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Assistance for Bosnia & Herzegovina on WFD Compliant Monitoring – Towards WFD compliant Monitoring in BiH

Final Report

UNDP GEF

WORKING FOR THE DANUBE AND ITS PEOPLE

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DANUBE
REGIONAL
PROJECT

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1. SUMMARY

The purpose of this assignment was to draft a way forward for the entire process towards WFD compliant monitoring in BiH. Monitoring is not regarded as an isolated issue, links to and synergies with other aspects of WFD implementation have been emphasised.

This document proposes a **general strategy in chapter 1**, describes **technical and managerial details for 9 main lines of activity in chapter 1** and **visualises the time schedule and interrelations in chapter 0**. Annexes provide additional material and earlier documents.

The document shall constitute a common basis for all involved administrative bodies. It is meant as a starting point, open for amendments and improvements during the implementation process. Further development could lead to a national guidance paper on monitoring which serves as a tool for harmonisation, training and knowledge management.

The general strategy

The general strategy in chapter 1 lists and justifies the following 5 general recommendations:

- Emphasising surveillance monitoring in the first years
- Stepwise development/refinement of operational monitoring
- Parallel and synergistic development of typology, national BQE methods and intercalibration (deviation from the general WFD time plan)
- Intensive exchange of experience with EU-MS especially with regard to transferable rules for monitoring design and for developing WFD compliant assessment methods
- Intensive exchange of experience and cooperation on the Sava level especially with regard to harmonising methodologies and sharing of international stations along the big rivers.

Main Activities

For each of the nine main activities a general description, implementation steps and interrelations between these activities are given. 4 out of these 9 activities have been selected by the beneficiaries for discussion during the first workshop. The consensus has been presented at the workshop on Feb 28. This refers to

- Intercalibration and Monitoring (see chapter 4.5)
- Hydromorphology and Monitoring (see chapter 4.3)
- River Typology and Monitoring (see chapter 4.6)
- Strategies, Synergies and options for the assessment of ecological status (no separate chapter, this topic has been integrated in other topics)

The topic ‘development of national methods for BQEs’ - though not selected by the beneficiaries - has also been discussed and developed during the workshop (see chapter 4.2).

The remaining activities have been integrated in this document in order to provide a complete picture of upcoming tasks. These topics are:

- Analytical methods, QA/QC for chemical quality (see chapter 4.4)
- Automated monitoring stations (see chapter 4.7)

- Monitoring general physico-chemical determinants (see chapter 4.8)
- Monitoring database (see chapter 4.9)
- Improving pressure related information (see chapter 4.10)

Schedule / Roadmap

The roadmap displays how the objective of 'WFD compliant monitoring' could be reached until 2009 and visualises interrelations between activities and whether they are part of operational or surveillance monitoring. A further step could include an estimate for required person days for each activity.

2. INTRODUCTION

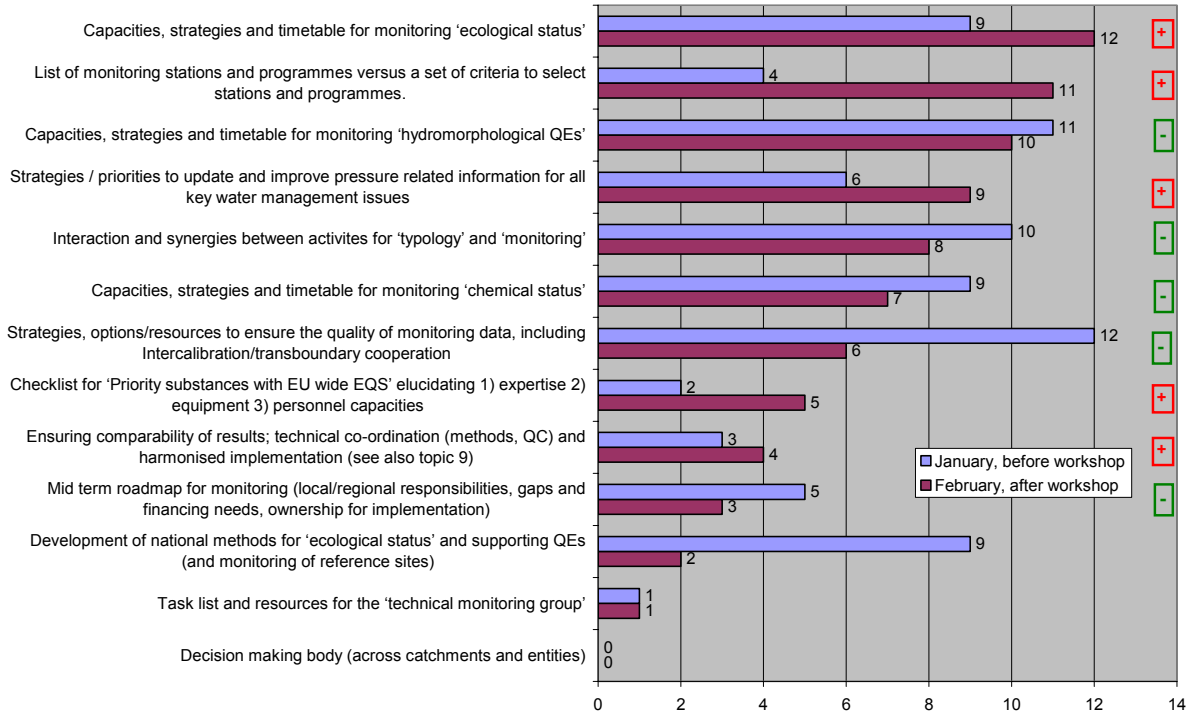
This document is the final report of the UNDP/GEF project "Assistance for BiH on WFD compliant Monitoring" and it builds on previous papers that have been distributed within the frame of the project "Assistance for BiH on WFD compliant Monitoring". These documents are:

- **Questionnaire V_2.doc**, discussion document dealing with 13 monitoring issues, 9 pages (has been integrated into Annex VII page 52)
- **WFD compliant monitoring part_I** - Power point presentation (see Annex VI page 48
- **Workshop_I_sent**, refined discussion document dealing with 13 monitoring issues, 18 pages (see Annex VII page 52)
- **Workshop_results_1**, Recommendations on selected aspects of WFD compliant monitoring, 9 pages (see Annex V page 38)

The contents of these documents are partly overlapping. Contents of earlier documents have been integrated in later versions in order to make the development and the reasoning behind transparent. The documents represent the whole consultation and stepwise refinement process.

The contents of the documents are the result of consultations and workshops with the beneficiaries. Some topics have been selected by the beneficiaries for detailed discussions.

The direct effect of this project is represented by the graph below. The graph shows how the beneficiaries have ranked the importance of 13 topics before and after the workshop on Feb 28. It is obvious that the perceived importance of some topics has considerably changed.



Further this document takes the results of the CARDS RBM project into account. The most relevant results for Monitoring are the technical reports 3a - d.

3. PROPOSAL FOR A GENERAL STRATEGY

This proposal aims at capitalising on the opportunities that are given by the specific state and situation of BiH with respect to WFD implementation. While the objectives and technical results shall comply with the WFD a deviation from the time schedule and order of activities can help to use synergies and speed up the process.

The proposal for a general strategy is based on an analysis of the existing situation which was subject of numerous meetings with representatives of BiH institutions and on the discussions during the workshops on Feb 8 and on Feb 28 2007. It tries to synthesise technical needs and legal obligations in an optimal way.

The overall aim of the strategy is to have a fully WFD compliant and efficient monitoring system by 2009. Efficiency will be reached by maximising the synergies with other aspects of WFD implementation in BiH and with other actors on the regional, national and supranational level.

The strategy and the proposed activities are built on generic considerations about monitoring:

- Monitoring will have clear consequences in terms of measures that need to taken. Flawed data and high uncertainties compromise the cost effectiveness of the programme of measures. The cost dimensions even of proactive monitoring are negligible as compared to the costs of measures.
- WFD compliant monitoring does not address impacted water bodies only but needs to establish the (overall)status of all water bodies within (sub)catchments/territories.
- The concept of ecological status requires that traditionally separated disciplines (and measurement networks) like e.g. Hydrobiology, Hydrology, Chemistry need to be coordinated and streamlined. Thus monitoring has become an interdisciplinary issue.
- Monitoring network design is understood as a continuous (and maybe rule based) process, accompanying the respective, relevant water management issues. Entirely static networks are neither effective nor informative.
- Comparability of status assessments largely depend on the positioning of stations relative to the position, type and extent of pressures. A consistent and harmonised approach to the delineation of 'allowable zones of impact' is fundamental.
- Long term monitoring of trivial phenomena and e.g. pressure-impact relations is not informative and thus not cost-efficient. E.g. monitoring very large or very small point source pressures will yield very predictable results and no added value for the water manager.(see also chapter 0 page 44)

The proposal for general strategy considers the current status of development of the different WFD modules (see chapter 1) that are needed for the establishment of a fully WFD compliant monitoring network.

The general strategy is based on the following cornerstones:

1. **Focus on surveillance monitoring in the first years.**
   Justification:
   - Surveillance sites are important on the bilateral and international scale
   - Surveillance monitoring does not need detailed information about pressures. It can be designed without detailed pressure impact analysis at water body level.
   - The parameter range is predefined (except PS and OS)

- Surveillance monitoring does not require at first the delineation of water bodies (an exercise that is not yet completed in BiH)
- Surveillance monitoring and development of national assessment methods for biological quality elements have numerous synergies. Both can be addressed in parallel.
- Surveillance sites are usually less costly than operational sites
- Surveillance monitoring can be implemented stepwise during a water management cycle.

2. **Stepwise development of operational monitoring.**
   Justification:
   - Operational monitoring is flexible and can be focused on the state of development of the Article 5 reports in terms of
     - Pressures that are already covered
     - Catchment scales (from 4000km^2 to smaller scales)
   - Dominant pressures organic point source pollution may be covered first because
     - Information about pressures from municipal and industrial point sources is already existing (, though without link to water bodies)
     - Essential parts of the required assessment methods (saprobic index delineated from benthic macroinvertebrates) are already existing
3. **Parallel development and maximising the synergies** (mainly by provident selection of sites) between monitoring and the development of
   - typology, especially the establishment of type specific references
   - national methods for BQEs,
   - data sets for intercalibration purposes
4. **Capitalising on experiences from countries** that have already
   - implemented WFD compliant networks especially with respect to
     - grouping similar water bodies for operational monitoring
     - selection of parameters indicative for the respective pressures
     - rules for the location of monitoring sites in relation to the pressures (considerations concerning the 'allowable zone of impact')
     - approaches for the selection of priority and other substances that need to be monitored
   - developed WFD compliant assessment methods
     - by adopting the same sampling methods

   Justification: Many aspects do not need local knowledge and do not depend upon the national legislation, thus they are transferable and universally applicable. A proper separation of local/regional and general aspects helps to avoid unnecessary double-work. Further, many approaches of EU-MS have already been checked for WFD compliance.
5. **Collaboration on the Sava catchment scale for issues which need local knowledge and input**
   - Development of WFD compliant methods for large rivers (Sava, Drjina)
   - Methodological approach to typology and hydromorphology
   - Coordinating and sharing international monitoring sites for efficiency, quality control and mutual learning

Justification: Irrespective of EU (accession) status, Sava countries share the same commitment for WFD implementation within the framework of Danube convention and ICPDR. It is an opportunity that important rivers constitute borders between Sava countries. Many other catchments are shared between two or more countries. Different methodological approaches at these rivers are inefficient and may compromise the objective of comparability. Shared stations and coordinated network designs at these rivers significantly reduce the rather high costs for international stations and they may help to share technical standards and improve the overall quality of monitoring.

4. MAIN ACTIVITIES

4.1.1.1. Fourth level heading

4.2. Monitoring and national methods for biological quality elements (BQEs) (see Gantt chart page 28 from 1.1.1.1 to 1.1.2.2)

4.2.1. Description and relevance

Biological quality elements are the core of WFD compliant monitoring of ecological status. The development of national methods or the adaptation of existing methods to the specific regional conditions is of utmost importance for comparability and consistency of water management at catchment scale. It should be kept in mind that the national BQE methods are not only a formal requirement but they are the new benchmark for almost all aspects of future water management (except the assessment of chemical status). Therefore, the development and continuous improvement of assessment methods needs specific attention.

BQEs should not be seen as an additional costly requirement but as a very efficient way to monitor the status of surface waters. Efficiency is rooted mainly in the integrative character of BQEs. BQEs integrate both, time and pressures while traditional grab samples represent only a certain property of the water at a certain time. In some cases BQEs also reflect the situation along a river stretch.

All BQEs are required for surveillance monitoring. In operational monitoring it is required to monitor the most indicative quality element for the respective pressure.

	rivers	lakes	Transi.	coastal	
Benthic Invertebrate Fauna	√	√	√	√	
Phytoplankton	√	√	√	√	
Macrophytes and Phytobenthos	√	√			
Fish Fauna	√	√	√		
Macroalgae			√	√	
Angiosperms			√	√	

There is a common understanding about the minimum criteria for WFD compliance. These criteria are either laid down in the directive or in CIS guidance papers. The ICPDR has presented a checklist for these minimum criteria (see ANNEX I)

The table on the left shows the BQEs that need to be assessed for different types of water resources.

Each BQE method can be divided I two steps:

- Sampling method
- Evaluation method

The sampling method is oriented towards representativity and does not need to be developed at the national level, whereas the evaluation method needs to account for the specific regional conditions (reference status, typology, …). Usually two sampling methods need to be adopted rivers, for large and for wadable rivers as well as for lakes.

4.2.2. Implementation steps

1. Decision about the sampling methods to be used (see Gantt chart on page 28 step 1.1.1.1) It is recommended to use commonly accepted well defined or standardised methods for sampling. Therefore, this step consists in screening the available methods and finding a consensus between the four agencies in BiH for the most appropriate.
2. Inventory of sites for the method development (see Gantt chart on page 28 step 1.1.1.2) The inventory of sites for the development of methods should include different combinations of

   2.1. status (I-V)

   2.2. pressures (first estimate: 3 chemical pressures (organic, nutrient, PS), 4-5 hydromorphological pressures (continuity, embankments and other morphological pressures, hydro-peaking, residual flow)

   2.3. river/lake types (first estimate: 5-10 rivers, <5 lakes)

   It can be concluded that the combination of 5 status classes with 7-8 different pressures and 10-15 surface water types would require more than dozens of sites. The selection of the most appropriate sites at a reasonable number will need to be based on expert judgement and should be a joint exercise of experts of all agencies in order to account for the different natural conditions in both entities (RS rather downstream and big rivers, Fed more small and upstream areas) and catchments (Danube, Mediterranean).
3. Adoption of species lists (see Gantt chart on page 28 step 1.1.1.3) There are minimum requirements for the number of species that need to be taken into account. With a view to

   3.1. upcoming intercalibration tasks,

   3.2. the long river stretches along the borders to Croatia and Serbia

   3.3. and the fact that all countries share the same ecoregion 5 (Dinaric-West-Balkan)

   it might be advantageous to share this task with the neighbouring countries.

   Duration: 2 months
4. Training of an appropriate number of experts for sampling (see Gantt chart on page 28 step 1.1.1.4)
   Each BQE requires specific sampling methods and sampling equipment.

   There are two possibilities for training. Either a separate team of experts will be trained for each BQE or one team of experts will be trained for all BQEs. While the first option helps to prioritise selected BQEs the latter would help to perform sampling campaigns in an efficient way and to develop all methods in parallel.
5. Sampling campaigns (see Gantt chart on page 28 step 1.1.1.5)
   Successful sampling needs to be properly planned in order to ensure comparability of the samples. Therefore sampling should take place in the most appropriate season (differs for different BQEs) and in comparable hydrologic and climatic conditions. Every external disturbance will increase the variability and "noise" in delineating the desired indices. One sample at each site will not be sufficient for the delineation of robust metrics. At least at some sites all biological quality elements should be assessed (e.g. at surveillance sites). Duration: depends on the number of sites for each BQE and on the respective BQE. A rough estimate is as follows:

   5.1. Benthic Invertebrate Fauna (BIF): 3 sites/day and sampling team

   5.2. Fish: 2 sites per day and sampling team (depends before all on the size of the river)

5.3. Macrophytes - Phytobenthos and Phytoplankton: 4 sites/day and sampling team

6. Development of the multimetric indices (see Gantt chart on page 28 step 1.1.1.6)
Hering, D., Feld, C.K., Moog, O. and Ofenbock, T., 2006. Cook book for the development of a Multimetric Index for biological condition of aquatic ecosystems: Experiences from the European AQEM and STAR projects and related initiatives. Hydrobiologia 566, 311-324.

4.2.3. Schedule

Due to the specific priority pressures in BiH, organic and nutrient pollution, it is an option to start the development of a method for Benthic Invertebrate Fauna (BIF) in 2007-2008 followed by Phytobenthos /plankton and fish metrics in 2008-2009.

With a view to the implementation steps which were listed above the first BIF samplings could start in autumn 2007 and be complemented by a second campaign in autumn 2008. The subsequent delineation of metrics could be finalised by the end of 2008. It has to be kept in mind that the delineation of an index for organic pollution is an easier task than other BIF based metrics e.g. general degradation or hydromorph. pressures as the latter require consistent data about pressures.

2007-2008: Benthic Invertebrate Fauna

2008-2009: Macrophytes & Phytobenthos, Phytoplankton and fish

4.2.4. Interrelations

For the development of BQE methods the typology needs to be completed including the delineation of reference conditions. Further a method for the prequalification of monitoring sites is needed.

Sites for the delineation of metrics can be shared with

- Typology
- Intercalibration
- Surveillance Monitoring

4.3. Monitoring and hydro-morphological quality elements (see Gantt chart page 28 from 1.2.1 to 1.2.4)

4.3.1. Description and relevance

Hydromorphological quality elements (HM-QEs) play an important role for the risk assessment and serve as a supporting parameter for ecological status. HM-QEs are an important input for the typology, the development of national methods for BQEs (see 4.2) and for cause effect relationships for hydromorphological pressures.

Countries which have not performed basic eco-morphological assessments and classifications for all rivers may consider to cover them within the monitoring system. Not as a supporting parameter for selected monitoring stations but to achieve the basic classification for typology etc. This aspect is mentioned within the HYMO Issue Paper as a gap of the current data basis.

There are various hydro-morphological quality elements but it would be important to target the effort specifically towards those required by the directive. These are

- Hydrological regime
    - quantity and dynamics of water flow
    - connection to groundwater bodies
- River continuity
- Morphological conditions
    - river depth and width variation
    - structure and substrate of the river bed
    - structure of the riparian zone

4.3.2. Implementation steps

While Hydrology is a continuous task, Morphology needs to be assessed only once during a RBM cycle.

During the workshop on Feb 8 in Sarajevo three strategic approaches were presented and one was recommended on Feb 28 during the second workshop. The hybrid approach defines a priori a mid term masterplan for hydrology but more important for morphology in terms of rivers/river stretches and methods and parameters. This masterplan guarantees consistency but it will be implemented stepwise based on a demand driven approach. The reasons for this recommendation are

- Harmonised methods
- Consistent data sets
- Financial burden distributed over several years

The following implementation steps are suggested (the list below includes all aspects, including those that are already finalised)

- Decision about methodology (see Gantt chart on page 28 step 1.2.1)
    - Morphology (done [1])
    - Hydrology
- Development of the masterplan (see Gantt chart on page 28 step 1.2.2)
- Training (see Gantt chart on page 28 step 1.2.3)
- Implementation (see Gantt chart on page 28 step 1.2.4)
    - Assessment of rivers with catchment > 2.500 km2
    - Assessment of rivers with catchment > 1000 km2
    - Assessment of rivers with catchments < 1000 km2

[1] During the workshop in Sarajevo on Feb 8 it was stated that there is already an agreement on the methodology for Morphological conditions and that only the decision for a method for Hydrology is missing.

4.3.3. Schedule

- Decision about methodology - 6.2007
- Training - 12.2007
- Rivers with catchment > 4000 km2 - 6.2008
- Rivers with catchment > 1000 km2 - 12.2008
- Rivers with catchments < 1000 km2 - 6.2009

4.3.4. Interrelations

The masterplan should account for the contributions of Hydromorphology to

- Pressure impact assessment
- Abiotic typology
- Delineation of pressure-impact relations (in the frame of validating and supplementing the risk assessment methodology)
- Ecological status assessment in the frame of surveillance and operational monitoring (of hymo pressures)

4.4. Development of analytical methods and interlaboratory comparison for the assessment of priority substances and other substances – chemical quality (see Gantt chart page 28 from 1.3.1 to 1.3.4)

4.4.1. Description and relevance

The Water framework directive together with decision 2455/2001 (list of 33 substances) and COM 2006_398 (EQS) and the QA/QC Commission decision establish the framework for assessing the chemical quality.

This topic has been addressed within the CARDS RBM project extensively and several processes and trainings have already started. Therefore the following is restricted to selected aspects that are pending and have not been part of the CARDS RBM project.

Monitoring of chemical quality can be very expensive. Therefore it was proposed to have two strategic approaches for the design of the network to monitor chemical quality:

- Probabilistic 'random' approach for site selection combined with deterministic approach for parameter selection – the surveillance approach
- Deterministic approach for sites and parameters – the operational approach

<u>Probabilistic approach:</u>

The probabilistic approach is considered as a 'search' strategy to complement the regular deterministic approach. The search is based on two criteria for selection of parameters and a random site selection. The criteria for determinant selection are considered to reflect the probability to detect a substance. These criteria are:

- 'Detectability', described as the ratio between the EQS and the LOD. Large numbers indicate 'easily detectable' and vice versa
- Degradability; a half quantitative criterion that describes whether a substance is refractory and shows conservative behaviour or whether t is rather easily degradable. Conservative substances need only limited sites while degradable substances need to be monitored in more locations or closer to the source.

This approach helps to reduce the determinant list in a target oriented transparent way. It is targeted at substances where the emission data are poor which is a weakness of the deterministic approach and possibly also at emerging substances not yet contained in the PS/OS lists.

Deterministic approach:

Due to the high analysis cost it is important to select the sites and parameters carefully. The directive requires to monitor PS where they are discharged into the subbasin and other substances where they are discharged in significant quantities. Thus, for a proper design of the monitoring network it is needed to know the following

- which PS are discharged
- where PS are discharged
- which other substances are discharged in which quantities

Further a criterion for the definition of the term 'significant quantity' is needed to design the monitoring of other substances.

As there is no comprehensive emission inventory available for all potential sources in BiH some suggestions were made.

- Adapt 'unit emission' approaches from other countries for diffuse agricultural and municipal point and diffuse sources
- Collect individual information on large industrial sources

The strategic approach towards a first emission inventory for priority substances and other relevant substances which was outlined above can be complemented by one monitoring campaign. This monitoring campaign has the objective to give an overview of the PS/OS situation even before the emission inventory and the method development is finalised. Such a campaign would be synergetic with the monitoring requirements of the TNMN network and complement it with information needed for the national level. The proposal is to complement the 5 international stations with 5-10 national surveillance sites. The determinant list should be identical with the TNMN list. The analysis would have to be performed by an external contractor as the BiH laboratories are not yet in the position to measure all determinants.

The data collected with such a one year campaign will help to

- Redesign the PS/OS programme for surveillance sites
- Validate the emission inventory
- Fulfil international commitments

The CARDS RBM project proposed a list of parameters that need to be developed and validated in the responsible laboratories in the country. This list is ranked according to analytical methods. Thus it reflects the laboratory perspective. A complementary approach could be based on the emission

inventory which was outlined above. This inventory could be used to rank the parameter development of priority of and other substances according to their importance.

The ranking of determinants will reveal how often a substance needs to be analysed. For rare substances the frequencies might be less than 10 analyses per year per laboratory. In the light of these frequencies it should be evaluated whether all methods for each and every determinant need to be developed and validated in all 4 relevant laboratories of BiH. Alternatively synergetic analytical capacities may be developed and contribute to the efficiency of the monitoring.

4.4.2. Implementation steps

- Design and implementation of the proposed PS/OS monitoring campaign by 2008 (see Gantt chart on page 28 steps 1.3.1.1-1.3.1.2)
- Probabilistic approach
    - Establish criteria 'detectability', degradability
    - Site selection
- Deterministic approach (see also Article 4 Com 397 (2006) final):
    - Collect 'unit emission' data from other countries
    - Inventory of relevant diffuse agricultural and municipal sources
    - Inventory of large industrial sources.
- Development and validation of methods and QA/QC scheme according to the proposals made by the CARDS RBM project (see Gantt chart on page 28 step 1.3.2)
    - Ranking of importance of priority substances and other substances with the help of a draft emission inventory based on 'unit emissions' adapted from other countries.
    - Re-grouping of determinants and adaptation of the time plan and deadlines according to the monitoring needs of the WFD
    - Stepwise integration of newly developed determinants into the ongoing monitoring programmes according to the proposal made by the CARDS RBM project.
- Development of the probabilistic approach (see Gantt chart on page 28 step 1.3.3)
- Development of the deterministic approach (see Gantt chart on page 28 step 1.3.4)

4.4.3. Schedule

- PS/OS monitoring campaign for international and 5-10 national surveillance sites - 1.2008
- Establishment of the probabilistic approach - 3.2008
- Establishment of the deterministic approach - 1.2009
- 2 phases for development/validation (analytical methods) - 1.2008
  - 1.2009

4.4.4. Interrelations

- An emission inventory like outlined above and in compliance with Article 4 of COM 397 (2006) for the purpose of chemical monitoring is also useful for the pressure – impact assessment for catchments smaller than 4.000km2.

4.5. Intercalibration and monitoring (see Gantt chart page 28 from 1.4.1 to 1.4.4)

4.5.1. Description and relevance

Comparability and consistency of monitoring results are one essential element of the quality of monitoring data. In general comparability and consistency have several dimensions:

1. over time
2. within (sub)catchments
3. across (sub)catchments
4. across administrative borders
5. across different assessment methods

Intercalibration (IC) deals with the comparability of classification results of high, good and moderate status of biological quality elements between countries (see bullet point 4 above). These classification results should correspond to comparable levels of ecosystem alteration. It should be kept in mind that a precondition for valid classification results is the availability of national assessment methods for BQEs.

4.5.2. Implementation steps

- Establishment of an intercalibration network. (see Gantt chart on page 28 step 1.4.1)
    - Covers sites that are of high, good and moderate status
    - Covers different types and pressures
    - Selection of sites may be based on expert judgement, no need for national BQE methods
- Participating in the geographical intercalibration group (GIG). It is a formal requirement, that national representatives are integrated in these group(s). (see Gantt chart on page 28 step 1.4.3)
- Application of national assessment methods at the IC-sites. This task can be done in parallel to the stepwise development of national assessment methods (see chapter 4). The proposed sequence is
    - Benthic macroinvertebrates (see Gantt chart on page 28 step 1.4.2.1)
        - Sampling
        - Evaluation of data, delineation of EQR (see Gantt chart on page 28 step 1.4.4.4)
    - Macrophytes & Phytobenthos, Phytoplankton and fish (see Gantt chart on page 28 step 1.4.2.2)
        - Sampling
        - Evaluation of data, delineation of EQR (see Gantt chart on page 28 step 1.4.4.4)

4.5.3. Schedule

- Intercalibration network by 6.2007
- Participation in GIG meetings scheduled for 2008
- Collection of data from the IC sites synchronised with the development of national BQE assessment methods
    - 2007-2008 benthic invertebrates
    - 2008-2009 other BQEs
- Data evaluation
    - 2008 benthic invertebrates
    - 2009 other BQEs

4.5.4. Interrelations

Typology (see chapter 4.6) and some pressure information (see chapter 4.10) is a precondition for the establishment of an IC-network

National assessment methods for BQEs (4) are required for the assessment of status at IC-sites

4.6. Typology and monitoring (see Gantt chart page 28 from 1.5.1 to 1.5.2.3)

4.6.1. Description and relevance

Typology is a precondition for water body delineation and no WFD compliant monitoring can be designed or implemented without water bodies. Although these tasks are designed as subsequent steps in the directive they have some common requirements which could be addressed at the same time in order to use synergies and speed up the process.

Typology and surveillance monitoring may share some sites (reference sites with a surveillance monitoring station). At these sites the assessment of all biological, hydromorphological and general-physico chemical quality elements is required and may be shared. A more detailed description of common requirements for monitoring and typology development is given under point 0 on page 61 (chapter 0 Annex V).

The most important criteria for the designation of surveillance monitoring sites do not include type-specific information. Thus, surveillance sites may be selected even before the abiotic typology is completed.

The most important criteria for the selection and grouping of operational monitoring sites do include type specific information. Operational monitoring relates specifically to water bodies at risk and the selection of sites may include grouping of similar water bodies. Typology is one criterium for grouping. Thus operational sites should better be selected after completion of the abiotic typology.

4.6.2. Implementation steps

Abiotic typology is currently being performed in BiH. Therefore the following focus on the delineation of reference conditions and the synergies of this exercise with monitoring tasks.

- Development/decision about methodology and optional factors (see Gantt chart on page 28 step 1.5.1)
- Delineation (and validation) of reference conditions for
    - biota, (see Gantt chart on page 28 step 1.5.2.1)
    - hydromorpological (see Gantt chart on page 28 step 1.5.2.2) and
    - general physico-chemical quality elements (see Gantt chart on page 28 step 1.5.2.3)

(overlap with surveillance monitoring of reference sites)

- Grouping of water bodies for the purpose of designing operational monitoring (see Gantt chart on page 28 step 1.5.3)
    - Delineation of water bodies based on abiotic typology
    - Grouping of water bodies based on river types
    - Subdivison of groups of operational sites according to identified pressures

4.6.3. Interrelations

Typology includes the delineation of type specific reference conditions for the development of WFD compliant assessment methods.

Typology is needed for the delineation of water bodies and for grouping of water bodies for the purpose of operational monitoring.

Typology and the delineation of type specific reference conditions is needed for the development of WFD compliant assessment methods.

4.7. Automated monitoring stations (see Gantt chart page 28 from 1.6.1 to 1.6.3)

4.7.1. Description and relevance

Independent from WFD implementation activities BiH has developed considerable resources for continuous monitoring. The main issue is to analyse whether these instruments can play a role within WFD compliant monitoring.

The inventory of automatic stations shows that there are different types of instruments with different parameter ranges. The following suggestions are made under the basic assumption that the right type of existing automatic station is applied for the respective purpose.

1. Continuous observation of a selection of the general physico chemical parameters and selected hydrological quality elements (quantity and dynamics of flow) which, however, needs to be complemented by manual sampling of e.g. nutrients which are not covered.
2. Backbone for alarm systems that need to be complemented by more sophisticated instruments in the future.

3. Investigative monitoring for the identification of polluters (point sources). Analysis of the time patterns of determinants indicative for the respective pollution type (e.g. oxygen depletion, conductivity, diurnial oxygen variation due to excess photosynthesis)
4. Observation of reference sites in order to complement the establishment of type specific reference conditions, to get a detailed assessment of the reference values for physico-chemical determinants.

4.7.2. Implementation steps

- Selection of the most appropriate sites
    - Establishment of criteria and list of sites that may meet the criteria (see Gantt chart on page 28 step 1.6.1.1)
    - Selection of sites according to established priorities (see Gantt chart on page 28 step 1.6.1.2)
- Establishment of a harmonised database for all instrument types and across administrative units. Issues for such a database are inter alia (see Gantt chart on page 28 step 1.6.2)
    - Consistent names and units for determinants
    - Consistent time intervals and synchronisation of instrument watches
    - Clearly defined metadata
    - Collection of missing metadata (rating curves for hydrologic profiles, coordinates,…)
- Development of data evaluation methods and conventions (e.g. standard graphs, aggregation levels,..) (see Gantt chart on page 28 step 1.6.3)

4.7.3. Interrelations

The concept for automated monitoring is directly linked with chapter 4.8 about monitoring general physico-chemical determinants.

4.8. Monitoring general physico-chemical parameters (see Gantt chart page 28 from 1.7.1 to 1.7.2)

4.8.1. Description and relevance

Legal basis:

Annex 5 WFD names the following as general physico-chemical quality elements in support of the biological elements:

- Transparency (lakes only)
- Acidification status (lakes only)
- Thermal conditions
- Oxygenation conditions
- Salinity
- Nutrient conditions (Annex 5 1.1.1), nutrient status (Annex 5 1.3.4)

The concrete interpretation of these parameters in terms of determinants, methods (and frequencies) is left open. E.g. which determinants are included in ‘nutrient conditions’? or

'oxygenation conditions' can not be assessed in a reasonable way by spot samples with a frequency of 4/y. If these general physico-chemical quality elements shall deliver meaningful information it is essential to develop a basic and consistent concept in terms of determinants, methods, frequencies etc.

There is only an explicit requirement to monitor 'all' general physico-chemical QEs within surveillance monitoring, though without further defining what is meant by the term 'all'.

Annex 2 and implicitly Annex 5 require the determination of type specific physico-chemical conditions at reference status. Also here no clear advice about determinants and frequencies is given.

Within operational monitoring general physico-chemical parameters may be included as supporting QE for biological QEs. The guidance on chemical monitoring (chapter 4.5.3) reconfirms this role.

Technical considerations:

General physico-chemical quality elements may contribute useful information as

- support for interpretation of biological assessments
- direct pressure indicators
- descriptors of type specific characteristics

In order to use this potential there is a need for developing an approach which differs considerably from the minimum legal requirements of the WFD. If such an approach is not developed it is better to restrict their assessment to the absolute minimum according to the legal requirements.

4.8.2. Implementation steps

The following list describes an approach to the assessment of general-physico-chemical determinants that is more comprehensive than the minimum requirements of the WFD.

- Development of a strategic approach including
    - Common understanding of the role of general physico-chemical determinants (see Gantt chart on page 28 step 1.7.1.)
        - Delineation of reference conditions (obligatory) and subsequent analysis of the discrimination power or significance of differences between different types of rivers/lakes. Such an exercise may either be based on
            - Independent grab samples i.e. delineation of statistical distributions of the respective determinants or on
            - Time series i.e. description of the dynamics and interrelations of the respective determinants
              It should be pointed out that flow measurements are a necessary to complement both approaches
        - Supporting quality elements within surveillance monitoring (obligatory) and operational monitoring (optional)
    - Concrete list of determinants to be included and corresponding frequencies and methods. As an example this list could take the following form
        - temperature, oxygen, conductivity, pH (and flow) with 'high' frequency based on
            - Spot samples at a certain time during the day or
            - Daily average values based on grab samples

- Diurnial variation based on continuous records (see also chapter 4.7)

- ‘Nutrients’ comprises: P: PO4 and total P, N: NH4, NO3 and total Nitrogen with monthly intervals
- Acidifcation comprises: pH and acid capacity
- Oxygenation conditions is understood as oxygen balance (consumption, reaeration) and comprises:
  - oxygen consumption (BOD, D(T)OC) with monthly intervals and
  - oxygen concentration (saturation)

- Methodology for data storage, metadata, data aggregation and evaluation. This could include the following issues:
  - Data base and interfaces to other formats and storage devices (e.g. data loggers, excel sheets, plain text tables, etc)
  - Metadata: Calibration protocols for electrochemic probes, Information about chemometric properties of methods, etc…
  - Data aggregation: arithmetic, flow weighed, boxcar or intermittent averaging, etc…

- Develoment of a concrete programme (see Gantt chart on page 28 step 1.7.2.): Sites and types of samples that should be covered by the enhanced programme for general physico-chemical determinants. Such a concrete programme could take the following form:
  - Obligatory requirements:
    - All surveillance sites with ‘all’ general physico-chemical determinants. A more detailed approach could differentiate the following:
      - ‘Normal’ surveillance sites (purpose: probabilistic assessment of the ‘overall status’) to be monitored for 1 year in a 6 years period
      - ‘Reference’ sites and sites for the assessment of the effects of ‘widespread anthropogenic uses’ to be monitored every second or every year for the first 6 year cycle (synergy between assessment of long-term natural trends and delineation/improvement of reference conditions for typology)
    - A selection of ‘reference sites’ if they are not surveillance sites
  - Additional options for an enhanced programme
    - Operational sites if delineation of ecological status of water bodies (possibly) at risk is the purpose
    - Operational sites if ‘chemical’ status is the purpose
    -

4.8.3. Interrelations

Delineation of type specific reference conditions (chapter 4.6)

4.8.4. Additional remarks

Some countries have decided to understand the general physico-chemical quality elements as fundamental for any sample. Therefore these quality elements are part of any biological or chemical assessment of water quality. Such an approach might be justified due to the marginal

cost of these parameters and due to the fact that they may be useful to continue time series as they have always been part of any water quality assessment.

4.9. Monitoring database (see Gantt chart page 28 from 1.8.1 to 1.8.5)

4.9.1. Description and relevance

The development and maintenance of an appropriate monitoring data base (and the corresponding user interfaces) is often considered to be less important than other elements of monitoring. Nevertheless it should be emphasised that the data base is the backbone for any data evaluation and reporting and an important tool to establish a consistent terminology. The development of a database requires considerable effort on the other hand it allows for significant savings in terms of time needed for data preparation, visualisation and reporting.

There is a commonly acknowledged need to adapt data storage and handling procedures to the needs of the WFD compliant water management, especially under the aspect of 'integration' of different disciplines and scales. Currently at different scales numerous databases and 'Water Information Systems' are under development. The European WISE system is complemented by information systems with river basin, national or sectoral (e.g. shipping) scales.

Thus a monitoring database has to be understood as part of a wider environment for water management, both, in terms of scaling as well as in terms of other aspects of water management (e.g. establishment of programmes of measures, risk assessment, reporting, etc.). It should be clear from the beginning that numerous interrelations between different systems need to be taken into account in order to capitalise on synergies and avoid double work. For example synergies or common issues are possible

- for all geographical aspects (common GIS / geographical reference basis)
- between Annex 2 and Annex 5 related to information about pressures and risk of failure to achieve good status
- typology and grouping of water bodies for operational monitoring
- and many more …

However, the core tasks of the monitoring database are:

- support the design and implementation of monitoring plans
- data entry, storage, aggregation, evaluation and visualisation of results
- integrate, replace or harmonise different former or still existing databases (e.g. hydrology, national/nternational water quality)
- allow for data queries and flexible filtering in order to optimise data accessibility
- reporting about the monitoring network design
- reporting about monitoring results as required
    - by national water act or
    - WFD Annex 5 chapter 1.4 for inland surface waters (and 2.2.4, 2.5. for groundwater) and
    - other international obligations (e.g. EIONET, TNMN, protected areas, etc ..)

4.9.2. Implementation steps

- Development of an appropriate data model (see Gantt chart on page 28 step 1.8.1.) based on
    - Existing data and metadata (e.g. from different administrative units)
    - Future needs according to national water act, WFD and other legal documents The data model might be visualised and discussed on the basis of an entity-relationship diagramme
- Decision about hardware architecture and responsibilities (e.g. distributed client server architecture, backup system, etc.) (see Gantt chart on page 28 step 1.8.2.)
- Development of system specifications in terms of (see Gantt chart on page 28 step 1.8.3.)
    - Interfaces and interoperability with other systems (e.g. DANUBE GIS, BiH database for automatic stations, WISE?)
    - User interface for data entry and data queries
    - Underlying geographical reference / GIS
    - Data preprocessing, evaluation and visualisation
        - Validation of data
        - Procedures or tools for plausibility assessment
        - Merging data from different subsystems, with different time and geographical scales, inter- extrapolation rules
        - Statistical procedures, aggregation, averaging and time series analysis and the corresponding graphs
        - …
- Coding, Programming either by internal experts or via tender procedure (see Gantt chart on page 28 step 1.8.4.)
- Training of responsible staff (see Gantt chart on page 28 step 1.8.5.)

4.9.3. Interrelations

Interrelations do exist with any other monitoring issue and with many other aspects of WFD implementation (e.g. impact assessment, intercalibration, programme of measures, ..). For every topic the data aspect has to be taken into account.

Therefore a timely establishment of the database is of crucial importance in order to avoid losses of data, information and thus performance.

4.10. Improving pressure related information (see Gantt chart page 28 from 1.9.1 to 1.9.4)

4.10.1. Description and relevance

Information about pressures is the basis for the design of operational monitoring and for investigative monitoring on specific issues. In the international context it supports the designation of TNMN surveillance type II stations.

Better information about pressures ensures a comprehensive and targeted approach to operational monitoring. As the currently available information is poor it was recommended to emphasise probabilistic surveillance monitoring and subsequently upgrade operational monitoring as soon as pressure information has been improved.

Further the establishment/planning of measures is largely based on detailed knowledge about pressures, while the monitoring is status or impact oriented and often does not contribute too much to the technical design of measures.

Information about pressures can be divided in two main aspects:

- Types and magnitude of pressures and their respective descriptors (e.g. height of an continuity interruption)
- Scales and timing of the the pressure assessment (e.g. 4000km^2 by 2006, 1000 km^2 by 2007, 100km^2 by 200x, 10km^2 by 20xx)

4.10.2. Implementation steps

- Establishment of a catalogue of pressures including e.g. (see Gantt chart on page 28 step 1.9.1)
    - Types of pressures
        - Hydrologic
            - Residual flow, Abstraction
            - Hydro-peaking
            - Rithralisation, Potamalisation
            - Disturbance of groundwater exchange
            - …
        - Morphologic
            - Sealing of
                - river bed
                - riparian zone
            - morphologic alteration of
                - slope
                - river width / depth
                - length
        - Pollution
            - Deagradable organic pollution (oxygen regime)
            - Deagradable nutrient pollution (oxygen depletion due to nitrification)
            - Nutrients as a local pressure with potential local eutrophication impact
            - Nutrients as pressures on larger scales with impacts on downstream water bodies and loads to the marine environment
            - Priority (hazardous) substance emissions
            - Emissions of other substances for which national EQS apply
            -

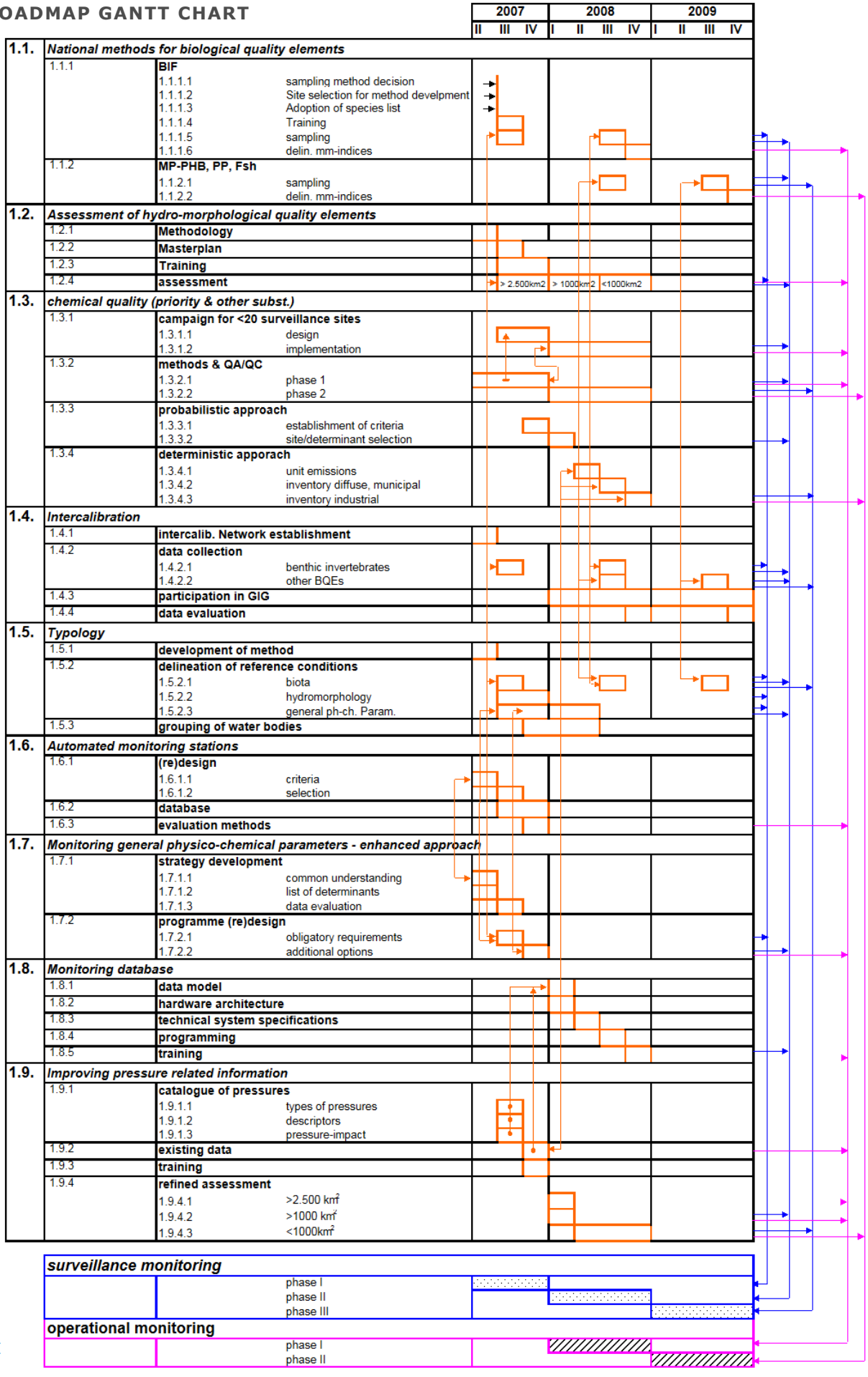
- Descriptors for the magnitude of the pressure
- Assessment of knowledge about pressure impact relations
  As many EU member states have already developed and applied their methodology for pressure assessments it is recommended to capitalise on this experience and concentrate on the adaptation to specific local conditions. An exchange with neighbouring countries could help to share the necessary effort for developing the catalogue and would help to foster comparability on the subbasin scale.

- Assessment of existing data followed by identification of gaps and strategies to close them (see Gantt chart on page 28 step 1.9.2)
- Training of experts for future, methodologically consistent pressure assessments (see Gantt chart on page 28 step 1.9.3)
- Implementation of a strategic plan e.g. in 3 steps for large, medium and small catchments (see Gantt chart on page 28 step 1.9.4)

4.10.3. Interrelations

Synergies with other aspects of WFD implementation concern mainly the pressure impact analysis and the emission inventories as described in Article Com 397/2006 'Inventory of emissions, discharges and losses'

ROADMAP GANTT CHART



ANNEX I – CHECK LIST OF WFD COMPLIANT BIOLOGICAL ASSESSMENT METHODS (PREPARED BY SEBASTIAN BIRK, FEB 2007, PROVIDED BY ICPDR)

The EU Water Framework Directive (WFD) stipulates to monitor the ecological status of surface waters using Biologicial Quality Elements (BQE). Quality classification is done by biological assessment methods meeting specific requirements. This document outlines the obligatory components of assessment methods complying with the demands of the WFD.

0. Check List

☒ *Consideration of certain BQE parameters.*
☒ *Ecological status assessment independent of pressures.*
☒ *'Ecological Quality Ratio' based on type specific reference values.*
☒ *5 classes of ecological quality.*
☒ *Good status boundaries derived from intercalibration.*
☒ *Worst BQE determines ecological status of water body (one out-all out).*
☒ *Classification includes measure of uncertainty.*

1. Indicative Parameters

For the different water categories (rivers, lakes, transitional and coastal waters) a certain set of BQEs has to be monitored[2]. Ecological status classification is based on particular **parameters indicative of the BQE**. The biological assessment methods must include all these indicative parameters in the classification of ecological status. In Table 1 indicative parameters are specified per surface water category and BQE.

[2] surveillance monitoring: all BQEs; operational monitoring: BQEs most sensitive to specific pressures

Table 1: Indicative parameters to be included in biological assessment methods for certain surface water categories and BQEs ([a] undesirable disturbance to the balance of organisms or water quality, [b] only lakes, [c] only Macroalgae)

Surface Water Category	Biological Quality Element	Taxonomic composition	Adundance	Ratio sensitive to insesitive taxa	Diversity	Age structure	Frequency and intesity of algal blooms	Secondary effects[a]	Bacterial tufts	Biomass	Absence of major taxonomic groups	Taxa indicative of pollution
Rivers and Lakes	Phytoplankton	x	x				x	x		x[b]		
	Macrophytes and Phytobenthos	x	x					x	x			
	Benthic invertebrate fauna	x	x	x	x						x	
	Fish fauna	x	x	x		x						
Transitional Waters	Phytoplankton	x	x				x	x		x		
	Macroalgae and Angiosperms	x	x					x[c]				
	Benthic invertebrate fauna		x	x	x							x
	Fish fauna	x	x	x								
Coastal Waters	Phytoplankton	x	x				x	x		x		
	Macroalgae und Angiosperms		x	x				x				
	Benthic invertebrate fauna		x	x	x							x

2. Ecological Quality Assessment, Ecological Quality Ratio and Classification

The WFD concept of **ecological status** requires an assessment independent of pressure. "Ecosystem health" has to be in the focus of biological monitoring. In practice, this can be achieved by using multimetric indices combining the results of several pressure specific indices. Multimetric indices provide multi-level outputs: The overall results appraise ecological quality, while single indices inform about causes of degradation. A "cook book" for the development of multimetric indices is provided by Hering et al. (2006)[3].

The biological assessment results need to be expressed using a numerical scale between zero and one, the '**Ecological Quality Ratio**' (EQR). The EQR value one represents (type specific) reference conditions and values close to zero bad ecological status (Figure 1).

[3] Hering, D., Feld, C.K., Moog, O. and Ofenbock, T., 2006. Cook book for the development of a Multimetric Index for biological condition of aquatic ecosystems: Experiences from the European AQEM and STAR projects and related initiatives. Hydrobiologia 566, 311-324.

Ecological quality is classified by one of five classes (high, good, moderate, poor and bad). To ensure comparability of the results of biological assessment methods the boundaries of the good ecological quality status are harmonised by the **intercalibration exercise**.

The WFD requires classification of water bodies at the level of the Quality Element. The worst of the relevant Quality Elements determines the final classification ("**One out, all out**" principle).

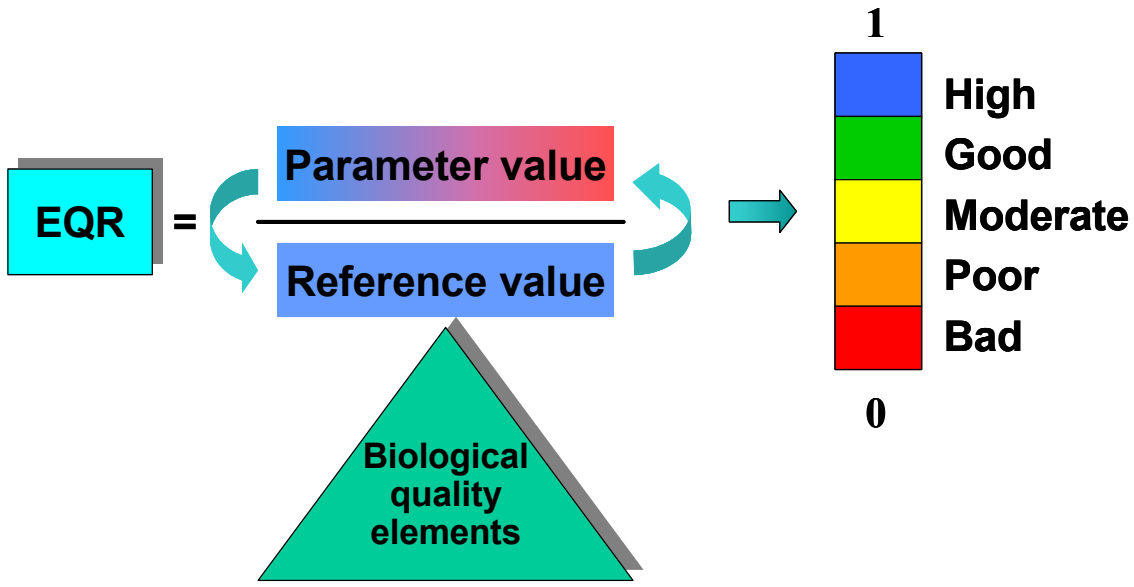


Figure 1: Graphical representation of the concept of the Ecological Quality Ratio (from van de Bund and Solimini, 2006[4])

4. Type specific reference conditions

The natural conditions of a surface water body type define the reference of ecological status assessment. Within types similar biotic communities are expected due to homogeneous environmental conditions. Type specific assessment reduces the natural variability and thus detects the anthropogenic influence on the biology more precisely. Therefore, surface water types shall reflect biotic types, and it may be necessary to establish different biotic typologies for the various BQEs. Channel substrate, for instance, is an important factor for macrozoobenthic communities. Water alkalinity is decisive for macrophytes and phytobenthos.

Type specific reference conditions can be derived by different methods:

- Investigation of *existing sites* that are not or only minimally influenced by human activity. General criteria for the selection of reference sites are given by the REFCOND guidance (CIS WG 2.3, 2003[5]), more specific criteria and threshold values have been elaborated within the intercalibation exercise (e.g. Olsauskyte and van de Bund, 2007[6]).

[4] van de Bund, W. and Solimini, A.G., 2006. Ecological Quality Ratios for ecological quality assessment in inland and marine waters. REBECCA Deliverable 10. JRC IES, Ispra. - http://www.rbm-toolbox.net/docstore/docs/3.0.Deliverable_D10.doc

[5] CIS WG 2.3, 2003. Guidance on establishing reference conditions and ecological status class boundaries for inland surface water. - http://www.minenv.gr/pinios/00/odhgia/7th_draft_refcond_final.pdf

[6] Olsauskyte, V. and van de Bund, W., 2007. WFD intercalibration technical report. Joint Research Centre, Ispra. - http://forum.europa.eu.int/Public/irc/jrc/jrc_eewai/library?l=/intercalibration_2&vm=detailed&sb=Title

- *Modelling* of reference conditions by prediction and historical data. Long-lasting, ubiquitous anthropogenic activity especially in European lowland areas limits the presence of existing reference sites. Knowledge about how indicative parameters react to human pressure enables prediction of parameter values at the absence of human influence. Historical records (e.g. old scientific literature, lake sediments, historical maps) dating from times of low industrial and agricultural intensity (usually end of 19th century and earlier) give information about natural conditions.
- Defintion of reference conditions by *expert judgment*. In this option information from a range of sources (e.g. monitoring data, relevant information on background levels) shall be used to confidently derive reference values for different Biological Quality Elements. This approach is onfy feasible if references cannot be established using existing sites or modelling.

4. Confidence and Precision

The use of ecological data in environmental monitoring and assessment bears various sources of **uncertainty** due to natural and/or methodological variability. The WFD demands an "adequate confidence and precision" of biological assessment methods to avoid misclassification of ecological status. Tools for the estimation of uncertainty are, for instance, given by Clark (2004)[7] and Brown and Heuvelink (2005)[8].

[7] Clark, R.T., 2004. Error/uncertainty module software STARBUGS. User manual. CEH, Dorchester. - http://www.ceh.ac.uk/products/software/software_starbugs.html

[8] Brown, J.D. and Heuvelink, G.B.M., 2005. Data Uncertainty Engine (DUE) - User's Manual. University of Amsterdam and Wageningen University and Research Centre, Amsterdam and Wageningen. - http://161.67.10.126/harmonirib/download/WP2/DUE_MANUAL_V3.0.pdf

ANNEX II – DETERMINANTS FOR TNMN SURVEILLANCE TYPE II SITES

	Surveillance Monitoring 2	
	Water	Water
	concentrations	load assessment
Parameter		
Flow	anually / 12 x per year	daily
Temperature	anually / 12 x per year	anually / 26 x per year
Transparency (1)	anually / 12 x per year	
Suspended Solids (5)	anually / 12 x per year	anually / 26 x per year
Dissolved Oxygen	anually / 12 x per year	
pH (5)	anually / 12 x per year	
Conductivity @ 20 °C (5)	anually / 12 x per year	
Alkalinity (5)	anually / 12 x per year	
Ammonium (NH_4^+-N) (5)	anually / 12 x per year	anually / 26 x per year
Nitrite (NO_2^--N)	anually / 12 x per year	anually / 26 x per year
Nitrate (NO_3^--N)	anually / 12 x per year	anually / 26 x per year
Organic Nitrogen	anually / 12 x per year	anually / 26 x per year
Total Nitrogen	anually / 12 x per year	anually / 26 x per year
Ortho-Phosphate (PO_4^{3-}-P) (2)	anually / 12 x per year	anually / 26 x per year
Total Phosphorus	anually / 12 x per year	anually / 26 x per year
Calcium (Ca^{2+}) (3, 4, 5)	anually / 12 x per year	
Magnesium (Mg^{2+}) (4, 5)	anually / 12 x per year	
Chloride (Cl^-)	anually / 12 x per year	
Atrazine	anually / 12 x per year	
Cadmium (6)	anually / 12 x per year	
Lindane	anually / 12 x per year	
Lead (6)	anually / 12 x per year	
Mercury (6)	anually / 12 x per year	
Nickel (6)	anually / 12 x per year	
Arsenic (6)	anually / 12 x per year	
Copper (6)	anually / 12 x per year	
Chromium (6)	anually / 12 x per year	
Zinc (6)	anually / 12 x per year	
p,p´-DDT and its derivatives (7)	anually / 1 or 12 x per year	
CODCr (5)	anually / 12 x per year	
CODMn (5)	anually / 12 x per year	
Dissolved Silica		anually / 26 x per year
BOD5	anually / 12 x	

ANNEX III – PRIORITY (HAZARDOUS) SUBSTANCE LIST (COM 397 (2006) FINAL)

PART A: Environmental Quality Standards (EQS) for Priority Substances in surface water

AA: annual average;

MAC: maximum allowable concentration.

Unit: [µg/l].

(1)	(2)	(3)	(4)	(5)	(6)	(7)
N°	**Name of substance**	**CAS number**	**AA-EQS[21]** **Inland surface waters**	**AA-EQS[21]** **Other surface waters**	**MAC- EQS [22]** **Inland surface waters**	**MAC-EQS[22]** **Other surface waters**
(1)	Alachlor	15972-60-8	0.3	0.3	0.7	0.7
(2)	Anthracene	120-12-7	0.1	0.1	0.4	0.4
(3)	Atrazine	1912-24-9	0.6	0.6	2.0	2.0
(4)	Benzene	71-43-2	10	8	50	50
(5)	Pentabromodiphenylether[23]	32534-81-9	0.0005	0.0002	*not applicable*	*not applicable*
(6)	Cadmium and its compounds *(depending on water hardness classes[24])*	7440-43-9	≤ 0.08 (Class 1) 0.08 (Class 2) 0.09 (Class 3) 0.15 (Class 4) 0.25 (Class 5)	0.2	≤ 0.45 (Class 1) 0.45 (Class 2) 0.6 (Class 3) 0.9 (Class 4) 1.5 (Class 5)	
(7)	C10-13 Chloroalkanes	85535-84-8	0.4	0.4	1.4	1.4
(8)	Chlorfenvinphos	470-90-6	0.1	0.1	0.3	0.3

[21] This parameter is the Environmental Quality Standard expressed as an annual average value (EQS-AA).

[22] This parameter is the Environmental Quality Standard expressed as a maximum allowable concentration (EQS-MAC). Where the MAC-EQS are marked as "not applicable", the AA-EQS values are also protective against short-term pollution peaks since they are significantly lower than the values derived on the basis of acute toxicity.

[23] For the group of priority substances covered by brominated diphenylethers (No. 5) listed in Decision 2455/2001/EC, an EQS is established only for pentabromodiphenylether.

[24] For Cadmium and its compounds (No. 6) the EQS values vary dependent upon the hardness of the water as specified in five class categories (Class 1: <40 mg $CaCO_3$/l, Class 2: 40 to <50 mg $CaCO_3$/l, Class 3: 50 to <100 mg $CaCO_3$/l, Class 4: 100 to <200 mg $CaCO_3$/l and Class 5: ≥200 mg $CaCO_3$/l).

(1)	(2)	(3)	(4)	(5)	(6)	(7)
N°	**Name of substance**	**CAS number**	**AA-EQS[21]** **Inland surface waters**	**AA-EQS[21]** **Other surface waters**	**MAC-EQS[22]** **Inland surface waters**	**MAC-EQS[22]** **Other surface waters**
(9)	Chlorpyrifos	2921-88-2	0.03	0.03	0.1	0.1
(10)	1,2-Dichloroethane	107-06-2	10	10	*not applicable*	*not applicable*
(11)	Dichloromethane	75-09-2	20	20	*not applicable*	*not applicable*
(12)	Di(2-ethylhexyl)phthalate (DEHP)	117-81-7	1.3	1.3	*not applicable*	*not applicable*
(13)	Diuron	330-54-1	0.2	0.2	1.8	1.8
(14)	Endosulfan	115-29-7	0.005	0.0005	0.01	0.004
(15)	Fluoranthene	206-44-0	0.1	0.1	1	1
(16)	Hexachlorobenzene	118-74-1	0.01	0.01	0.05	0.05
(17)	Hexachlorobutadiene	87-68-3	0.1	0.1	0.6	0.6
(18)	Hexachlorocyclohexane	608-73-1	0.02	0.002	0.04	0.02
(19)	Isoproturon	34123-59-6	0.3	0.3	1.0	1.0
(20)	Lead and its compounds	7439-92-1	7.2	7.2	*not applicable*	*not applicable*
(21)	Mercury and its compounds	7439-97-6	0.05	0.05	0.07	0.07
(22)	Naphthalene	91-20-3	2.4	1.2	*not applicable*	*not applicable*
(23)	Nickel and its compounds	7440-02-0	20	20	*not applicable*	*not applicable*
(24)	Nonylphenol	25154-52-3	0.3	0.3	2.0	2.0
(25)	Octylphenol	1806-26-4	0.1	0.01	*not applicable*	*not applicable*

(1)	(2)	(3)	(4)	(5)	(6)	(7)
N°	**Name of substance**	**CAS number**	**AA-EQS[21]** **Inland surface waters**	**AA-EQS[21]** **Other surface waters**	**MAC-EQS[22]** **Inland surface waters**	**MAC-EQS[22]** **Other surface waters**
(26)	Pentachlorobenzene	608-93-5	0.007	0.0007	*not applicable*	*not applicable*
(27)	Pentachlorophenol	87-86-5	0.4	0.4	1	1
(28)	Polyaromatic hydrocarbons (PAH)[25]	*not applicable*	*not applicable*	*not applicable*	*not applicable*	*not applicable*
	Benzo(a)pyrene	50-32-8	0.05	0.05	0.1	0.1
	Benzo(b)fluoranthene	205-99-2	Σ=0.03	Σ=0.03	*not applicable*	*not applicable*
	Benzo(k)fluoranthene	207-08-9				
	Benzo(g,h,i)perylene	191-24-2	Σ=0.002	Σ=0.002	*not applicable*	*not applicable*
	Indeno(1,2,3-cd)pyrene	193-39-5				
(29)	Simazine	122-34-9	1	1	4	4
(30)	Tributyltin compounds	688-73-3	0.0002	0.0002	0.0015	0.0015
(31)	Trichlorobenzenes (all isomers)	12002-48-1	0.4	0.4	*not applicable*	*not applicable*
(32)	Trichloromethane	67-66-3	2.5	2.5	*not applicable*	*not applicable*
(33)	Trifluralin	1582-09-8	0.03	0.03	*not applicable*	*not applicable*

25 For the group of priority substances of polyaromatic hydrocarbons (PAH) (No. 28), each individual EQS shall be complied with, i.e., the EQS for Benzo(a)pyrene and the EQS for the sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene and the EQS for the sum of Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene must be met.

ANNEX IV – OTHER POLLUTING SUBSTANCES WITH EU WIDE EQS (COM 397 (2006) FINAL)

PART B: Environmental Quality Standards (EQS) for other Pollutants

AA: annual average;

MAC: maximum allowable concentration.

Unit: [µg/l].

(1)	(2)	(3)	(4)	(5)	(6)	(7)
N°	**Name of substance**	**CAS number**	**AA-EQS[21]** **Inland surface waters**	**AA-EQS[21]** **Other surface waters**	**MAC-EQS[22]** **Inland surface waters**	**MAC-EQS[22]** **Other surface waters**
(1)	DDT total[26]	*not applicable*	0.025	0.025	*not applicable*	*not applicable*
	para-para-DDT	50-29-3	0.01	0.01	*not applicable*	*not applicable*
(2)	Aldrin	309-00-2	Σ=0.010	Σ=0.005	*not applicable*	*not applicable*
(3)	Dieldrin	60-57-1				
(4)	Endrin	72-20-8				
(5)	Isodrin	465-73-6				
(6)	Carbontetrachloride	56-23-5	12	12	*not applicable*	*not applicable*
(7)	Tetrachloroethylene	127-18-4	10	10	*not applicable*	*not applicable*
(8)	Trichloroethylene	79-01-6	10	10	*not applicable*	*not applicable*

[26] DDT total comprises the sum of the isomers 1,1,1-trichloro-2,2 bis (*p*-chlorophenyl) ethane (CAS number 50-29-3); 1,1,1-trichloro-2 (*o*-chlorophenyl)-2-(*p*-chlorophenyl) ethane (CAS number 789-02-6); 1,1-dichloro-2,2 bis (*p*-chlorophenyl) ethylene (CAS number 72-55-9); and 1,1-dichloro-2,2 bis (*p*-chlorophenyl) ethane (CAS number 72-54-8).

ANNEX V – RECOMMENDATIONS RESULTING FROM THE FIRST WORKSHOP

--RECOMMENDATIONS ON WFD COMPLIANT MONITORING IN BIH --

Vienna, February 2007

prepared by:

1. INTRODUCTION

This paper summarises the results of the monitoring workshop on Feb 8. These results are complemented by information of the meetings between BiH institutions and the consultant on Feb 6-7.

The 4 major topics for the workshop have been selected by the local authorities from the list of issues which was distributed with the questionnaire (28 Dec 2006). In preparation of the workshop the selected topics where elaborated in more detail in a refined discussion paper. This document was distributed on Feb 5.

2. OBJECTIVES OF THE WORKSHOP ON FEBRUARY 8

The workshop aimed at

- Complementing and continuing the monitoring plan which was proposed by the CARDS RBM project
- identifying synergies between monitoring and other issues of WFD implementation
- fostering consistency and harmonisation of monitoring across national and international administrative units
- supporting the 'technical monitoring group'
- scrutinising the distribution of emphasis over different monitoring tasks

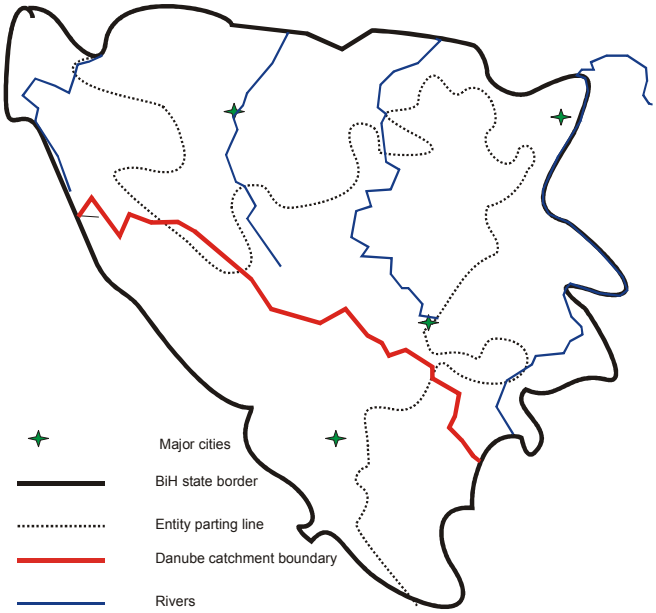


Figure 1: Scheme of the territory of BiH, the entity and catchment borders

3. RECOMMENDATIONS ON INTERCALIBRATION

1. **<u>The Intercalibration network should maximise the synergies with:</u>**
    a. **Development of national methods for BQEs**. **All** IC sites can also be used for the development of national methods for BQEs.
        i. Synergies concern the
            1. hydromorphologic description,
            2. pressure assessment
            3. biological monitoring results
        ii. IC sites should cover a variety of combinations of pressures and river types
        iii. IC sites should cover the good status boundaries, i.e. at least sites with excellent, good and moderate status
    b. **Site selection for the typology** – IC should use reference sites that are also part of the typology development. The synergy refers to:
        i. The establishment of type specific reference conditions
        ii. Abiotic obligatory / optional descriptors
    c. Surveillance sites
        i. Along the borders with neighbouring countries (e.g. TNMN – sites)
        ii. Within the territory of BiH
    d. Neighbouring ICPDR & Sava catchment countries along the Sava and Drina
2. **<u>Immediate participation in future EC-GIG activites for remaining BQEs</u>**
    a. First step: selection and nomination of national representatives / experts for the EC GIG and corresponding activity for the Mediterranean GIG
3. **<u>Clarification of the number of intercalibration river types within the territory of BiH</u>**
    a. First proposal (to be discussed within the GIG): To complement the IC typology for Ecoregion 5 (Dinaric Western Balkan for Serbia, BiH, Croatia and SL) with either:
        i. Medium-sized (100 km^2-1000 km^2), calcareous, mountain (200m-800m) or
        ii. Large (1.000 km^2-10.000 km^2), calcareous, low mountain (200-500m) As a result of these first considerations the number of Intercalibration sites is expected to be at least 6 for each dominant pressure.
4. **<u>A priori harmonisation/coordination of criteria for</u>**
    a. reference conditions
    b. BQE sampling methods
    with the Milestone 6 report of the EC-GIG and / or with the responsible experts

4. RECOMMENDATIONS ON HYDROMORPHOLOGY

1. It was recommended to consider a **harmonised and standardised methodology** in detail because Hydromorphology will be required for numerous concerns:
    a. All sites for elaborating a WFD compliant BQE method.
    b. Reference sites (high staus) in the frame of the surface water typology
    c. Intercalibration sites (high, good and possibly moderate-bad status)
    d. All surveillance sites
    e. Operational sites (at risk due to hydrological or morphological pressures)
    f. Operational sites for grouping according to hydromorphological pressures
    g. Water body delineation
    h. Cause effect relationships for the development of improved risk criteria for the next impact assessment
2. **Clarification of responsibilities** because Hydrology and Morphology are traditionally covered by different institutions. Harmonisation has been reached nationally on Morphology but not on methods for Hydrology. Thus the remaining tasks are:
    a. To clarify the compliance of morphological methods with WFD criteria and international standards (e.g. RHS- river habitat survey). Does the method cover :
        i. River continuity?
        ii. river depth and width variation?
        iii. structure and substrate of the river bed?
        iv. structure of the riparian zone ?

        According to the discussion during the workshop the national approach to Morphology covers all relevant aspects.
    b. To find a consensus on hydrological methods and institutional responsibility. In this context it was mentioned that the international standards as promoted by the World Meteorological Organisation ar a good basis for a harmonised national approach.
3. Three **options to deal with hydromorphology** where outlined and one of them the so called hybrid approach was recommended. The hybrid approach defines a priori a mid term masterplan for hydromorphology in terms of rivers/river stretches and methods and parameters. This masterplan guarantees consistency but it will be implemented stepwise based on a demand driven approach. The reasons for recommending this approach were:
    a. Harmonised methods
    b. Consistent data sets
    c. Financial burden distributed over several years

5. RECOMMENDATIONS ON RIVER TYPOLOGY AND MONITORING

A draft table displaying data types/information-needs versus different issues of implementing the Water Framework Directive was presented and explained in detail. The table is meant as an overall assessment of **potential synergies between tasks in relation to implementing the WFD**.

The table should help to reduce the complexity and give an overview, nevertheless it can just indicate a way forward. It was recommended to elaborate this table in more detail and to complement it with additional information on deadlines.

	data types / information needs	**Aspects of implementing WFD**			
		Typology	**WBD**	**Monitoring**	**IC**
		A	**B**	**C**	**D**
1	Measurement of all BQEs, HQEs	needed		needed	needed
2	Assessment of system B obligatory/optional factors	needed	needed	needed	needed
3	Assessment of eological status	needed	needed	needed	needed
4	Measurement of general phys-chem determinants	needed	needed	needed	
5	Collection of pressure information	needed		needed	
6	Clarification on representativity, Extrapolation – 'site selection'	needed	needed	needed	
7	… To be continued and updated …				

Remarks / expalanation:

Field … keywords

A1 … to 'establish type specific reference conditions'

B1 … no direct use

C1 … necessary for all surveillance sites

D1 … All biological Quality elements are subject to Íntercalibration

A2 … System B Typology is based on these obligatory / optional descriptors

B2 … typology is transferred to river stretches based on (extrapolated) typology descriptors

C2 … needed as an input for the designation of applicable reference conditions

D2 … selection of parameters is needed as metadata or descriptors for IC - sites

A3 … not necessarily needed as a criterium for sites selection (may also be based on expert judgement)

B3 … no changes of ecological status are allowed within a water body (though, may also be based on pressure information thus B3 and B5 can replace each other)

C3 … status for all water bodies has to be reported (in some cases based on a selection among similar water bodies)

D3 … needed for thos QEs that are subject to Intercalibration

A4 … selection of general phys-chem determinants may be part of System B 'optional factors'

B4 … abrupt changes of general phys-chem determinants are not allowed within a water body

C4 … According to Annex 5 always needed as a supporting parameter

D4 … no direct use

A5 … needed to underpin the site selection ('reference status')

B5 … can replace B3

C5 … useful to select position monitoring station

A6-C6 … all issues are based on extrapolation of point information on river stretches/water bodies

6. RECOMMENDATIONS ON CAPACITIES, STRATEGIES FOR MONITORING ECOLOGICAL STATUS

At first sight it seems very demanding to report ecological status of all water bodies within a countries territory. Therefore it is important to focus on the efficiency of the network. The directive allows for some approaches to increase the network efficiency, the corresponding CIS guidances help to assess the topic of network efficiency in more detail.

During the workshop several aspects of network efficiency have been addressed and some solutions have been recommended:

- **Grouping of water bodies**:
  Water bodies may be grouped and monitored by a selection of representative sites if :
  - A credible and validated approach to describe the representativity of a water body can be provided. Such an approach has to consider:
    - Type and specific sensitivity of a water body. This topic should be covered by the typology.
    - Type of the respective pressure and consideration of the combination of pressures
    - Magnitde of the pressures
- **Network optimisation** through:
  - Ranking of priorities, especially priority pressures. Such a ranking may consider the following aspects
    - Measures are to be implemented soon, monitoring is needed to validate/supplement the risk assessment methodology
    - There is only poor knowledge of cause – effect relations. Impact assessment and establishment of a Programme of Measures are hampered by this poor knowledge
    - If there is a high variability due to unknown reasons.
  - A priori establishment of evaluation rules: These rules are needed to assess whether a station delivers meaningful or only trivial results. In the latter case they can be replaced by more efficient stations.

  - Ranking of monitoring purposes: E.g. In the beginning the overall status or the validation of the risk assessment may be more important than the assessment of long – term natural trends.

- Finding a reasonable **equilibrium between surveillance and operational monitoring**. It was recommended to consider to prioritise surveillance monitoring in the beginning and to increase the intensity of operational monitoring stepwise. The reasons for this recommendation were:
  - Currently the impact assessment does not cover all water bodies, but the impact assessment is a precondition for the designation of operational sites.
  - The international obligations of BiH in the frame of the Danube catchment are focused on transboundary, large scale issues which can be covered by surveillance monitoring (2000km^2-4000km^2)
  - Also the TNMN Surveillance Type II approach uses surveillance as a tool to assess specific pressures.
  - Currently the water body delineation is not ready for all catchment sizes and for the whole territory of BiH. Operational Monitoring refers to concrete water bodies or groups of water bodies only, thus complete water body delineation is needed for operational monitoring.
  - Surveillance requires all BQEs, intensive Surveillance in the beginning will help to develop and refine the corresponding measurement methods.
  - There are significantly different costs for operational and surveillance monitoring sites.
  - Operational Monitoring requires experience with WFD compliant BQEs for the selection of the most indicative quality element.

7. SPECIFIC RECOMMENDATION TO REFINE THE OPERATIONAL MONITORING OF MUNICIPAL WASTEWATER DISCHARGES

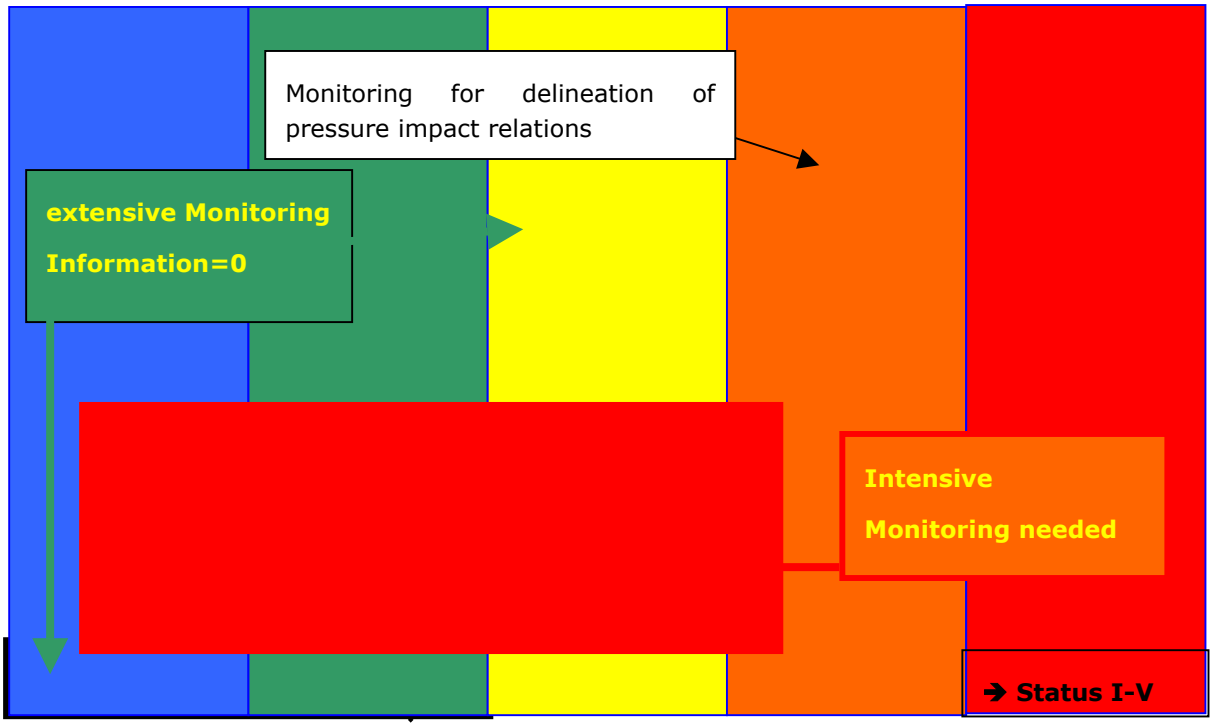
The CARDS RBM Monitoring proposal foresees operational (intensive or extensive) monitoring for each and every significant point source. In the frame of this project a systematic approach has been proposed to choose intensive and extensive stations in a reproducible and systematic way.

The underlying consideration is that very low as well as very high specific loads have a predictable influence on the water body. Very low specific loads will have no effect on ecological quality and very high specific loads will definitely result in a very clear deterioration of good status. Intensive monitoring of such sites would produce trivial results and may be reduced in favour of other, more interesting locations.

Therefore, it was proposed to refine and validate the cause effect relationship that was used within the CARDS RBM project. The approach was based on a predicted increase of BOD in the river. Every source causing an increase of more than 1mg/L BOD was considered to be significant.

The following graph illustrates the proposal. Only sites where it can not be predicted that there will be either a significant or no effect should be subject to intensive operational monitoring. This requires

- the delineation of a refined 'pressure – effect' relation based on ecological status as dependant variable (instead of BOD – increase) and 'person equivalent per average (or minimum) flow' as independent variable
- validation whether the cause effect relation is type specific
- an assessment of the confidence interval of this relation



8. DEVELOPMENT OF NATIONAL ASSESSMENT METHODS FOR BIOLOGICAL QUALITY ELEMENTS

ICPDR recommended the consideration of a paper that defines the minimum criteria for 'WFD compliant methods for Biological quality elements'.

Further it was recommended to split the method development in 'sampling' and 'evaluation' method.

For sampling it was recommended to

- use the common MHS methodology and
- train sufficient experts.

For the evaluation it was recommended to consider that the time to develop the method is at least two years and to use only samples according to WFD compliant methods for the derivation of metrics.

For all other aspects please refer to the identification of synergies in previous chapters of this document.

9. RECOMMENDATION CONCERNING PRIORITY (HAZARDOUS) SUBSTANCES (P(H)S) AND OTHER SUBSTANCES (OS)

It was stated during the workshop that there is only limited information about emissions of priority and priority hazardous substances for the entire territory. There is a good coverage for large industrial sites but limited information on small (municipal), diffuse sources of P(h)S and oS. In addition there are unknown numbers of former municipal and industrial dumping sites that might be potential sources of P(h)S. In some cases, due to carstic geology, it will be very complex to understand, where to monitor.

To design the monitoring of PS it is necessary to know where and which P(h)S are emitted. It is not necessary to know which quantities are emitted as the directive states that they have to be monitored as soon as they are discharged, irrespective of the quantity.

To design the monitoring of oS it must also be known which quantities they are discharged, because the directive requires monitoring, if they are emitted in 'significant quantities'.

It was proposed to assess the emissions of agricultural areas and municipal sources by using 'unit emissions'.

For municipal sources specific unit emissions per person can be assumed, similar to 'person equivalents' for organic carbon (BOD, COD). Due to the current situation (almost no wastewater treatment) there is no need to reduce these unit emissions due to degradation in the WWTPs. It can be assumed that the complete load is discharged into the rivers. The delineation of specific unit emissions has been done in EU MS and it has been validated by monitoring. Therefore, BiH might consider applying the same principle and optimising the approaches of EU MS.

For agricultural sources unit emissions can be delineated based on crop, soil and distance from the rivers or groundwater table. This approach is more complex but has been applied by other EU MS and it has been validated in some cases. BiH might capitalise on these experiences and adapt this approach to local conditions.

This exercise will result in assumed emissions of P(h)S and oS for BiH. It will be the task of Monitoring to validate and optimise this approach. In other words, it will be necessary to design a specific programme for validating the assumed discharges. This task is attributed to surveillance monitoring in the frame of supplementing and validating the risk assessment.

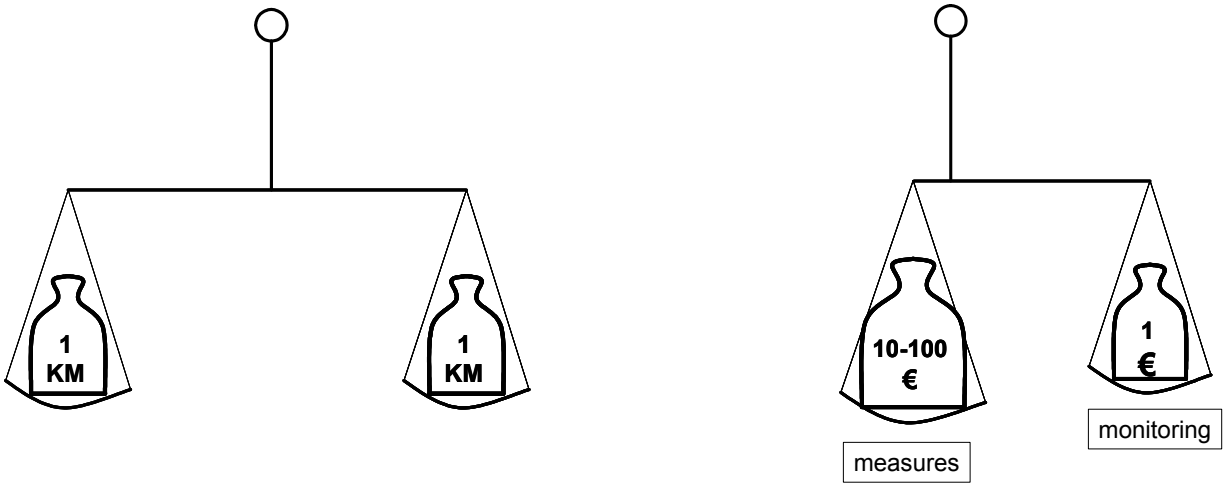
Nevertheless, it will not be necessary/feasible to monitor all substances at all surveillance sites. It was proposed to apply two criteria to define the 'network density' for a certain substance (the frequency is given by the directive and leaves only 1 degree of freedom - to increase the frequency). The criteria that were proposed are:

- A qualitative classification of degradability: Is the substance refractory/conservative it can be measured even in distant locations, while degradable substances need to be measured close to the source
- A quantitative description of the 'detectability' of the substance. 'Detectability' describes whether the limit of detection of the analytical method is close or far from the environmental quality standard. A substance is easily detectable if the limit of detection is far below the EQS and vice versa.

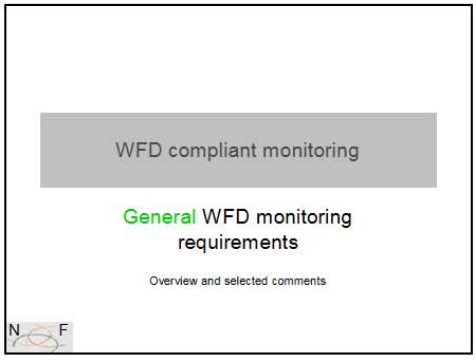
10. GENERAL RECOMMENDATION CONCERNING MONITORING COSTS

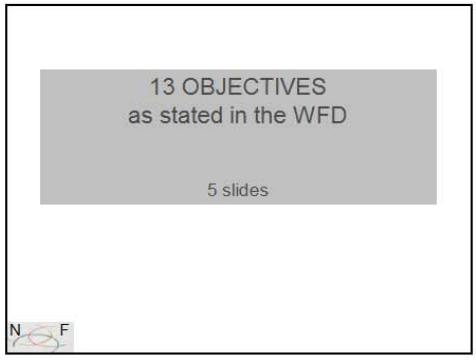
There was a general agreement that the cost of monitoring should always be considered as part of cost-effect relation. The benefits of monitoring in terms of better decisions and better allocation of resources for measures should always be taken into account. Normally the costs/detrimental effects of type I or type II errors exceed the monitoring costs.

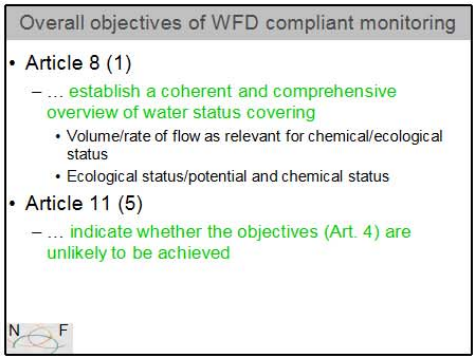
The 'monitoring leverage effect' was illustrated by comparing a normal balance with the monitoring balance.

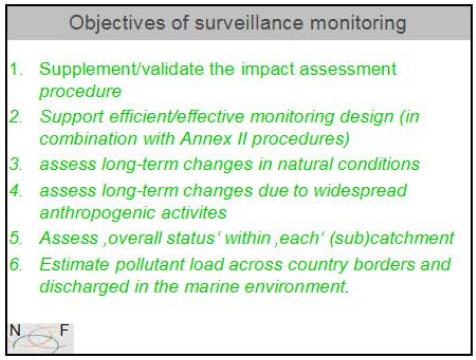


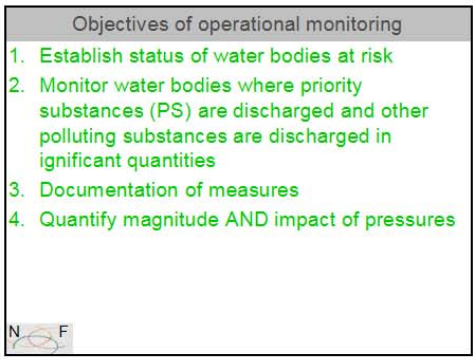
ANNEX VI – GENERAL FACTS AND CONSIDERATIONS ABOUT WFD COMPLIANT MONITORING – POWER POINT PRESENTATION

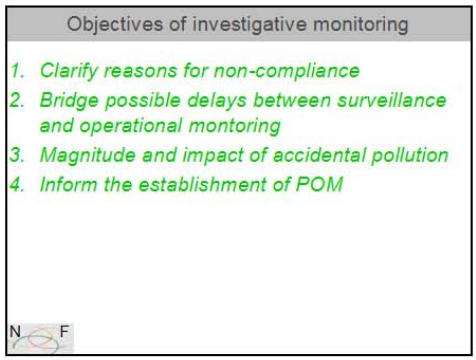












NON - Objectives of monitoring

*Surveillance **NON** - objectives*

- *- mapping and analysing water quality problems;*
- *- testing the effectiveness of the programme of measures;*
- *- obtaining a detailed or complete overview of the quality of all types of water*

*Operational **NON** – Objectives*

- *Identification of causes for failing environmental objectives*
- *Inform the establishment of POM*

N F

Quality elements

3 slides

N F

Biological Quality Elements - BQEs

	rivers	lakes	Transi.	coastal	
Benthic Invertebrate Fauna	√	√	√	√	
Phytoplankton	√	√	√	√	
Macrophytes and Phytobenthos	√	√			
Fish Fauna	√	√	√		
Macroalgae			√	√	
Angiosperms			√	√	

N F

Hydromorphological Quality elements - HQEs

	rivers	lakes
Quantity & dynamics of flow	√	√
Connection to groundwater	√	√
Residence time		√
Depth (&width) variation	√	√
Continuity	√	
Structure and substrate of the bed	√	√
Structure of shore / riparian zone	√	√

N F

Chemical and physico-chemical elements - PCQEs

	rivers	lakes
Thermal conditions	√	√
Oxygenation conditions	√	√
Salinity	√	√
Acidification status	√	√
Nutrient conditions	√	√
Transparency		√

N F

General rules for selecting quality elements

Surveillance

- All
  - BQEs
  - hydromorphological
  - general physico-chemical
- relevant priority substances (discharged into the river basin or subbasin)
- Relevant other substances (discharged in significant quantities into river basin or subbasin)

Operational

- Quality elemnt(s) which are indicative for the pressure AND most sensitive for impact

N F

Selection of Monitoring sites

2 slides

N F

Selection of monitoring sites - Surveillance

Where surveillance points?

-- explicitly in WFD --

- … rate of water flow is significant within the rbd
- … large rivers where catchment area >2.500km²
- … volume of water is significant incl. large lakes/reservoirs
- … significant wb cross MS boundary
- … 77/795/EEC sites (info exchange)
- … loads across MS boundaries and into marine environment

-- implicit needs –

- pristine wb/reference locations natural/anthropogenic long term changes
- Equal coverage of all types of risk status (not, possibly, at risk)

N F

Selection of monitoring sites – operational

Where operational points?

-- explicitly in WFD --

- … (selection of) water bodies at risk of failing EO
- … (selection of) water bodies which change due to measures
- … water bodies into which priority substances are discharged
- … water bodies into which other substances are discharged in significant quantities

-- implicit needs –

- Clear and consistent selection of the exact position in relation to the respective pressure, otherwise comparability of results is compromised (‚allowable zone of impact' etc.)

N F

Selection of monitoring sites – protected areas

Where points for protected areas?

-- explicitly in WFD --

- Drinking water abstraction points
- Species and habitat protection areas at risk

Unclear …

- Sensitive areas according to UWWTD

N F

Additional and maybe critical aspects

5 slides

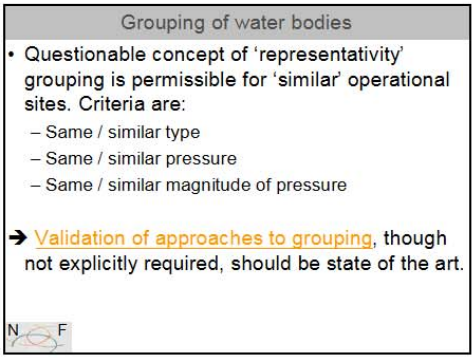
N F

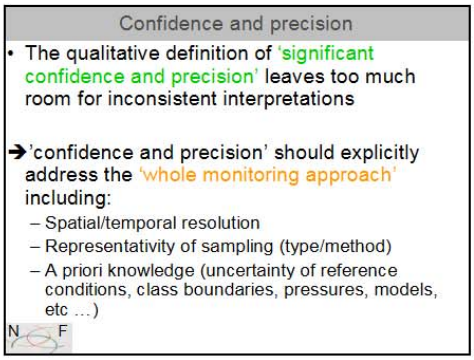
Extrapolation of monitoring results to river stretches

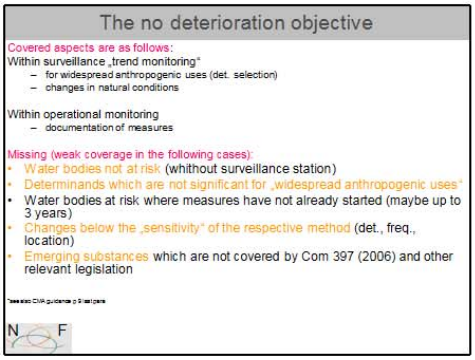
Critical aspects:

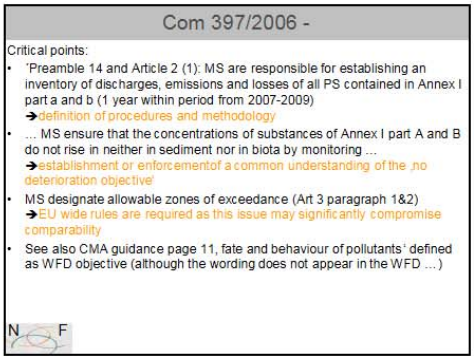
- extrapolation of results from discrete ‘monitoring points/stretches’ to whole water bodies
- establishment of status for water bodies without monitoring sites
- establishment / validation of status of water bodies which
  - are not at risk AND
  - have no monitoring sites

N F


Grouping of water bodies
• Questionable concept of 'representativity' grouping is permissible for 'similar' operational sites. Criteria are:
– Same / similar type
– Same / similar pressure
– Same / similar magnitude of pressure
➔ Validation of approaches to grouping, though not explicitly required, should be state of the art.
N
F


Confidence and precision
• The qualitative definition of 'significant confidence and precision' leaves too much room for inconsistent interpretations
➔'confidence and precision' should explicitly address the 'whole monitoring approach' including:
– Spatial/temporal resolution
– Representativity of sampling (type/method)
– A priori knowledge (uncertainty of reference conditions, class boundaries, pressures, models, etc …)
N
F


The no deterioration objective
Covered aspects are as follows:
Within surveillance „trend monitoring"
– for widespread anthropogenic uses (det. selection)
– changes in natural conditions
Within operational monitoring
– documentation of measures
Missing (weak coverage in the following cases):
• Water bodies not at risk (whithout surveillance station)
• Determinands which are not significant for „widespread anthropogenic uses"
• Water bodies at risk where measures have not already started (maybe up to 3 years)
• Changes below the „sensitivity" of the respective method (det., freq., location)
• Emerging substances which are not covered by Com 397 (2006) and other relevant legislation
N
F


Com 397/2006 -
Critical points:
• 'Preamble 14 and Article 2 (1): MS are responsible for establishing an inventory of discharges, emissions and losses of all PS contained in Annex I part a and b (1 year within period from 2007-2009)
➔definition of procedures and methodology
• … MS ensure that the concentrations of substances of Annex I part A and B do not rise in neither in sediment nor in biota by monitoring …
➔establishment or enforcementof a common understanding of the ‚no deterioration objective'
• MS designate allowable zones of exceedance (Art 3 paragraph 1&2)
➔EU wide rules are required as this issue may significantly compromise comparability
• See also CMA guidance page 11, fate and behaviour of pollutants' defined as WFD objective (although the wording does not appear in the WFD …)
N
F

ANNEX VII – DISCUSSION PAPER FOR THE MONITORING WORKSHOP ON FEBRUARY 8 IN SARAJEVO

Assistance for Bosnia & Herzegovina on WFD Compliant Monitoring: - Discussion Paper in Preparation of the First Workshop -- Evaluation of the Questionnaire --

Vienna, January 2007

1. INTRODUCTION

This paper is based on the questionnaire which has been sent to relevant actors in BiH in Dec 2006. The paper contains the evaluation of the questionnaire and elaborates in more detail those issues which have been considered to be most important.

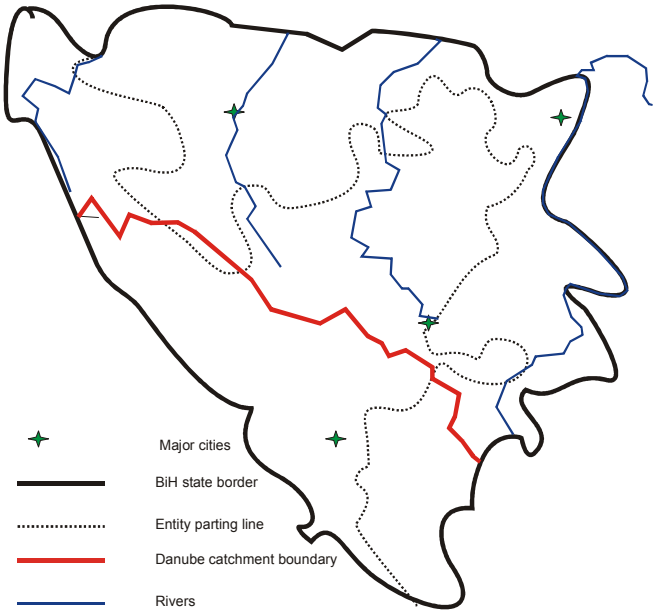


Figure 2: Scheme of the territory of BiH, the entity and catchment borders

2. RANKING OF ISSUES

The following presents the ranking[9] of the issues, according to their relevance for the current situation in BiH. This ranking represents the opinion of those 8 persons/institutions which have answered the questionnaire. It is representative for the ad-hoc opinion of involved persons and might change during the project and during the further implementation activities.

No	topic	Rank	points
10	Strategies, options and necessary resources to ensure the **quality of monitoring data**, including Intercalibration and transboundary cooperation (see also topic 4)	1	1,14
3	Capacities, strategies and timetable for monitoring **'hydromorphological QEs'**	2	1,13
11	Interaction and synergies between activites for **'typology' and 'monitoring'**	3	1,085
1	Capacities, strategies and timetable for monitoring **'ecological status'**	4	1,08
2	Capacities, strategies and timetable for monitoring **'chemical status'**	4	1,08
4	Development of **national methods for 'ecological status'** and supporting QEs (and monitoring of reference sites)	4	1,08
13	Strategies / priorities to update and improve **pressure related information** for all key water management issues	5	1,03
8	**Mid term roadmap for monitoring** (local/regional responsibilities, gaps and financing needs, ownership for implementation)	6	0,99
12	List of monitoring stations and programmes versus a set of criteria to select stations and programmes.	7	0,98
5	Ensuring **comparability of results**; technical co-ordination (methods, QC) and harmonised implementation (see also topic 9)	8	0,93
9	**Checklist for 'Priority substances with EU wide EQS'** elucidating 1) expertise 2) equipment 3) personnel capacities	9	0,88
7	Task list and resources for the **'technical monitoring group'**	10	0,83
6	**Decision making body** (across catchments and entities)	11	0,73

Table 1: Ranking of the issues raised in the questionnaire. ----------

[9] The ranking is based on the normalised score in order to eliminate individual differences. The average score of each questionnaire after nomalisation is 1.

Issue 10: rank 1/11
Strategies, options and necessary resources to ensure the quality of monitoring data, including Intercalibration and transboundary cooperation (see also topic 5)

Original description taken from the Questionnaire document:

WFD implementation has both, national and international aspects. The international basin wide approach requires specific efforts but it provides also opportunities to collaborate and improve efficiency. While issue 5 addresses rather technical aspects, issue 10 should deal with the formal requirements to join the intercalibration exercise.

Topic 10 would aim to elucidate the formal and administrative requirements and options to manage the intercalibration exercise for BiH. It would aim to ensure that this activity is harmonised with other aspects of WFD implementation (monitoring design and method development).

Comparability and consistency of monitoring results are one essential element of the quality of monitoring data. In general comparability and consistency have several dimensions:

- over time
- within (sub)catchments
- across (sub)catchments
- across administrative borders
- across different assessment methods ('all roads lead to rome' but which one is the shortest?)

Intercalibration (IC) deals with the comparability of *classification results* of high, good and moderate status of biological quality elements *between countries*. These classification results should correspond to comparable levels of ecosystem alteration. It should be kept in mind that a *precondition for valid classification results is the availability of national assessment methods for BQEs* (see chapter 0.).

Intercalibration is based on an *intercalibration network that should cover high, good and moderate status*. The first phase of the IC exercise implies the establishment of such an Intercalibration network. High good and moderate status may be based on *'expert judgement from joint inspections and all available information'*. Thus there is no formal requirement of a national assessment method for the *selection/designation* of intercalibration sites.

With reference to the situation in BiH it should be pointed out that the intercalibration network should *go beyond the 'reference locations' as described in the CARDS RBM monitoring proposal*. For the selection of reference locations see CIS WG 2.3, 2003. 'Guidance on establishing reference conditions and ecological status class boundaries for inland surface water'.

Further it should be pointed out that IC should cover a representative *range of combinations of pressures with surface water types*. Two requirements can be delineated from this. The first is the availability of *comparable pressure related information* (see chapter 0) and the second is the

existence of a rough idea of the respective *surface water typology* (see chapter 0). National typology and river types for the intercalibration have to be differentiated.

In addition there is the need to provide unified typology related descriptors for the intercalibration sites. *Selected descriptors have to be delivered for the intercalibration sites*. These descriptors are (have been) agreed upon in the geographical intercalibration group.

The intercalibration is organised in geographical intercalibration groups (GIG). *It is a formal requirement, that national representatives are integrated in these group(s)*.

There are specific restrictions as to whether heavily modifies water bodies can be included in the intercalibration network (see CIS guidance No 6 and No 14). Thus, it is a formal *precondition to know which water bodies are candidates for heavily modified water bodies*.

In the **second phase** of IC the respective national assessment methods for BQEs have to be applied to the IC sites (if there are not already data available). Data need to be evaluated in a way consistent with the completed evaluations of EU MS. *It has to be clarified who will take over the responsibility and costs of integrating BiH data into the environmental quality ratio calculations which where delivered to EC in the milestone 6 report.*

Remark (to be confirmed by appropriate experts/institutions):

- *By Dec 2006 in the eastern continental geographical intercalibration group only benthic invertebrates have been intercalibrated. Therefore, also BiH may consider to prioritise this BQE. As the dominant pressures on BiH rivers are municipal and industrial wastewater discharges the prioritisation of benthic invertebrates would be line with the situation in BiH.*
- *Due to time constraints it may be problematic to wait with the second phase of the Intercalibration exercise (i.e. application of national assessment method to the sites of the intercalibration network) until the national assessment method is finalised. In this case appropriate provisions may be made to ensure that the results can be reproduced, once the national assessment method is developed. Taking into consideration that each 'assessment method' for BQEs can be divided into the sampling and the evaluation procedure, a strategy may be developed. Basically this implies that from the beginning the sampling method and the documentation should be compliant with the needs of the national method. In this respect it may be recommendable to capitalise on the sampling experience, practice and standards of EU member states. The evaluation, based on the completed national assessment method, may be done at the end of the second phase of the exercise.*

Specific issues, general remarks and recommendations concerning IC in BiH:

- Continuation of IC in EU MS for *remaining regions, types and quality elements* (see also CIS 2007-2009 workplan):
  The intercalibration has been an intensive process over years and a number of meetings, presentations etc. have helped the countries to build up the capacities and expertise for this work. For BiH it may be more difficult to start without the support of these past meetings. But not all river/lake types and not all BQEs have been intercalibrated yet. Therefore, it may be advantageous if BiH joins the continuation of the IC and sends representatives to future meetings in order to have the support of the larger group for the remaining types, regions and quality elements.
- To be continued and complemented with the workshop outcomes ….

General advantages for BiH:

- Benthic invertebrate intercalibration:
  The EC GIG based the IC on a 'common metric'. Further specific approaches had to be defined to deal with different definitions of reference sites and different sampling protocols. These results may be taken into account for the selection/development of a BiH methodology for benthic invertebrates.
- The discussions about benthic invertebrate IC has had results that were reported in the milesstone 6 report. BiH can capitalise on these results and apply the methodology straightforward.
- The process to define the most appropriate approach to IC was demanding and required significant efforts. BiH can take over the results and save the corresponding resources for other WFD implementation activites.
- To be continued and complemented with the workshop outcomes ….

General disadvantages for BiH:

- BiH does not get the support of repeated meetings concerning benthic invertebrate IC. It has to perform this exercise alone or within the Sava catchment context in collaboration with other West-Balkan non member states.
- To be continued and complemented with the workshop outcomes ….
-

Synergies with and links to other WFD implementation activities: Summary

- phase 2 of IC may not be finalised before *Issue 4 'national methods for BQEs'* possibilities to divide the task into 'sampling' and 'evaluation' may contribute to a faster completion.
- descriptors for intercalibration sites can be collected synergetically in the frame of
  - *Issue 3 'hydromorphological quality elements'*
  - *Issue 11 'typology and monitoring'*
- To be continued and complemented with the workshop outcomes ….
-

Responsibility assessment:

topic	RS[1,2]	Fed[1,2]	Joint reporting[1]
Formal designation of IC sites			
Expert judgement from joint inspections			n.a.
Collection of descriptors/metadata for IC sites			n.a.
Join the EC GIG group			
Provide assessment method for BQEs (phase 2)			
Evaluation of phase 2 data			
Revision of IC site inventory based on data evaluation			
……			
To be continued and complemented with the workshop outcomes			

[1] … Institution and contact person, [2] … both for Danube and for the Adriatic catchment respectively

Issue 3 : rank 2/11
Capacities, strategies and timetable for monitoring 'hydromorphological quality elements'

Original description taken from the Questionnaire document:

Hydromorphological quality elements (HM-QEs) play an important role for the risk assessment and serve as a supporting parameter for ecological status. HM-QEs are an important input for the typology, the development of national methods for BQEs (topic No 4) and for cause effect relationships for hydromorphological pressures. To some extent and under specific conditions it may be justified that hydromorphological quality elements may replace ecological status assessments although usually they complement information of BQEs.

Hydro-morphological quality elements play an important role in the WFD and are highly interlinked with several topics of WFD implementation. Thus a proper strategy to assess hydromorphological QEs may significantly contribute to an efficient implementation of WFD (compliant monitoring).

Again, comparability and harmonisation of methods and strategies across entities and involved institutions are decisive.

Countries which have not performed basic eco-morphological assessments and classifications for all rivers should cover them in their monitoring systems. Not as a supporting parameter for selected monitoring stations but to achieve the basic classification for typology etc. This aspect is mentioned within the HYMO IP as a gap of the current data basis.

Discussing topic 3 would help to draft a way forward under consideration of existing capacities and data ((hydro)meteorological institutes) and it would help to clearly define and agree about the role of hydro-morphological QEs. The specific BiH context might be an opportunity to use consistent, high quality information about hydro-morphological QEs synergistically for several WFD implementation requirements.

Synergies with and links to other WFD implementation activities:

Consistent data about hydromorphological quality elements (HQEs) are needed for the following purposes and locations:

1. All sites used for elaborating a national *WFD compliant assessment method.* These will most probably have to cover all status classes.[10]
2. Reference sites (high staus) in the frame of the *surface water typology*
3. *Intercalibration sites* (high, good and possibly moderate-bad status)
4. All *surveillance sites*
5. *Operational sites* which are at risk due to hydrological or morphological pressures
6. *Operational sites for grouping* according to hydromorphological pressures
7. *Water body delineation*
8. *Cause effect relationships* for the development of *improved risk criteria* for the next impact assessment

[10] HQEs, especially those considered to be most indicative for hydro-morphological pressures (benthic invertebrates and fish) serve as the independent variables for developing appropriate metrics. The task could also be roughly described as 'calibrating' the national assessment method and elucidating the specific sensitivity towards selected pressures. To the same extent they are needed to 'validate' the developed metrics.

Possible strategies:

From this compilation it becomes evident that it is difficult to predict in detail where, when and which data on hydromorphology will be needed in the future. Two approaches may be taken into consideration:

- To perform a *complete assessment of hydromorphology over the entire territory* at an early stage of WFD implementation. The resulting data can be used for multiple purposes in future WFD implementation activities. Another advantage is that they would be consistent in terms of methodology, quality and spatial resolution.
- To assess *hydromorphology in a demand driven approach*. E.g. in 2007 for surface water typology sites, in 2008 for sites that are used for the development of national assessment methods and so forth. The risks of this approach are as follows:
    - Inconsistent data sets due to a focus on a selection of some HQEs for defined purposes
    - Parallelities might be overseen thus reducing efficiency
    - Inconsistent data formats and methods due to numerous actors.

Concrete questions for the workshop:

- Which methods are used to assess HQEs and are they consistent over time and the whole country? Is it planned to use the same assessment methods in the future?
- What is the current status in BiH concerning availability of HQE data? Which rivers, lakes regions etc are covered and who 'owns' the data?
- Which HQEs are available?
    - Quantity & dynamics of flow
    - Connection to groundwater
    - Residence time
    - Depth (&width) variation
    - Continuity
    - Structure and substrate of the bed
    - Structure of shore / riparian zone
- Are the data available in a consistent electronic format?
- Could a concerted effort to assess HQEs over the whole country be useful and could it be financed or is a demand driven approach preferable?

In detail HQEs play the following roles in the WFD:

- Annex II: 1.3 (i-vi) Establishment of type-specific reference conditions for surface water body types:
  For each surface water body type….type-specific hydromorphological and …conditions shall be established representing the values …… for that surface water body type at high ecological status….
- Annex V: 1.2 Normative definitions of ecological status classifications. Table 1.2.

- General definition of high ecological status:
  There are no, or only very minor, anthropogenic alterations to the values of the … hydromorphological quality elements for the surface water body type from those normally associated with that type under undisturbed conditions.
- For status classes other than high: hydromorphological quality element are required to be in consistence with the needs of BQEs for the respective status class

- Annex V: 1.3.1 Hydromorphology as compulsory quality element for surveillance monitoring
- Annex V: 1.3.2 Hydromorphology as a criterion for the selection of monitoring sites and as a parameter indicative of selected pressures

In the frame of the Article 5 reports hydromorphological alterations have been identified as on of the most striking anthropogenic pressures on water bodies across Europe. In the light of this the CIS process has adopted a new activity specifically dedicated to hydromorphological alterations resulting from shipping, hydropower and flood defence. This activity plays an important role in the 2007-2009 workprogramme: 'It is a mandate for CIS activity on Hydromorphology to *exchange information on approaches to the assessment and management of significant hydromorphological pressures* … to facilitate the transfer of expertise between Member States and …'

Responsibility assessment:

topic	RS[1, 2]	Fed[1,2]	Joint reporting[1]
WFD compliant assessment methods			
Typology rivers / lakes			
Formal designation of IC sites	See chapter 0		
HQEs for monitoring sites			
Water body delineation			
To be continued and complemented with the workshop outcomes			

[1] … Institution and contact person, [2] … both for Danube and for the Adriatic catchment respectively

Issue 11: rank 3/11
Interaction and synergies between activities for 'typology' and 'monitoring'

Original description taken from the Questionnaire document:

Typology, water body delineation and monitoring have several technical and administrative aspects in common although they are designed / considered as subsequent steps in the WFD. It is important to harmonise these different steps of WFD implementation, to identify potential synergies and avoid parallel work. Differences of the time plan for WFD implementation between EU MS and BiH and experiences from other countries may be an opportunity for optimised approaches to these issues.

Topic 11 would assess the potential for simultaneous, parallel and interlinked approaches to monitoring, typology, water body delineation and intercalibration with the objective of increasing efficiency and keeping the time plan.

Typology is a precondition for water body delineation and no WFD compliant monitoring can be designed without water bodies. Although these tasks are designed as subsequent steps in the directive they have some common requirements and they have to be consistent. The following table lists some aspect and illustrates whether there are shared aspects for the tasks of typology, water body delineation (WBD), Monitoring and Intercalibration (IC). It is not meant as a detailed description but rather as an approximation and summary of similarities.

A detailed planning of future WFD implementation activities may capitalise from these similarities and use the potential of these sysnergies.

	topic	typology	WBD	Monitoring	IC
1	all BQEs, HQEs	y for reference		y surv-trend	y hig-mod.
2	syst. B obligatory/optional factors	y	y	y[1]	y metadata
3	eological status	y site selection	y 'one status'	y for all wbs	y for EQR
4	representativity, Extrapolation	y	y	y	
5	Phys-chem determinants	y/n	y	y	
6	Pressure information	y		y	

[1] needed for reference conditions for the type specific BQE method

table 2: summary of similar data needs for different WFD implementation activites. The first column is used as an identifier for the type of data (see table below)

1. all BQEs, HQEs
   For the typology these are needed to establish 'type specific reference conditions'. For Monitoring all biological and hydromorphological quality elements have to be assessed in the frame of surveillance monitoring. Identical data sets are needed for typology and surveillance monitoring of reference sites (for the purpose of detection of long term trends

in natural conditions and widespread anthropogenic activity). Data from surveillance sites (high-moderate status) can be used for Intercalibration puposes.

2. syst. B obligatory/optional factors
   The typology is completely based on these obligatory factors and partly, according to the national approach, on optional factors. The same data have to be used for the water body delineation as a water body cannot incorporate two or more river types. Monitoring need these data if BQEs and HQEs are assessed as these methods are type specific. Similar dat will be required as meta-daa for the reporting sheets of the Intercalibration.

3. ecological status:
   Status information is needed for the selection of reference sites, although it is possible to select the sites with 'expert judgement'. However, selection based on status information is more reproducible and transparent. For the water body delineation status information is needed because status should not change within a water body. For Monitoring it is a basic task to report ecologic (and chemical) status for all water bodies. Finally Intercalibration needs status information at least for those quality elements that are subject of the data evaluations.

4. representativity, Extrapolation:
   The first three tasks (but not the Intercalibration) are extrapolating point information to larger river stretches. In all cases information from selected sites or small stretches is considered to be representative for parts of the river system. Therefore representativity is a topic for all four tasks and has to be approached in a consistent way.

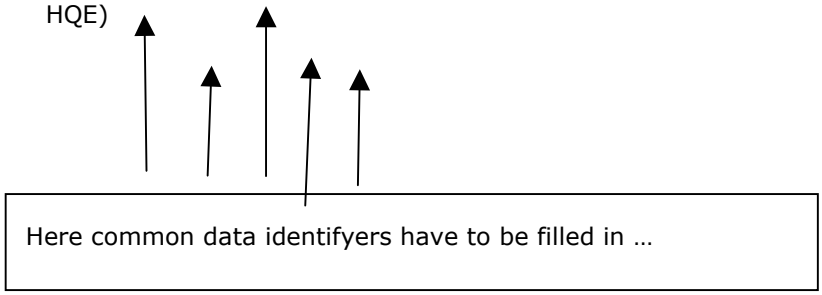
5. Phys-chem determinants:
   Within the typology physico-chemical determinants/parameters may be part of the 'optional factors' and they are definitely part of the reference condition that have to be established. WBD considers abrupt changes of physico-chemical properties as a reason to separate water bodies. For Monitoring Annex 5 considers the general physico-chemical parameters as supporting element wherever BQEs or priority/other substances are measured.

6. Pressure information:
   This information is useful for the typology to underpin the reference status of a site, for monitoring it is necessary to position the stations and to derive parameters for grouping of water bodies.

Opportunities:

Efficient approaches to the four mentioned (and maybe other) tasks would have to aim at maximising the overlaps and synergies of stations and required data. A simple table as illustrated below could be developed that serves as a basis to maximise synergies and minimise costs.

Station ID	Typology	WBD	Monitoring	IC	Common data needs for all tasks
Name 1	e.g. (i.e.BQE, HQE)	1	e.g.1,3		e.g 1,3,5
Name 2					
….					



Responsibility assessment:

topic	RS[1, 2]	Fed[1,2]	Joint reporting[1]
Typology			
Water body delineation			
Monitoring			
Intercalibration			
Elaboration of the 'synergy table'			
To be continued and complemented with the workshop outcomes			

[1] … Institution and contact person, [2] … both for Danube and for the Adriatic catchment respectively

Issue 1: rank 4/11
Capacities, strategies and timetable for monitoring 'ecological status'

Original description taken from the Questionnaire document:

The WFD introduced the e*cological status* as a yardstick to assess the quality of water bodies. Therefore, one objective of monitoring is to be able to classify the ecological status of each waterbody within a country's territory. This requires providing a number of resources (human, institutional, financial).

As BiH is not an EU-MS it may follow a different timetable than the one given in the WFD provided that the national commitment regarding WFD implementation within the Danube Declaration is met. Timetable and required resources are interlinked and therefore part of the same topic.

There are different potential solutions for the task to provide the ecological status for all water bodies with a sufficient level of confidence and precision. By no means all water bodies will have to be monitored individually. There are possibilities to attribute a status to water bodies by using other information that might be available and there are options for grouping water bodies.

It has to be kept in mind that this tasks is also synergistically linked with the monitoring objective of 'supplementing and validating' the Risk assessment *procedure.*

Issue No 1 would help to develop ideas for the most efficient way to provide an ecological status for all waterbodies.

To deal with this topic would encompass to sketch the required resources and strategies for assessing ecological status of all water bodies and to develop a realistic timetable for BiH.

Remark: Topic No 1 is not to be confused with topic No 4 which addresses the requirements for developing a national assessment method as a separate issue.

The concept of ecological status[11] aims at defining a joint degradation scale for different types of possible pressures on surface waters. One task of monitoring is to report an ecological status class for all water bodies in Europe accompanied by a realistic statement concerning confidence and precision of the respective classification.

The most important elements to be able to provide a status classification for all water bodies are:

- WFD compliant evaluation *methods for BQEs (see chapter 0)* in case of high status also for HQEs (see chapter 0)
- A credible approach to representativity or *grouping of water bodies* – how to transfer monitoring results to river continuums and how to transfer monitoring results to similar

[11] While the definitions and discussions of the strengths and weaknesses of this concept are very formal (not to say dogmatic) the real approaches of EU MS and accession countries seem to be oriented at the best feasible and realistic transfer and implementation of the priciple. This situation represents the general truth that, if no one understands what a term or an idea means, a definition has to be found and disseminated. WFD and the corresponding CIS guidances provide numerous definitions and interpretations, evidence for universality and generality of the principle. However, there is a common understanding of some elements of ecological quality and there is also space for solutions and interpretations that are specific for one country (as long as plausible evidence, explanations and justifications is given).

water bodies. Apart from the trivial approach that all unimpacted waterbodies are at a high status, different approaches for water bodies which are subject of anthropogenic influences have been defined or postulated in the frame of designing WFD compliant networks. The elements to be considered for representativity issues are:

- Spatial – basically an evaluation of the river continuum approach versus the definition of distinct and 'uniform' water bodies for management purposes. Spatial representativity has to reflect the different scales of natural changes (large) and anthropogenically induced changes (small).
- Natural changes/environmental descriptors – basically covered by typology
- Type of pressure or types of combinations of pressures
- Magnitude of pressures or combinations of magnitudes of pressures[12]

- A concept to optimise the efficiency of the network. During network design such a concept helps to prioritise monitoring purposes and information needs. During the monitoring cycle the concept shall ensure that stations which deliver trivial or no information are replaced by other, more efficient stations. Elements of the concept may be the following.
  - Ranking of pressures: Pressures which need a detailed assessment thus an intensive monitoring may be ranked first. Criteria for intensive monitoring may be
    - It is planned to start soon with the implementation of measures. Monitoring is needed to validate the risk assessment and to design appropriate measures.
    - There is only poor knowledge of cause effect relationships for a specific combination of pressure and surface water type
    - There is a high variability due to unknown reasons.
  - Evaluation rules: A checklist to assess whether a station fulfils its tasks or not. These rules will help to detect stations which do not deliver meaningful data and to replace them with more efficient stations.
  - Ranking of information needs. It may be considered to prioritise certain monitoring purposes. As an example, to validate and supplement the risk assessment may be regarded as more important than the detection of long term natural trends. Consequently the frequency and number of stations may be shifted from one to the other purpose.
  - …

In general surveillance stations cause less costs than operational stations. *Consequently a concept to provide ecological status for all waterbodies should prioritise surveillance stations in the first years.* At a later stage surveillance programmes might be complemented with an operational programme. In some cases surveillance might be replaced completely by the operational programme and in some cases even the frequency of the surveillance programme may be reduced to once in every third water management cycle.

[12] The current draft of a CIS guidance of the chemical monitoring activity has for the first time mentioned the magnitude of a pressure as a criterion for grouping of water bodies, and it has raised for the first time the issue of grouping in the context of surveillance monitoring.

An approach with main emphasis on surveillance in the first years would also help to *develop the BQE methods in the frame of intensive surveillance monitoring*. Further it *supplements the risk assessment* and helps to *bridge the time until the information about pressures (which is necessary for designing operational programmes) has been refined*. The approach to distribute surveillance stations should not be purely statistical (stratified sampling) but reflect the typology, especially represent all catchment sizes, however, with a priority on large catchments in the beginning (to be able to fulfil international obligations).

A recent report presented by EC has revealed that there is a great variation of interpretations of the topics mentioned above between EU MS. While some states have more than 20 monitoring stations per 1000km2 others have one, while some countries cover less than 10% of water bodies with surveillance stations other cover more than 50%.

Issue 2: rank 4/11
Capacities, strategies and timetable for monitoring 'chemical status'

Original description taken from the Questionnaire document:

Assessment of chemical status means to check the compliance with environmental quality standards for priority-, priority hazardous- and other substances. Currently not all the substances of the lists can be monitored/analysed by the laboratories in BiH with a sufficient level of confidence and precision.

The cost of fulfilling this task depends largely on the selection procedure for monitoring sites and determinands. Not all substances have to be analysed for all water bodies. Inventories of emission sources and other data may help to develop an efficient selection strategy. Examples of decision criteria from other countries can be tested for their applicability in BiH and/or an own adapted strategy can be developed.

Cost assessments from other countries can substantiate that the total cost of WFD compliant monitoring is very sensitive towards the strategy for assessing the chemical status. Several determinants are very expensive and, once selected, have to be monitored at least 12 times a year.

This topic would help to link the laboratory capacities of both entities with a suitable and WFD-compliant strategy to assess chemical status. A common timetable would help to align the activities of all involved laboratories and allow to control the process.

Issue 4: rank 4/11
Development of national methods for 'ecological status' and supporting QEs (and monitoring of reference sites)

Original description taken from the Questionnaire document:

In order to ensure a certain quality level and comparability across country borders the WFD sets a framework for the minimum standards for the assessment of BQEs (e.g. species composition and abundance).

While sampling BQEs can be based upon standardised and internationally acknowledged methods, assessment of the results requires a 'national' scale which has to be based on the specific reference conditions, typologies and deterioration characteristics of the rivers on the country's territory.

Depending on the availability of existing biological data the development of national assessment scales can be a demanding task and it needs to be planned well in advance as it requires expertise, data and time. On the one hand it may be a demanding time and resource consuming task but on the other hand if properly done, it helps also to reduce uncertainties especially with regard to drafting and implementing a programme of measures.

The efforts for sampling and developing the national methods will also contribute to the initial status assessment, to supplement and validate the risk assessment procedure, to substantiate the typology and to assess the 'overall status' of surface water in BiH. In addition to these potential synergies it can be performed and eventually outsourced as an intensive campaign over one or two years.

Topic 4 will help to get a more precise estimate on the time and financial resources needed to develop national scales for classification of the ecological status.

Issue 13: rank 5/11
Strategies / priorities to update and improve pressure related information for all key water management issues

Original description taken from the Questionnaire document:

Pressure related information plays an important role in both, the monitoring design and in the pressure impact analysis. Both contribute to the planning process for measures. Priorities are needed as it is unrealistic to address all pressures at once. Activities to update existing and collect new pressure related information should be in line with the needs of the monitoring design, with the priorities for the national programme of measures and with international priorities (key water management issues: e.g. organic pollution, hydromorphological alterations).

Topic 13 aims to outline which pressure related information would be needed and by when it should be available. This discussion could be beneficial for the monitoring implementation time plan, for reviewing the pressure impact analysis, validating and supplementing the risk assessment procedure and for drafting the programme of measures.

Issue 8: rank 6/11

Mid term roadmap for monitoring (local/regional responsibilities, gaps and financing needs, ownership for implementation)

Original description taken from the Questionnaire document:

Within this project a road map for the development of the national monitoring networks and programmes should be drafted. A mid term roadmap for monitoring helps to outline the respective implementation tasks and helps to make the process transparent for all involved actors. Further, it ensures continuity of implementation activities. Such a roadmap helps to control a complex process over a period of one water management cycle.

There are some reasons for recommending a road map:

1) Monitoring is a core element of water management it is linked with numerous other implementation activities (not only WFD).

2) Usually numerous institutions are involved in monitoring design and implementation and numerous institutions are involved as stakeholders. A roadmap provides equal access to information about the state, plans, tasks and responsibilities.

3) The necessity to prioritise due to limited resources and capacities makes the process more complex.

Topic 8 could assist in the development of a mid term strategy of monitoring design and implementation and improve the efficiency and communication by providing a joint and comprehensive programme.

Issue 12: rank 7/11

List of monitoring stations and programmes versus a set of criteria to select stations and programmes.

Original description taken from the Questionnaire document:

Monitoring is commonly understood as an iterative process with numerous steps from network design to information utilisation and redesign. There are different approaches to deal with this process. One is rather driven by tacit expert knowledge and usually results in lists of stations and programmes. The other is more formalised and more transparent. In addition to lists of stations and programmes it requires to clearly point out the motivation and objective for each station and every programme. As the monitoring objectives are clearly stated it is easier to assess the performance of the network and to adapt to changes. It is also easier to discuss the necessary monitoring budget because there is a clear linkage between the costs and the achievable objectives.

Topic 12 addresses the advantages and disadvantages of both approaches. Based on an in-depth discussion it would facilitate a general agreement about the strategic approach to monitoring design.

Issue 5: rank 8/11

Ensuring comparability of results; technical co-ordination (methods, QC) and harmonised implementation (see also topic 9)

Original description taken from the Questionnaire document:

Comparability of monitoring results is an important topic especially if decisions about measures are to be taken. If different actors or institutions are monitoring water quality in the national and international context it is important to provision against inconsistent data at the basin or sub-basin level.

Comparability has to be discussed and ensured before the start of monitoring and it has various dimensions or aspects. It is **not** sufficient to use the same or equivalent measurement methods (standards). Comparability has to be ensured also in terms of measurement frequency, spatial resolution, determinant selection, time (during the hydrological cycle or hydrologic situation), location (e.g. relative to pressures) and data evaluation.

Comparable data guarantee consistent information at basin level and allow for mutual learning and synergistic interpretation of monitoring results (e.g. assessment of confidence and precision across country/entity borders, cause – effect / dose-response relationships, etc …).

Topic 5 would help to stress the importance of a priori agreement on all dimensions of comparability and raise the awareness in this context. Topic 5 should result in a checklist of factors that need to be considered to ensure comparability.

Issue 9: rank 9/11
Checklist for 'Priority substances with EU wide EQS' elucidating 1) expertise 2) equipment 3) personnel capacities

Original description taken from the Questionnaire document:

Environmental quality standards have been set on the EU level by the COM(2006)397. Currently it is not clear whether and which laboratories in BiH can measure these substances.

Topic 9 would help to assess the situation with regard to monitoring 'chemical status' and help to outline where gaps in terms of expertise, equipment and capacities do exist.

Issue 7: rank 10/11
Task list and resources for the 'technical monitoring group'

Original description taken from the Questionnaire document:

Since the 'monitoring group' has been established in BiH it would be advantageous to develop a concrete mandate for this group. This mandate can only be developed with a view to the full variety of issues of monitoring design and implementation. This project and the involvement of an independent expert might be an opportunity to draft a first outline of this mandate.

Topic 7 would result in the formulation of a first task list and mandate for the 'monitoring group' and help to develop a common understanding of its duties.

Issue 6: rank 11/11
Decision making body (across catchments and entities))

Original description taken from the Questionnaire document:

Some aspects of monitoring design have a political or strategic dimension and scientific / technical decisions cannot be made due to uncertainties or due to different opinions of involved institutions. In some cases a profound knowledge of the national legislation is needed which cannot be provided by technical consultants. In these cases a decision making body is needed, a committee, institution

or some other provision must be made to ensure consistency of monitoring design and implementation. This is not a formal requirement but a question of ownership and responsibility.

Many of these decision are in the context of priority ranking which is necessary due to limited resources e.g. to prioritise monitoring of certain pressures.

Topic 6 could help to outline the tasks of a decision making body and make recommendations on the expertise that should be provided.

3. PROPOSALS TO BE DISCUSSED

Opportunities

BiH has pre-accession status and the national water allows for delays in the WFD implementation time schedule. This specific situation leaves space for implementation strategies that might deviate from EU-MS but which may be at least as effective and maybe more adapted to the local conditions and current situation in BiH.

Monitoring Point sources

Proposal:

Organise the monitoring of pressures stemming from municipal wastewater discharges in a way that focuses on the derivation of a clear pressure – impact relation rather than considering each individual case.

Monitor only those pressures individually where

the decision whether a water body is at risk or not can not be made based on the pressure – impact relation (see figure 3)

Measures are not necessary according to the UWWD

Discussion:

From the directive and the guidance paper it is required to monitor almost each and every point source. The directive allows only to group different point sources within a water body and to monitor them with one station. There are questions that go along with these requirements:

Scaling: If a treatment plant has an effluent that is separated from e.g. the rainwater overflow, are these two point sources? In other words: How far have two or more effluents to be positioned from each other to be a 'separate point source'? This applies for BiH in that sense: Sewers in municipal areas discharge often at different points to the river within the municipal area. It would be extremely inefficient and in terms of information extremely meaningless to monitor each single effluent separately.

Information needs: Does a dominant pressure necessarily needs to be the focus of the monitoring programme? Although discharges of municipal, industrial and combined wastewater is the most important pressure in BiH it is questionable whether monitoring each and every point source yields useful information. Especially discharges of municipal wastewater can be regarded as a relatively uncomplicated pressure; uncomplicated in terms of pressure – impact relation and uncomplicated in terms of designing, planning measures. With regard to that it would be good to consider grouping as a legitimate and appropriate tool for monitoring point sources of municipal wastewater.

Parallelities: Agglomerations and their wastewater management are mainly addressed in the UWW-Directive. Measures can be planned even without any additional input from WFD compliant monitoring. Regarding EU-MS there is certain logic behind the implementation of the UWWD (1991-1998-2000-2005) and the WFD. According to these time schedules urban waste water should not really be an issue for the POMs (Exemptions are only those agglomerations where there is still a status inferior to good status despite compliance with the UWWD– i.e. small agglomerations <2000 PE on very small rivers (catchment >10km2))

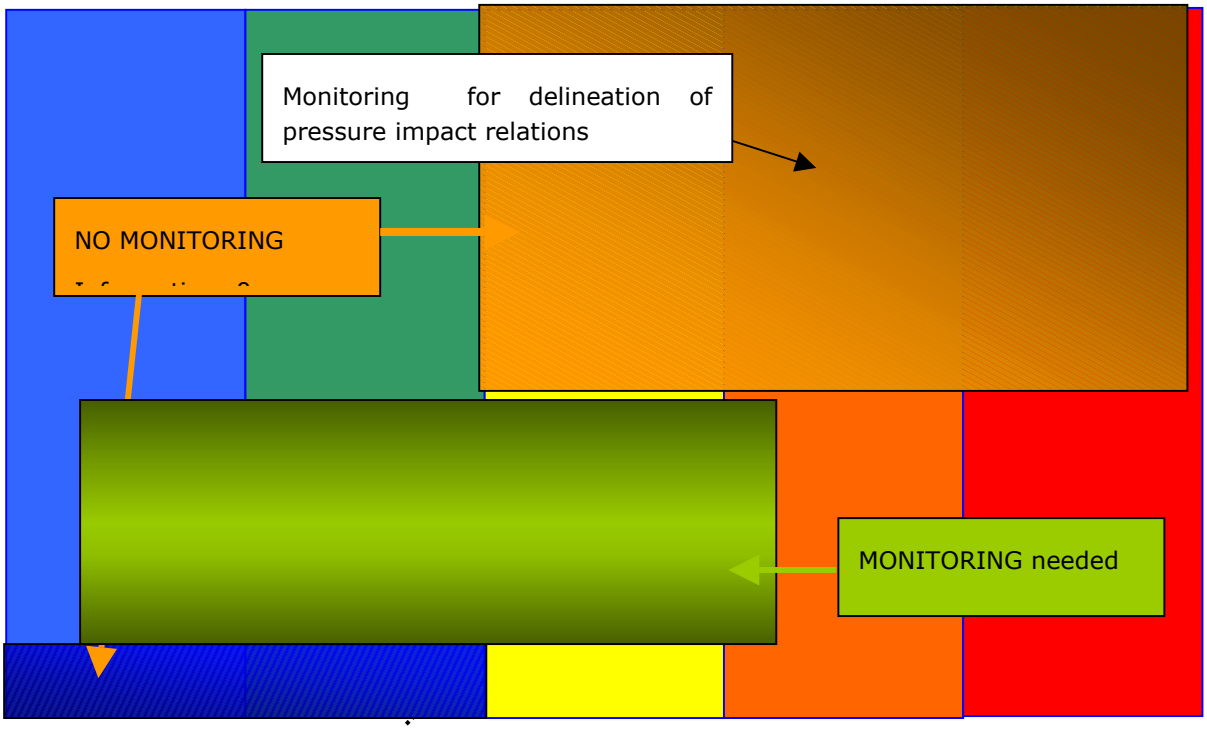


figure 3: Scheme of the strategy fort he selection of poitn sources for monitoring (applicable only after a cause-effect relation and its confidence intervals have been derived)

4. ISSUES FOR DISCUSSION

The following list of issues was compiled as a result of the meetings so far. It is not ranked according to importance or according to relevance for the project, neither does it separate strategic from technical topics or questions.

Issue 1: CU
Currently the whole monitoring topic is discussed under the header "WFD implementation" whereas it can be clearly seen that some of the topics are not **genuine WFD implementation** (e.g. monitoring municipal and industrial effluents). To discuss this separation between monitoring of 'single pressures' and 'monitoring ecological status' could help to improve the understanding of WFD compliant monitoring.

Issue 2: CU
The focus of the proposed network is on pollution with degradable organic substance. It would help

to increase the awareness of the fact that effluents of **untreated wastewater create three WFD related pressures**: organic pollution, nutrient pollution, hazardous substances pollution.

Issue 3: PotOPP
Sketch the **opportunities that arise from the different time schedule** in EU-MS and pre-accession countries (e.g. synergies between typology, monitoring and impact assessment, avoid errors of EU-MS (e.g. water body delineation), hybrid approach to Article 5 and monitoring design)

Issue 4: GAP
Open discussion of and **quantification in terms of financing and time schedule of the requirements of monitoring the 'ecological status'** including method development, typology, intercalibration and water body delineation; drafting a way forward, developing a road map.

Issue 5 (see also Issue 1): CU
General discussion and corresponding decisions on the following topic: Does BiH implement the WFD only or does it understand these **activities as part of the EU integration process** (e.g. implementing the urban waste water directive, surface water for drinking water, nitrates directive, …). The main difference is that the framework of EU legislation might seem inconsistent without taking into account the whole ensemble of EU legislation. preliminary answer by MOFTER (Mr. Reuf Hadžibegić): "The new water act implements ALL relevant EU directives, thus UWWD has the same status on the political agenda like WFD."

Issue 6: CU strategic cornerstones / principles / paradigms
Promote a quality oriented approach: Assume a quality oriented strategy instead of only formally fulfilling WFD requirements. Evidentiate the link between targeted measures and monitoring, the potential **economic consequences of flawed data**.

Issue 7: CU strategic cornerstones / principles / paradigms
Develop a **reasonable compromise between an output oriented and a process oriented approach**. Discuss monitoring as a control circuit of transitional states.

Issue 8: PotOPP
Outline a strategy for a transition from a 'station' oriented network to a 'water body' oriented network.

Issue 9: GAP
Assess possibilities to **improve pressure related information** (land use, emission cataster, hydromorphological assessments (double role of hydro-morphology: as a 'pressure' and as a 'quality element')).

Issue 10: GAP
Inventory of **protected areas**: Which international conventions are endorsed in BiH?

Issue 11:
Discuss **scaling issues** with regard to monitoring and pressure impact assessment: DRB scale = 4000km2, surveillance scale = 2.500km2, WFD scale generally assumed to > 10km2, national scale)

Issue 12: GAP
Outline capacities and resources needed to perform hydromorphological assessments.

Issue 13: GAP
Develop a transition approach from 'operational monitoring according to assumed pressures' (tacit expert knowledge) to 'operational monitoring as a consequence of pressure-impact analysis'

Issue 14: potOPP
Highlight **transboundary issues and potential synergies**: Joint monitoring of the Sava (with Croatia) and the Drina river (with Serbia) also for QC purposes.

Issue 15: CU strategic cornerstones / principles / paradigms
Due to distributed responsibilities for water management and monitoring (2 ministries and 4 water agencies + hydrometeorological institutes) **comparability of the results** is an important topic. Comparability in terms of methods, confidence and precision but also in terms of time schedule for implementation. Although the proposed programme is for the entire territory and therefore consistent, the practical implementation needs to take place in a harmonised way across entity borders (for the Danube catchment) and laboratories (for the Adriatic catchment).

Issue 16: CU strategic cornerstones / principles / paradigms
With reference to Issue 15 there is currently no institution or platform that is responsible to coordinate and harmonise. MOFTER does not seem to have the authority and technical expertise

Issue 17: GAP
Intercalibration process for BiH: Organisational frame, capacities, resources and time plan?

Issue 18: CU strategic cornerstones / principles / paradigms
Numerous (several 100) online monitoring devices have been supplied to BiH by various projects. The potential use of these 'stations' (namely multiparameter probes) for WFD compliant monitoring is unclear; in general it seems that the potential of these devices is overestimated. It would help to define clear tasks of these devices within the frame of WFD compliant monitoring (and to avoid unnecessary efforts).

Issue 19: GAP
Develop a reasonable and clear strategy for P(H)S and other substances under the given restrictions. Currently there is no decision rule to decide which (hazardous) priority and which other substances should be selected for a certain location. An (updated) emission inventory is missing (although there is a discharge tax system in place).

Issue 20: GAP
Issues of grouping water bodies could not be integrated into the proposed design. Thus the representativity can currently not be assessed.

Issue 21: GAP
The network in general and the time schedule for implementation are impact oriented. Thus it may not give a balanced picture of ALL the water bodies in BiH. Changes in the overall picture are likely to occur as an 'artefact' resulting from an increasing number of non-impacted monitoring locations.

Issue 22: GAP
Hydromorphological monitoring is foreseen for stations where biological monitoring is planned. The selection of sites is largely dominated by pollution due to discharges of untreated wastewater. Therefore it is likely that sites where only hydromorphological impacts occur are underrepresented. As a consequence it may become difficult to include hydromorphological alterations in the next impact assessment due to lasting lack of data.

Issue 23: potOPP
Due to the division in extensive and intensive stations the proposed monitoring frequencies are not fully compliant with the WFD and guidance document.

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