1999)	Bioassay by mytilus larvae (Normal and abnormal Trochophores (%); normal, abnormal and dead Prodissoconches (%))	2 per year	Monitoring site – “hot spots”	30	+

Method	Parameter/s	Interval	Site type • Monitoring site • Reference site • Project based site selection	Number of samples (per year)	WFD compliance
Program within the framework of the EMBLAS project	Marine Litter	2 per year	Project based site selection	beach areas and during the cruise	+
Visual monitoring and photo-identification	Marine mammals	2 per year	Monitoring site, Project based site selection	Shore stations and during the cruise	+
Additional comment	*Sampling and processing of usual hydrobiology samples are carried out according to Standard methods, 1998 and Standard methods, 2005*				

The evaluation of the different methods in terms of WFD-compliance has yet to be completed.

5.2.2 Activity 2.1.2 Purchase of equipment, including hydrological and water quality monitoring stations and rehabilitation and upgrade of existing equipment and existing laboratories

Final decisions on procurement are yet to be made, but lists of equipment needs were drafted in the questionnaires and will be assessed during procurement.

Institute of Hydrobiology of the National Academy of Sciences of Ukraine, Kyiv

The Institute of Hydrobiology of the National Academy of Sciences of Ukraine, Kyiv stated equipment needs in the questionnaire:

- Modern microscopes and binoculars with legal soft ware
- Modern pH-meters
- Modern Oximeters
- Modern Echo depth-sounders
- Modern Thermometers
- Distance finders for Macrophytes investigations
- Drone for Macrophytes investigations
- Inflatable boats
- Modern expeditionary bus for field survey

Central Geophysical Observatory, Kyiv

Table 9: List of equipment needs of Central Geophysical Observatory, Kyiv

Type		Specification	Pieces
Equipment	Microscopes	Stereoscopic microscope: 1 pieces with trino head, objective 0.7 … 4.5x	2
		Biological microscope: bino head, achromatic lens, magnification 40-1000x	1
	Laboratory fume hood		1
	Computers	Desktop computer: RAM 4GB, HDD 500GB, display resolution 1920 x 1080	1
		Notebook: RAM 4GB, HDD 500GB,	1
	Unionalls	Semioveralls waders (neopren)	2
Electronic identification keys	Phytoplankton/phytobenthos	Diatomea, Cyanophyta, Chlorophyta	
	Macrozoobenthos	Plecoptera, Ephemeroptera, Trichoptera, Coleoptera, Amphipoda	
Software	Omnidia	Perhaps something else for phytoplankton, macrozoobenthos	
Books, guidances	Atlases of the algae and water macroinvertabrates of Central Europe		
International standards	Necessary normative docs for carrying out hydrobiological monitoring in accordance with the requirements of the WFD		

Institute of Marine Biology of the NAS of Ukraine (IMB NAS UKRAINE), Odessa

IMB NAS stated equipment needs in the questionnaire:

- Microscope OlympusCKX53 – 1
- Resin for preparations Meltmount – 1
- Microscope Konus Infinity-3 – 1
- Binocular microscopes – 3
- Digital camera Sigeta UCMOS 3100 3,1 MP – 1
- Ultrasonic Cleaner Bath NT-285 30/50 watt – 1
- Epoch 2Microplate Spectrophotometer – 1
- Niskin bathometer, volume 5 L – 3
- Hand winch – 1
- Underwater video camera “Action” – 1
- Portable digital camera – 1
- Portable GPS for field work – 1
- Wetsuit for diving – 1
- Flow meter – 1
- Minibus for 12 people for coastal expeditions – 1
- Powerboat – 1

- Atomic Absorption Spectrophotometer Shimadzu AA-7000 – 1
- Chromatograph with the ability to determine fractions of petroleum (polyaromatic hydrocarbons) – 1
- Multicorer sampler for selection of marine sediments – 1
- Sea water sampling bottles, volume 20 L – 2
- Stationary thermostats with cooling for cultivation of test objects – 2
- Portable thermostats with cooling for cultivation of test objects – 5

Ukrainian Scientific Centre of Ecology of the Sea (UkrSCES), Odessa

UkrSCES stated equipment needs in the questionnaire:

- Stereomicroscope (Type of the microscope Upright; research class)
- Pump for determination of Chl
- Analytical scales, accurate to 0.0001

5.2.3 Activity 2.2.1 Preparation of training plans and organisation of hands-on trainings and training of trainers with regard to monitoring and laboratory analyses and to support laboratories for accreditation

The preliminary training plans for surface water monitoring will be based on a detailed assessment of the needs of the institutions responsible for surface water monitoring in the Ukraine. Individual training and field survey(s) will be developed within the framework of the EUWI+ project in order to attain maximum targeting on the needs of the Ukrainian administration. Training materials and the development of a surface water survey manual will be based on EPIRB manuals, which will be revised if necessary. Sampling training and field survey(s) will be carried out for various body monitoring parameters. The surveys will serve to validate conceptual understanding and gather the data necessary for the enabling of risk and status assessment. The exact content of training will also depend upon the equipment purchased or to be purchased under Activity 2.1.2. The fostering of exchanges of experience between administrations and the establishment of working relations on a technical level will be evaluated.

Initial regional workshops are planned in order to discuss the requirements of the WFD and develop a stepwise approach to implementation. Subsequently, individual training will be organised for the specific needs relating to the assessment of biological quality elements.

Institute of Hydrobiology of the National Academy of Sciences of Ukraine, Kyiv

The Institute of Hydrobiology of the National Academy of Sciences of Ukraine, Kyivyiv stated training needs in the questionnaire:

- Training Workshop «Ecological Status/Potential Determination: EU and Ukrainian Experience» (May, June 2018)
- Training Workshop «Procedure of Ecological Status/Potential Determination in the Basins of Heavily modified and artificial water bodies» (September, October 2018)

Central Geophysical Observatory, Kyiv

CGO stated training needs in the questionnaire:**Kyiv**

- Field surveys
  - selection of sampling sites on appointed water massive;
  - practical sampling determined biological quality elements;
  - sampling on various types of water massives: large rivers, lakes, artificial (reservoirs), transitional waters;
  - primary samples processing (field and laboratory)
- Training in the pilot project in creating a practical network monitoring of the appointed water massive
- Work in a software environment (Asterics, Omnidia etc)
- Identification course on Plecoptera, Amphipoda, Coleoptera, Diatomaea
- Ecological status identification

Institute of Marine Biology of the NAS of Ukraine (IMB NAS UKRAINE), Odessa

IMB NAS stated training needs in the questionnaire:

- Methods identification of water bottom habitats.
- Integral methods for determination the ecological status class of aquatic ecosystems by biological indicators in accordance with the standards of the Water Frame Directive and the Marine Strategy.
- Adaptation of IUCN criteria for protected species to the hydrobionts of the Ukrainian sector of the Black and Azov Seas.

Ukrainian Scientific Centre of Ecology of the Sea (UkrSCES), Odessa

UkrSCES stated training needs in the questionnaire:

- Sampling and identification of organisms-indicators of planktonic organisms
- Sampling and identification of organisms-indicators of benthic organisms

5.2.4 Activity 2.3.1 Assessment of the needs and identification of priorities in implementation of the RBMPs

During the EPIRB project, initial SWB delineation exercises were carried out in the Upper Dnipro and Prut basins. Further SWB delineation according to system A of the WFD will be completed for the whole Dnipro River.

As already mentioned under Activity 2.1.1, the legislative basis, administrative responsibilities and water management organisation and monitoring are currently being restructured in a move towards WFD compliance. The preparation of the legal basis on GW delineation and monitoring is being supported by the APENA project and EUWI+ provided substantial comments and input regarding methodologies.

5.2.5 Activity 2.3.2 Technical Support in the elaboration and implementation of the pilot RBMPs

This activity focuses on the development of a first generation RBMP for the Dnipro basin.

A clear and pragmatic step-by-step approach (manual) similar to that used for GW will be implemented for SW, SWB characterisation and delineation, and the development of the design of monitoring networks (based on existing CIS and EPIRB guidance). This procedure will include a draft template for SWB characterisation (based on the EPIRB Water Body at Risk Report and EU and AT experience) and a template for the characterisation of monitoring sites (based on EU and AT experience). These documents and templates will form a basis for further tailoring and national adaptation during the implementation process. For further details see the SW roadmap for Ukraine in chapter 7.2.

The UBA SW team provides input on the important aspects requiring consideration when identifying and delineating surface water bodies. Ukrainian experts will draw up a preliminary list of relevant pressures with the support by the UBA SW team. The resulting draft list of SW-relevant pressures will then be used by the IOW to collect data under Activity 2.3.6. Subsequently, a draft list of indicator parameters and monitoring frequencies related to these relevant pressures will be compiled.

6 RELATED ISSUES

6.1 Legal and institutional reform

Ukraine started the implementation of the EU-UA Association Agreement on 27 June 2014 and has ten years to implement its obligations. Annex 30 of the Agreement lists 29 directives and 8 sectors. The GW Directive is not on the list, but will be considered. As compared to the current situation in Ukraine, GW monitoring and management in the WFD have a different logic. Therefore, the current legislation is being amended at present along with the administrative responsibilities, in order to ensure that the right tools are available in Ukraine.

There is a general action plan for the implementation of the Association Agreement available on the web portal of the Ukrainian government: www.kmu.gov.ua. Each responsible ministry has developed an implementation plan (29 plans for 29 directives) and the amendment of the National Water Code was adopted by Order № 3603 (04.10.2016). Its preparation took two years and numerous new terms were introduced, e.g.: groundwater body, status of water bodies, River Basin Management Plan, responsibilities). On 21 August 2017, a final major amendment to the regulation occurred, which provided the implementation plan:

- Nine RBDs (five are trans-boundary) – 13 sub-basins.
- A list of pollutants was adopted to identify the water status of surface water bodies and GWBs.
- Basin management authorities are attached to the State Water Agency. They will develop the RBMPs and control implementation.
- The Trans-boundary Commission between the UA and the MD was established and controls implementation. Agreed RBMP needs to be developed.

Furthermore, several legal acts and resolutions have been prepared by the APENA project and are awaiting approval. These include, e.g.

- MENR Order #23 from 26 January 2017 “On Identification of Sub-Basins and Water Management Units within the Established River Basin Districts” registered by the MOJ and published on the parliament web portal
- MENR Order “On Delineation of River Basin Districts, Sub-Basins and Water Management Units” (approx. 450 pages!) submitted for approval by the MENR; 2017
- MENR Order #45 from 6 February 2017 “On Approving the List of Priority Substances” registered by the MOJ and published on the parliament web portal
- MENR Order #25 from 26 January 2017 “On Approving the Model Regulation on River Basin Councils” registered by the MOJ and published on the parliament web portal
- Resolution “On Approving the Procedure for the Development of River Basin Management Plans”; 2017
- Draft Order of the MENR “On the approval of the methodology of identification of surface and groundwater bodies”; (ongoing)
- Draft resolution of the Ukrainian cabinet regarding a new national water monitoring system (ongoing)

6.2 Institutional sustainability of selected institutions

With the new state water resource monitoring system, Ukraine has established a strategic framework and a legal and financial basis for progress towards national, WFD-compliant water quality monitoring that includes the redefinition and redistribution of competences and responsibilities.

Particularly with regard to the development of a monitoring network for ground- and surface waters Ukraine has to face many challenges and there is a long way to go before the full technical capacities in the responsible laboratories as required by the WFD can be established. A step-by-step approach aimed at enhancing the technical capacities of selected laboratories could be a solution for the reaching of a full technical capability in the mid- to long-term.

Following on from the organisational basis (set-up of the monitoring already elaborated upon in legislation), more detail needs to be provided on the baseline capacity of the existing system to implement WFD using existing delineation methodology. This will include further ground-truthing assessments of the laboratories and their capacity on the basin and sub-basin levels. Assuming a minimum monitoring WFD programme to be in place within the next ten years, depending upon the delineation methodology and the costs of capital, maintenance and operations, the scale of the system can be established. Once this has been determined, shortfalls can be defined through a comparison of current and planned funding. Should any exist, the strategy and phasing-in of the strategy could be extended over a longer period, or additional funding maybe sought. The work involved in drawing up a WFD-compliant representative monitoring programme, could be undertaken as part of the first generation RBMP for the Dnipro and as a first step for both GW and SW by the project team experts.

7 NEXT STEPS

7.1 Linkage with laboratory assessment

The identification of the significant anthropogenic pressures on water goes hand-in-hand with the identification of the associated chemical substances and indicators, which should be part of the monitoring system. Precise adjustment in line with Activity 2.1.2 in terms of laboratory needs and capacities is recognised as a guarantee that these substances can be analysed in the relevant laboratories.

7.2 Programming

7.2.1 Groundwater programming

A clear and pragmatic step-by-step procedure on how to identify aquifers, delineate GWBs and design monitoring networks is currently under development.

If considered necessary by the member state consortium and the Ukrainian administration, a groundwater survey might be organised during the summer of 2018 in order to fill the gaps in the baseline data required for further steps in the RBMP process.

A regional workshop on the principle requirements of the WFD could be organised jointly for the Ukrainian institutions working on ground- and surface water.

See below for the groundwater roadmap for Ukraine.

Table 10: Groundwater roadmap for Ukraine

	Implementation steps	Ukrainian experts	MS-consortium	Timing (Location)
1.	**Preparatory (home) work** by MS consortium experts: • A clear and pragmatic **stepwise procedure** (terms of reference) on how to identify aquifers, **delineate GWBs** and design **monitoring** networks (based on existing CIS and EPIRB guidance). This document will be based on the draft order of the MENR on the methodology of the identification of surface and groundwater bodies. This order is due for acceptance in January/February 2018 (submitted and discussed in the SAWR working group). • The stepwise procedure also includes a draft template for GWB characterisation (based on the EPIRB Water Body at Risk Report and EU and AT experience) and a template for the characterisation of monitoring sites (based on EU and AT experience).		UBA (ToR)	
2.	**Discussion** of the stepwise procedure (per email) as an initial step was already taken by the APENA workshop.	Name/ institute	UBA	
3.	**Preparatory (home) work** by country experts: ***Groundwater bodies*** a. First draft **delineation** of the GWBs following the stepwise procedure (in map 1:200,000): I. Compilation of hydrogeological information (maps, profiles…). II. Selection of aquifers of relevance from a WFD perspective (used, intended to be used, linked to ecosystems). III. Compilation of available pressure information (maps, inventories). b. Compilation of a draft **list of** GW-relevant **pressures** for each GWB (that should be considered by IOW for data collection). ***Monitoring*** a. **Inventory** of existing monitoring **sites** and existing wells/springs, which could be potentially used as monitoring sites (consider multipurpose use). b. First draft monitoring **network** for each GWB in line with the principles of the step-by-step procedure. c. Compilation of a draft **list of** (chemical) indicator **parameters** related to the relevant pressures and monitoring frequencies. Documentation of the applied methodology and considered information (extension and tailoring of the 'step-by-step procedure', inclusion of references and literature).	Name/ institute		
4.	**1st workshop** with a focus on: ***Groundwater bodies*** a. Discussion of draft GWBs and hands-on revision. b. Presentation and discussion of the characterisation template and the structure of the 'verbal' description of GWBs. c. Discussion/finalisation of the list of identified GW-relevant human pressures. ***Monitoring*** a. Discussion of draft monitoring networks and hands-on revision. b. Presentation and discussion of the characterisation template for monitoring sites. c. Discussion/finalisation of monitoring frequency and relevant (chemical) indicator parameters. d. Discussion of investment needs (e.g. new sites and those to be refurbished, additional infrastructure and sampling equipment). e. Planning of sampling training and potential surveys.	Name/ institute	UBA	

	Implementation steps	Ukrainian experts	MS-consortium	Timing (Location)
5.	**Preparatory (home) work** by country experts: ***Groundwater bodies*** a. Revision of GWB delineation according to the conclusions of the workshop. Inclusion in GIS. b. Modification of the GWB template and the description structure to national needs in accordance with the conclusions of the workshop. c. Characterisation of each GWB according to the template and the description structure ***Monitoring*** a. Revision of monitoring networks for each GWB, based on the conclusions of the workshop. Inclusion in GIS. b. Adjustment of the monitoring site template to national needs according to the conclusions of the workshop. c. Characterisation of the monitoring sites according to the template. d. Elaboration of investment need specifications (e.g. new sites and those to be refurbished, additional infrastructure and sampling equipment). Documentation of the applied methodology and considered information (extension and tailoring of the 'step-by-step procedure', inclusion of references and literature).	Name/ institute		
6.	**Preparatory (home) work** by MS consortium experts: a. Training material on sampling (if necessary update of the EPIRB manual with UA examples). b. Survey manual		UBA	
7.	**2nd workshop** Depending upon the progress made between the workshops, the following activities could either be finalised, or progress and open questions discussed further: ***Groundwater bodies*** a. Further discussion and hands-on training/finalisation of GWB delineation. b. Further discussion and hands-on training/finalisation of GWB characterisation (template and description). ***Monitoring*** a. Further discussion and hands-on training/finalisation of monitoring network. b. Further discussion and hands-on training/finalisation of monitoring site the characterisation (template). c. Further discussion/finalisation of investment needs including specifications.	Name/ institute	UBA	
8.	**Preparatory (home) work** by country experts. Depending on the progress made thus far: ***Groundwater bodies*** a. Completion of GWB delineation. b. Completion of GWB characterisation (templates and description). ***Monitoring*** a. Completion of monitoring network design. b. Completion of monitoring site characterisation. c. Completion of investment need specifications. Documentation of the applied methodology and considered information (extension and tailoring of the 'step-by-step procedure', inclusion of references and literature).	Name/ institute		

	Implementation steps	Ukrainian experts	MS-consortium	Timing (Location)
8.	**3rd workshop –** focus depends upon the progress made thus far: ***Groundwater bodies*** a. Finalisation of GWB delineation. b. Finalisation of GWB characterisation. ***Monitoring*** a. Finalisation of the monitoring network. b. Finalisation of monitoring site characterisation. c. Finalisation of investment needs and specifications.	Name/ institute	UBA	
10.	Theoretical and practical **training** on sampling (e.g. in close harmony with field survey(s)).	Name/ institute	UBA	

	The document regarding the step-by-step implementation procedure is a living document, which is continuously being supplemented with UA details and the literature used in order to finally achieve tailored UA guidance.	Name/ institute	UBA	

7.2.2 Surface water programming

In accordance to the step-by-step approach of the WFD, the implementation of the following activities is planned for 2018 and 2019.

Training can be incorporated into surface water surveys. The goal is to ensure standardised sampling techniques and data collection as a basis for all monitoring activities. In order to maximise the outcome, fieldwork will aim at the generation of valuable survey data and thus fill in the gaps in the baseline data required for further steps in the RBMP process.

Table 11: Surface water roadmap for Ukraine

	Implementation steps	Ukrainian experts	MS-consortium	Timing (Location)
1.	**Preparatory (home) work** by MS consortium experts: • Assessment of the status quo: EPIRB documents regarding characterisation, typology and surface water body delineation • ToR for SW water body delineation • Review of existing characterisation, typology and surface water body delineation • Organisation and logistics of regional workshops		UBA	
2.	**Delineation workshop** **One joint workshop covering water body delineation is planned** Characterisation, typology and surface water body delineation a. Background and principles b. Review of existing data/documents c. Presentation of examples	Name/ institute	UBA	25 – 26 April 2018 Kyiv
3.	**Preparatory (home) work** by country experts: **Presentation of Water Framework Directive implementation**/compliance steps containing information on: a. Pre-existing water body delineation b. Selection of biological quality elements c. Monitoring site selection d. Pressure impact relation	Name/ institute		

	Implementation steps	Ukrainian experts	MS-consortium	Timing (Location)
4.	**Regional workshops** A regional workshop is planned for the Caucasus region, AZ, GE & AM, focusing on: a. Assessment systems I. Biological quality elements II. Standardised sampling and indication potential b. Monitoring network I. Monitoring network design II. Site selection III. Sampling frequency **Interactive hands-on training** a. Risk assessment and pressure impact relationships I. Presentation of the selected case study and general discussion II. Two working groups for biological quality elements and hydromorphology possible	Name/ institute	UBA	14 – 18 May 2018
5.	**Sharing workshop outputs with French team** a. Preliminary risk assessment b. Preliminary SW WB delineation		UBA/IOW	
6.	**Evaluation of equipment list** a. Preparation of procurement b. Confirmation of equipment list by countries		UBA	

8 STRATEGIC OUTLOOK AND RECOMMENDATIONS

The State Geological Service, the State Informational Geological Fund and the UBA GW team will discuss and agree a groundwater roadmap for Ukraine. The steps foreseen in this roadmap will then be implemented jointly, with ownership of the process lying with the Ukrainian administration, and the UBA GW team providing support. The involvement of significant numbers of junior staff in the exercises and training is highly recommended in order to facilitate the long-term transfer of hydrogeology and groundwater management knowledge. The gathering of such specific knowledge usually takes many years and intensive practice and forms the basis for sustainable groundwater management, environmental protection and water supply security in the future.

This step-by-step procedure owned by the Ukrainian administration will ensure positive results, while adhering to the concept of institutional sustainability, i.e. the development of capacity within Ukraine's administration, which will enable it to continue along the path of approximation to the WFD and the principles of IWRM. It is recognised that the EUWI+ project will represent a first and important step in this direction, but that additional external support might be required at later stages of this approximation process.

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