

Background paper to the Public Consultation

On the revision of the Annexes of the Groundwater Directive

Authors:

Andreas Scheidleder (Umweltbundesamt-AT) & Sarah Bogaert (ARCADIS BE)



DISCLAIMER

Please note: The views expressed in this background paper are the sole responsibility of the authors and may not in any circumstances be regarded as stating an official position of the European Commission or individual Member States.

Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use which might be made of the information contained herein.

Table of contents

1	Background	1
1.1	Groundwater Directive requirements – Relevance of Annex I and II	1
1.2	Why a review?	1
1.3	Policy context.....	3
2	Baseline situation and key problems to be addressed.....	7
2.1	Application of EU-wide groundwater quality standards (GWD Annex I).....	7
2.2	Established groundwater threshold values and their comparability (GWD Annex II)	8
2.2.1	Substances for which threshold values have been established	8
2.2.2	Evolved knowledge base and existing knowledge gaps.....	10
2.2.3	Comparability of threshold values (TVs).....	11
2.3	Transparency and reporting.....	12
2.4	Identification of key problems	13
3	Objectives of the present review.....	15
4	Identification of policy options.....	16
4.1	Overview	16
4.2	Policy options in relation to the update of the list of substances regulated at EU and national level to new scientific and technical information (Annex I and Annex II part B)	17
4.3	Policy options in relation to the insufficient comparability of TVs and hence of the assessment of groundwater chemical status	17
4.4	Policy options in relation to insufficient transparency and reporting.....	18
4.5	Policy options in relation to knowledge gaps	19
5	List of References.....	23

List of Abbreviations

CIS	Common Implementation Strategy
DW	Drinking water
DWD	Drinking Water Directive
EC	European Commission
EQS	Environmental Quality Standard
EQSD	Environmental Quality Standards Directive
EU	European Union
GW	Groundwater
GWB	Groundwater body
GWD	Groundwater Directive
IPChem	Information Platform for Chemical Monitoring
MAC	Maximum allowable concentration
NBL	Natural background level
TV	Threshold value
µg/L	micrograms per liter
WFD	Water Framework Directive

1 Background

1.1 Groundwater Directive requirements – Relevance of Annex I and II

Europe's waters are at risk from a wide range of pollutants from different sources, from over-abstraction and from physical changes to water courses. The Water Framework Directive (WFD, 2000/60/EC) was adopted in the year 2000 to provide a policy framework for preserving and restoring the quality of European water bodies in a highly integrated manner. As the cornerstone of EU water policy, the WFD requires that all water bodies must meet the "good status" as a rule by the end of 2015.

Entering into force in the year 2006, the Groundwater Directive (GWD, 2006/118/EC) on the protection of groundwater against pollution and deterioration is one of the daughter directives of the WFD and establishes criteria for the assessment of good chemical status. For this purpose, Member States are required to apply the groundwater quality standards defined in Annex I of the GWD and establish threshold values (TVs) following the application of the guidelines set out in Annex II.

Quality standards under Annex I are provided for nitrates and pesticides (individual and total), where for pesticides this also includes relevant metabolites, degradation and reaction products. Additionally Annex I includes reference to the Plant Protection Products, Biocides and Nitrates Directive in terms of ensuring consistency in terminology, definition and application. Annex I also includes a requirement to establish more stringent standards (threshold values) on a case-by-case basis where it is needed to ensure that environmental objectives are achieved.

Annex II establishes the framework for defining and reporting TVs. Threshold values must be established for all pollutants (and indicators of pollution) which are putting groundwater bodies at risk of failing to meet the objectives for good chemical status. They must be established by taking into account all of the requirements of good chemical status as defined in Annex V (2.3.2) of the WFD, in particular the potential impact on and interaction with, associated surface water bodies and directly dependent terrestrial ecosystems like wetlands.

Annex II is divided into three parts:

- Part A provides guidelines for the establishment of TVs;
- Part B identifies a minimum list of pollutants (and their indicators) that must be considered when setting TVs and;
- Part C identifies the related information that should be reported in the RBMPs.

1.2 Why a review?

During the development of the GWD, it was not considered appropriate to list new quality standards that would be applied uniformly to all groundwater bodies throughout Europe, because of the natural variability of groundwater chemical composition and the lack of monitoring data and knowledge at the time.

The position of the European Parliament (Committee on the Environment, Public Health and Food Safety, March 21, 2005) stated: “*To introduce common standards would be to ignore the variability of the natural quality of groundwater not only between, but also within, aquifers (e.g. chloride can vary naturally from 20 mg/l to over 10,000 mg/l within a distance of 10 km). Groundwater’s roles in supporting ecosystems and other uses also vary. Imposing common standards would be like standardising shoes to a single size and design. Sometimes they would be too tight, sometimes too loose.*”

And the Committee on Agriculture and Rural Development expressed its opinion that, “*If the different threshold values applied by the Member States prove to have a negative impact on the environment or the economic level playing field in the Community, legislation should be adopted in order to prevent it.*” (Environment Parliament, 2005)

The GWD entered into force in the year 2006 and reflects best available knowledge and consensus of that time. According to Article 10 of the GWD, the Annexes I and II should be amended in light of scientific and technical progress every six years. This is the first review of this kind.

According to Article 10 (Review) of the GWD,

Without prejudice to Article 8, the Commission shall review Annexes I and II to this Directive by 16 January 2013, and thereafter every six years. Based on the review, it shall, if appropriate, come forward with legislative proposals, in accordance with the procedure laid down in Article 251 of the Treaty, to amend Annexes I and/or II. In its review and in preparing any proposal, the Commission shall take account of all relevant information, which might include the results of the monitoring programmes implemented under Article 8 of Directive 2000/60/EC, of Community research programmes, and/or of recommendations from the Scientific Committee on Health and Environmental Risks, Member States, the European Parliament, the European Environment Agency, European business organisations and European environmental organisations.

The objective is now to review the Annexes I and II of the GWD, ensuring that the provisions in the Directive are still in consensus with the technical/scientific developments and in line with the WFD and GWD aiming at a high and equal level of protection of water resources including uses throughout Europe.

As the Fitness Check of EU Freshwater Policy ([SWD\(2012\) 393](http://ec.europa.eu/environment/water/blueprint/fitness_en.htm); http://ec.europa.eu/environment/water/blueprint/fitness_en.htm) states, the Groundwater Directive is still in the process of implementation therefore it would be too early to draw conclusions on the overall performance achieved in the Member States with the implementation of the Directive. The scope of the present review is therefore limited to the specifications laid down in Article 10 of the GWD, e.g. representing only a distinct part of the overall compliance regime and status assessment procedure. As Article 19.2 of the WFD foresees that this Directive will be reviewed at the latest 19 years after the date of its entry into force, legal amendments to the WFD are outside of the scope of the present review but can be taken forward during the review of the WFD in a later stage.

If only technical adaptations would be needed in the Annexes of the GWD in the light of scientific and technical progress, the procedure foreseen in Article 8 should be used. The present review will consider cases where Article 8 might be used.

According to GWD Article 8 (Technical adaptations),

1. Parts A and C of Annex II and Annexes III and IV may be amended, in the light of scientific and technical progress, in accordance with the regulatory procedure with scrutiny referred to in Article 9(2), taking into consideration the period for reviewing and updating river basin management plans, as referred to in Article 13(7) of Directive 2000/60/EC.

2. Part B of Annex II can be amended, in accordance with the regulatory procedure with scrutiny referred to in Article 9(2), in order to add new pollutants or indicators. (This is without prejudice as to realignment of these provisions by virtue of the follow up to the Lisbon Treaty - delegated and implementing acts)

1.3 Policy context

Since the year 2000, when the WFD entered into force, huge efforts have been undertaken by the Member States in establishing the first river basin management plans (RBMPs) by the end of 2009.

Starting with the identification of the River Basin Districts (RBD) and the responsible competent authorities in Europe, by 2004 all RBDs needed to be characterised for the first time, by delineating and describing all water bodies and by reviewing the impact of human activity on the status of surface waters and groundwater. When focusing on groundwater quality only, this review had to be validated by monitoring data (surveillance monitoring) for all groundwater bodies and as a result, for all groundwater bodies it had to be identified whether they were at risk of failing to achieve the good groundwater chemical status objectives by 2015.

Entering into force in the year 2006, the GWD establishes the criteria for the assessment of good chemical status by setting EU-wide uniform groundwater quality standards as well as provisions on the establishment of groundwater threshold values. All groundwater bodies 'at risk' are subject to further characterisation and operational monitoring and for those pollutants contributing to the risk characterisation, groundwater threshold values had to be established for the first time by the end of 2008. Finally, to achieve the good status objectives, appropriate measures have to be implemented by the Member States.

The procedure and results, from the identification of the RBDs to the implementation of measures, had to be summarised in the RBMPs, which was reported for the first time to the European Commission by the end of 2009 and which is subject to review and revision every six years.

The European Commission published the Blueprint to Safeguard Europe's Water Resources in November 2012 that aims to tackle the obstacles which hamper action to safeguard Europe's water resources, based on an extensive evaluation of the existing policy. The Blueprint assessed several elements of groundwater related legislation and its implementation:

- The Fitness Check of EU Freshwater Policy ([SWD\(2012\) 393](#); http://ec.europa.eu/environment/water/blueprint/fitness_en.htm) contains some analysis of the Groundwater Directive however this analysis is limited because the Groundwater Directive is still in the process of implementation. A large majority of respondents to the public consultation considered that the Groundwater Directive is successful. The Fitness Check recognises though that whilst the Directive have led to improvements in water quality, there are nonetheless indications that further action may be needed to address both listed substances and to include an expanding list of pollutants which are not presently covered by EU legislation.
- The European Overview of the 3rd Implementation Report of the Water Framework Directive ([SWD\(2012\)379](#); http://ec.europa.eu/environment/water/water-framework/implrep2007/index_en.htm#third) has a strong groundwater component, as it assesses the whole water management cycle focusing especially on groundwater monitoring, groundwater status assessment and measures related to groundwater protection. The first RBMPs gave first insight into the different established approaches, assessment criteria and status results. The Report contains conclusions and recommendations, some of them form the basis of the review of the GWD Annexes:
 - Detailed and disaggregated information is required on the monitoring undertaken at each site and water body so that a complete assessment of the monitoring across the EU can be done in future.
 - It is recommended that more detailed information is provided in future RBMPs as monitoring is one of the key aspects in classifying water bodies and identifying where measures are needed. This should help make the whole decision making process more transparent to all stakeholders.
 - Co-ordinated monitoring of international transboundary water bodies should be further developed in order to achieve effective monitoring of those water bodies.
 - Reliability of the status assessment should be improved by extended monitoring.
 - RBMPs should clearly address all elements specified in the WFD related to both the good chemical and the good quantitative status of groundwater. RBMPs should clearly report the reasons for not considering certain elements.
 - Groundwater bodies characterised as being at risk and the pollutants that contribute to this classification should be reported in the RBMPs.
 - RBMPs should clearly indicate whether all substances causing a risk of not meeting good chemical status and all Annex II substances were considered in the establishment of groundwater threshold values and what are the results of these considerations.

- Information on exceedances of quality standards and/or threshold values should be reported also for groundwater bodies in good chemical status.
- Groundwater dependent ecosystems and groundwater associated surface water bodies should always be considered.
- Methodologies for the establishment of threshold values need to be transparent and better harmonised among Member States. Acceptable extent of exceedance of quality standards and threshold values should be based on transparent criteria considering CIS guidance documents.
- Transboundary co-ordination of the establishment of threshold values should be applied in all transboundary groundwater bodies.
- In support of the 3rd WFD Implementation Report an in-depth assessment was performed to explore the reasons for the considerable variations of TVs that was identified in the first River Basin Management Plans (http://ec.europa.eu/environment/water/water-framework/implrep2007/pdf/In-depth_assessment_GW_TV-FinalReport.pdf). Earlier the European Commission prepared a report on the TV established in the Member States, which provided a first overview of the substances/indicators for which TVs were established and the ranges of the TVs throughout Europe (C(2010) 1096 final; <http://ec.europa.eu/environment/water/water-framework/groundwater/pdf/EN.pdf>).

In parallel, the Working Group Groundwater under the Common Implementation Strategy for the WFD prepared Technical Report No 7 which summarises recommendations contributing to the review of the GWD (European Commission 2012b; <https://circabc.europa.eu/w/browse/1e3530ea-5c51-4868-b4ff-8285b5fb90c8>).

2 Baseline situation and key problems to be addressed

2.1 Application of EU-wide groundwater quality standards (GWD Annex I)

For the purposes of assessing chemical status, Member States are required to apply the groundwater quality standards defined in Annex I of the GWD. Groundwater quality standards are established for nitrates (50 mg/L) and for pesticides (0.1 µg/L and 0.5 µg/L) and they refer to existing EU environmental legislation, the Nitrates Directive (91/676/EEC), the Regulation 1107/2009 concerning the placing of plant protection products on the market and the Regulation 528/2012 concerning the placing on the market and use of biocidal products. These quality standards guarantee a uniform, comparable and transparent level of protection of the environment within the EU and they contribute to close integration with related policies of environmental legislation.

According to the RBMPs, the main pollutant responsible for causing poor groundwater chemical status in Europe is nitrates (European Commission, 2012) followed by pesticides, showing that Annex I is addressing EU-wide concerns. As the exceedance of the currently established groundwater quality standards for nitrates and pesticides is the main reason for poor groundwater chemical status, there is still potential for improvement of the baseline situation throughout Europe.

With the GWD provisions laid down in Point 3 of Annex I and the risk-based approach established in Article 3 and in Annex II Part A, Member States are obliged to establish more stringent TVs than the uniform quality standards where compliance even with the uniform standards could result in failure to achieve the environmental objectives for both associated surface waters and groundwater dependent terrestrial ecosystems. For nitrates, more stringent threshold values have been established by five Member States, and nine Member States have established more stringent TVs for in total 37 pesticides (for details please consult the report "In-depth assessment of the differences in groundwater threshold values established by Member States" on http://ec.europa.eu/environment/water/water-framework/implrep2007/pdf/In-depth_assessment_GW_TV-FinalReport.pdf).

Overall very little scientific evidence or assessment methodology is currently available to enable consideration of groundwater dependent ecosystems. In the framework of the Common Implementation Strategy for the WFD an information exchange on the established methodologies and best practices used in Member States is in progress. Based on the results of this information exchange technical documents will be prepared to assist the establishment of ecosystem based threshold values in more Member States in the next cycle of river basin management planning. Therefore tightening of existing European quality standards is not considered in this review.

Regarding pesticides, Annex I states that a groundwater quality standard of 0.1 µg/L will apply to all active substances in pesticides, including their relevant metabolites, degradation products and reaction products (0.5 µg/L for the sum of all of these detected in groundwater). During the elaboration of the Technical Report No 7, (European Commission, 2012b) there was agreement that it would be useful to clarify the definition of "relevant metabolite". However, following

discussions at the 21st WGC meeting (13th October 2011) it was recognized that "relevant metabolite" might have different meanings in the context of the different pieces of European legislation and the scientific community; therefore this issue cannot be tackled in the review of GWD Annexes only.

2.2 Established groundwater threshold values and their comparability (GWD Annex II)

During the development of the GWD, it was not considered appropriate to list quality standards under Annex I other than for Nitrates and Pesticides to be applied uniformly to all groundwater bodies throughout Europe because of the natural variability of groundwater chemical composition and the lack of monitoring data and knowledge at the time. Instead, a risk-based approach (Article 3 and Annex II Part A) was established. This risk-based approach is based on the review of impacts of human activity on the status of groundwater and the validation of the results of the review by surveillance monitoring where there is a likelihood of risk. In a next step, the risk-based approach requires the establishment of national/local quality standards (so called threshold values) for all pollutants and indicators which characterise groundwater bodies at risk of failing to achieve good groundwater chemical status.

Following Article 3 and Annex II Part A of the GWD, Member States have to establish groundwater threshold values following the approach above for all pollutants and indicators which characterise groundwater bodies at risk of failing to achieve good groundwater chemical status. According to the guidelines under Annex II Part A, when establishing threshold values Member States need to consider the receptors¹ of groundwater, the natural background concentrations of naturally occurring substances and the substances and indicators listed in Part B of Annex II.

In 2010 the European Commission report under Article 3.7 GWD (European Commission, 2010) provided a first overview of the threshold values established by Member States and the applied procedures. It gave first insight in the pollutants/indicators for which TVs were set, and the considerable ranges of TVs for particular pollutants. The first RBMPs (by 2009) provided for the first time comprehensive information on the status of groundwater bodies and the established TVs throughout Europe. The plans were assessed within the 3rd WFD Implementation Report accompanying the Blueprint to Safeguard Europe's Water Resources (European Commission, 2012).

2.2.1 Substances for which threshold values have been established

As reported by Member States, groundwater threshold values were established in total for more than 580 pollutants/indicators in Europe. Excluding all pesticides for which the quality standard of 0.1µg/L was reported as the TV, there remain 215 pollutants/indicators with TVs. For 20 pollutants/indicators, groundwater TVs have been established in at least eight Member States in Europe (see Table 1). Due to the risk-based approach, substances are considered as not being relevant in those

¹ Receptors potentially affected by groundwater contamination can be e.g. drinking water abstraction, GW dependent terrestrial ecosystems or surface water bodies.

Member States which did not establish TVs (no risk of failing good groundwater chemical status as a result of those substances).

Table 1: All pollutants/indicators for which threshold values have been established in at least eight Member States. Threshold values, ranges and quality standards under the Environmental Quality Standards (EQS) Directive and the Drinking Water (DW) Directive

Substance/Indicator	DWD	EQS AA-value	Number of Member States that established/identified			Threshold values		
			TVs	Poor status	Risk*	Min	Max	Ratio
Annex II – naturally occurring substances								
Chloride (mg/l)	250		26	15	18	24	4,750	198
Ammonium (mg/l)	0.5		24	14	14	0.065	10	152
Sulphate (mg/l)	250		24	13	16	100	7,000	70
Arsenic	10		23	13	13	5	653	131
Lead	10	7.2	23	9	10	5	320	64
Cadmium**	5	0.08–0.25	21	7	11	0.08	27	338
Mercury**	1	0.05	19	5	8	0.05	1	20
Conductivity (µS/cm)	2,500		16	11	11	520	10,480	20
Annex II – synthetic substances								
Tetrachloroethylene		10	11	8	6	0.3	58	193
Trichloroethylene		10	10	9	6	0.2	55	276
Tetrachloroethylene + Trichloroethylene	10		8	-	5	5	10	2
Other naturally occurring substances								
Chromium	50		12	-	4	5	50	10
Nickel		20	12	-	9	5	116	12
Copper	2,000		10	-	6	10.1	2,000	198
Boron (mg/l)	1		9	-	4	0.5	1	2
Fluoride (mg/l)	1.5		9	-	4	0.75	7	9
Nitrites (mg/l)	0.5		8	-	6	0.09	1.4	16
Sodium (mg/l)	200		8	-	5	50.9	1,300	26
Other synthetic substances								
Benzene	1	10	12	-	7	0.5	1	2
Benzo(a)pyrene**	0.01	0.05	10	-	4	0.005	0.075	15
1,2-Dichloroethane	3	10	9	-	5	1.5	3	2

Note: All threshold values in µg/L except otherwise stated.

* Source: European Commission, 2010. Risk refers to the risk of failing to meet the objectives under Article 4 WFD for groundwater bodies.

** Priority hazardous substance (according to the EQSD)

The substances listed under Annex II Part B were found to be the most frequently reported in the RBMPs and besides Annex I pollutants are the only ones reported to be causing poor status of groundwater bodies in Europe. Therefore, no other substance except those listed in Annex II Part B could be identified as of European-wide concern.

2.2.2

Evolved knowledge base and existing knowledge gaps

Certain substances posing a potential risk of adverse effects on the environment may have long been present in the environment but information on their presence and significance is only now becoming available. These so-called emerging contaminants or pollutants include among others some veterinary and human pharmaceuticals, flame retardants, artificial sweeteners, personal care products, pesticides and their degradation products, biocides, life-style compounds, and other industrial compounds such as solvents, surfactants or plasticizers.

A review² of sources, fate and occurrence of emerging organic contaminants in groundwater concluded that ng/L to µg/L concentrations are present in groundwater for a large range of these substances as well as metabolites and transformation products and under certain conditions they may pose a threat to freshwater bodies after decades due to relatively long groundwater residence times.

Groundwater may be particularly vulnerable to the persistence of several emerging pollutants as natural attenuation appears to be constrained, due to the absence of photodegradation by sunlight. As a consequence, a long-term and probably sustained contamination of groundwater with micropollutants especially beneath urban areas can be expected.

In the coming decades, more of these contaminants are likely to have drinking water standards, environmental quality standards and/or groundwater threshold values defined, and therefore a better understanding of their spatial and temporal variation remains a priority.

Compared to surface water resources, the occurrence of emerging contaminants in groundwater, and their presence as mixtures, is poorly characterised. Many national and regional studies have been biased towards potentially contaminated sites, so that the actual occurrence or frequency of detection and distribution in groundwater remains largely unknown. More systematic regional scale and European wide studies are needed to fully assess the spatial and temporal occurrence of emerging contaminants in groundwater and more research is needed on their fate and their environmental effects (Lapworth et al. 2012).

Also the Fitness Check of EU Freshwater Policy as part of the Blueprint identified a clear gap regarding the consideration of human (and to a lesser extent veterinary) pharmaceuticals, but recognised that due to the lack of sufficient and robust information and data further investigations need to be stipulated before further decisions are taken at European level. The Commission is due to present a report on the scale of this problem, along with an assessment of whether amendments to EU legislation on medicinal products or other relevant EU legislation are required (European Commission, 2012a).

In principle, if Member States follow and implement the risk-based approach correctly and comprehensively, it could be assumed that the significant pressures are addressed and tackled. However, due to the huge number of chemical substances present in the environment and the considerable gap in available and robust monitoring data, in practice some pressures and impacts in the risk assessment might not be detected. And where the knowledge gaps for certain

² (Lapworth et al. 2012)

groups of contaminants remain, these pressures and impacts might not be appropriately or widely addressed in the future either.

2.2.3 Comparability of threshold values (TVs)

The WFD and GWD concede certain flexibility to the Member States in the establishment of TVs by taking regard of the different receptors of the groundwater body, the risks and functions, the characteristics and behaviour of the pollutants and the hydrogeological characteristics represented by the natural background levels.

The comparison of the established TVs which were reported in the RBMPs demonstrates huge ranges (see the ratios between maxima and minima in Table 1). An in-depth assessment (Scheidleder, 2012) explored the reasons behind the variations of threshold values for selected pollutants/indicators and concluded that even if a certain degree of harmonisation within the establishment of TVs and the compliance regime (chemical status assessment) is aimed at in the Directives, the assessed criteria, approaches and methodologies applied by Member States are considerably different. The existence of different approaches and methodologies results in incomparability of TVs in Europe and can cause problems in achieving good status objectives in transboundary groundwater bodies.

It was found that the wide ranges and the high values of TVs throughout Europe are mainly caused by the natural background levels (NBLs) but also by various environmental quality standards used, depending on the relevant receptor to be considered.

The NBLs represent the hydrogeological and hydro-chemical conditions in a groundwater body and they are the result of various factors such as water–rock interactions, chemical and biological processes in the vadose zone, residence time, rainfall, relationships with other aquifers (leakage). For this reason, each groundwater body is different and has a unique natural chemical composition. Furthermore, within each groundwater body, spatial variations of the natural background level are frequently observed (Deeply investigated within the Baseline project and the BRIDGE project). Currently, each Member State is free to apply any methodology in deriving such NBLs as Annex II provides no respective guideline or specification. But, as concluded from BRIDGE (case study implementation) the TV establishment strongly depends on the NBLs, hence the procedure is very sensitive to the selection of reasonable NBLs (Hinsby & Melo, 2006).

For some synthetic substances without natural background the established threshold values are surprisingly variable as well (see Table 1). This variability mainly originates from the fact that different receptors (with different ecotoxicological criteria values or national drinking water standards) were considered within the risk-based approach of the TV establishment process.

Also the established relationships between TVs on the one hand and NBLs, drinking water standards and environmental quality standards on the other hand give rise to incomparability of threshold values. Currently there are eight different relationships applied throughout Europe between TVs and NBLs.

The fact that the NBLs are established at different geographical levels also influences variability and comparability (at the level of groundwater bodies, river basin districts or at national level). The sizes of groundwater bodies, the level, method and period of aggregation of monitoring results are highly variable and the definition and identification of the acceptable extent of exceedance when assessing chemical status. These aspects are included in the WFD and therefore go beyond the present review of GWD Annexes and might be tackled at the time of the review of the WFD.

The Blueprint to Safeguard Europe's Water Resources states that "The relationships between the threshold values and the background values vary considerably from Member State to Member State depending on the national approaches taken" (...) "Threshold values established in Europe are hardly comparable" (...) "Methodologies for the establishment of threshold values need to be transparent and better harmonised among Member States". (European Commission, 2012c).

2.3 Transparency and reporting

Transparency in the reported information would be the first condition of correct interpretation and of comparability of EU-wide results. This concerns reporting of groundwater bodies characterised as being at risk and of the pollutants that contribute to this classification and that were considered in the establishment of TVs. In addition to this, the methodologies of calculating and considering NBLs of pollutants should be transparent and information on exceedance of quality standards should be reported in case groundwater bodies are of good chemical status.

Annex II Part C lays down all information that has to be reported by the Member States within the RBMPs as regards the pollutants and their indicators for which threshold values have been established. All elements mentioned are subject to reporting as long as it is feasible to report them, which gives some flexibility to Member States.

However, the information reported in the RBMPs was not always sufficient and not providing a solid basis for comparisons and analyses, which had to be complemented by further targeted questionnaires to the Member States. This was the case when preparing the Commission report in accordance with Article 3.7 of the GWD on the establishment of groundwater threshold values (European Commission, 2010) and during the in-depth assessment of groundwater threshold values (Scheidleder, 2012). Member States did not always follow the guidelines established under Annex II Part A or they interpreted them in different ways, while also the reported information is not complete in a number of RBMPs, which prevents assessing whether the guidelines have been followed or not.

The NBLs are the most influencing factors in establishing TVs and primarily responsible for the considerably high ranges. In face of their elementary influence on the TVs, there is a clear lack of reporting about the basis and methodology with which NBLs are derived hampering transparency and comparability of NBLs.

Furthermore, it is important to recognise that the NBL is not a single value but a range of values, which may vary considerably within and between groundwater bodies (Hinsby & Melo, 2006).

The analyses and assessments prepared so far showed that several reporting gaps of elements listed in Annex II Part C can be identified for a number of Member States:

- Although threshold values were reported for a large number of pollutants/indicators, it was not always clear which of these pose an actual risk to groundwater bodies of not meeting good status in 2015 (European Commission, 2012c). The number of groundwater bodies at risk and the pollutants contributing to this classification were mostly not reported and no Member State provided observed concentrations/values.
- Information on NBLs was rarely reported and there was no link to the groundwater bodies at risk.
- Information as regards the relationship between TVs and NBLs was not very detailed and neither was the relationship between TVs and quality objectives.
- Information on the relationship between TVs and any other information on substances' properties was not reported at all.

Even if Member States fulfil the reporting obligations under the WFD and GWD, it is difficult to compare the status results throughout Europe at the next reporting cycle. Therefore the European Overview of the 3rd WFD Implementation Report³ accompanying the Blueprint, recommends the following:

- "RBMPs should clearly address all elements specified in the WFD"
- "RBMPs should clearly report the reasons for not considering certain elements."
- "Groundwater bodies characterised as being at risk and the pollutants that contribute to this classification should be reported in the RBMPs."
- "RBMPs should clearly indicate whether all substances causing a risk of not meeting good chemical status and all Annex II substances were considered in the establishment of groundwater threshold values and what are the results of these considerations."
- "Information on exceedances of quality standards and/or threshold values should be reported also for groundwater bodies in good chemical status."

2.4 Identification of key problems

When analysing the current situation, the findings and the conclusions drawn from related discussions, analyses and assessments, four specific challenges can be identified to be addressed in the present review of Annex I and II:

1. Although the Blueprint did not identify new pollutants that cause European-wide risk to groundwater bodies there is some new information on emerging substances. Also, variability of methodologies to establish TVs in Member States might not ensure the same level of environmental

³ A European Overview – Commission Staff Working Document ([SWD\(2012\)379](#), p. 172

protection in transboundary groundwater bodies. Therefore updating the list of substances regulated at EU and national level based on new scientific and technical information is potentially needed (Annex I and Annex II part B).

2. Throughout the EU, there is insufficient comparability of TVs and hence of the assessment of groundwater chemical status (Annex II part A). Different approaches of threshold value establishment can cause problems of achieving good status objectives in transboundary groundwater bodies.

Although a certain degree of harmonisation within the establishment of TVs and the compliance regime (chemical status assessment) is given in the GWD and WFD and in the guidance documents assisting in their implementation, considerable differences were found in the assessed substances/indicators, criteria, approaches and methodologies applied by Member States.

3. Insufficient transparency and reporting as regards the assessment of groundwater chemical status (Annex II part C)

Currently, information requested under Annex II Part C is to be reported 'where feasible'. This limitation seemed to be commonly interpreted as 'optional reporting' and used to justify non-reporting by many Member States. Moreover, the analyses and assessments prepared so far demonstrated that important elements for assessing comparability of threshold values and status results are not subject to reporting or the reporting requirements under the GWD were not always entirely clear or requested at the appropriate level of aggregation.

4. Knowledge gaps were identified relating to risk assessment of substances of concern, including emerging environmental contaminants

Even though the knowledge has been improved since the adoption of the GWD there are still significant gaps regarding the knowledge of the occurrence of all potential substances and pollutants in groundwater of concern, including emerging contaminants and their fate and environmental effects (unregulated substances are not being monitored regularly). This might lead to a situation where pollutants/indicators and their pressures might remain undetected and not appropriately and widely addressed in the future.

3 Objectives of the present review

The obligations under the WFD are referred to in previous sections. In line with those, the general objectives of the proposal are the following:

- Ensure a high and equal level of protection of groundwater resources including their connected or dependent ecosystems and their uses on a level playing field including transboundary groundwater bodies.
- Enhance the comparability of the assessment of groundwater chemical status throughout the EU
- Rely decision-making on sufficient, correct, robust and transparent information
- Increase the knowledge base on the occurrence and fate of substances of concern

The specific objectives are the following:

- Adjust the lists of pollutants to the latest scientific and technical knowledge
- Move towards a uniform and transparent procedure for establishing TVs
- Optimise transparency and quality of reporting and remove reporting deficits
- Strengthen the current legislation on reporting requirements
- Ensure improved knowledge based on monitoring data to make future identification of substances of concern more effective

These objectives are compatible with the overarching EU objective, reinforced in the Treaty of Lisbon, that the EU will work for the sustainable development of Europe based, in particular, on a high level of protection and improvement of the quality of the environment.

4 Identification of policy options

4.1 Overview

The options presented in this section address one or more of the problems and objectives presented in sections 2 and 3. The table below shows the correspondence between the options and the problems, sub-problems and objectives. The last column indicates the specific questions addressing the options in the Public Consultation Questionnaire.

Problem	Sub-problem	General objective	Specific objectives	Options	Questions
Adjustments of pollutant lists might be needed to new scientific and technical information on substances of concern	-	Ensure a high and equal level of protection of groundwater resources including transboundary groundwater bodies	Consider the latest scientific and technical knowledge Identify substances for which uniform quality standards could be set	A2-A3	5–9
Insufficient comparability of TVs	Variation and lack of transparency in methodologies applied by Member States	Enhance the comparability of the assessment of groundwater chemical status throughout the EU	Move towards a uniform and transparent procedure for establishing TVs	B2-B4	10
Insufficient transparency and reporting	-	Rely decision-making on sufficient, correct, robust and transparent information	Optimise transparency and quality of reporting and remove reporting deficits Strengthen the current legislation on reporting requirements	C2-C3	11–16
Insufficient knowledge base	Chance that risks or poor status remain undetected	Increase the knowledge base on the occurrence and fate of substances of concern	Provide a mechanism to improve the knowledge base and make future identification of substances of concern more effective Ensure improved knowledge based on monitoring data	D2-D4	17–19

4.2 **Policy options in relation to the update of the list of substances regulated at EU and national level to new scientific and technical information (Annex I and Annex II part B)**

Amendments to the current legislation are recommended where substantial new and robust data have become available since the GWD entered into force, provided that they are of European-wide concern. With the findings of the first RBMPs, it can be investigated whether there is significant evidence for the revision of the list of substances for which EU-wide quality standards are set (Annex I) and the list of substances for which the establishment of threshold values shall be considered (Annex II Part B). Including additional substances under Annex I and establishing uniform quality standards could increase the level of comparable environmental protection throughout Europe.

As laid down in the baseline chapter 2.2, based on the information reported by Member States in the first RBMPs, no other substance except those listed in Annex II Part B seemed to be of European-wide concern.

Option A1: No change

This option would mean continuing as now. The baseline is explained in section 2.1.

Option A2: Upgrading naturally occurring Annex II Part B pollutants/indicators to Annex I

This option would mean to upgrade one or more of the eight naturally occurring Annex II Part B pollutants/indicators (which are the only naturally occurring substances of European-wide relevance) to Annex I and to establish a single value (for each pollutant/indicator) to be proposed as common European groundwater quality standard.

Option A3: Upgrading synthetic Annex II Part B pollutants to Annex I and establish quality standards

This option would mean to upgrade one or both of the Annex II Part B synthetic substances tetrachloroethylene and trichloroethylene to Annex I and to establish a single value (for each pollutant) to be proposed as common European groundwater quality standard.

4.3 **Policy options in relation to the insufficient comparability of TVs and hence of the assessment of groundwater chemical status**

The establishment of groundwater threshold values and the whole procedure for assessing groundwater status leaves considerable flexibility to the Member States. The different threshold values set throughout Europe, the status results of the groundwater bodies and the established environmental protection levels throughout Europe are hardly comparable.

Option B1: No change

This option would mean continuing as now. The baseline is explained in section 2.2.3.

Option B2: Specify in detail a harmonised and uniform procedure for the determination of natural background levels

This option proposes a clear definition of a uniform methodology for the calculation of NBLs which could contribute to general harmonisation and better comparability of TVs. The BRIDGE project (Müller et al., 2006) offers a methodology for calculating background levels which might be applied to all substances ranging from purely anthropogenic origin and occurring both, naturally and as a result of human activities. A simple approach using aquifer typologies as a starting point for the derivation of background levels is proposed, in case knowledge is limited (European Commission, 2009).

Option B3: Specify more precisely the relationship between NBLs and TVs

Today, six different methodologies are applied in Europe in case NBLs are below criteria values of receptors or uses and two different methodologies are applied in case NBLs are exceeding criteria values. This option proposes a clear specification of the relationship between TVs and NBLs which would contribute to further harmonisation and comparability of different TVs.

Option B4: Exclude NBLs from the TV establishment but consider NBLs later in the compliance regime

This option proposes that NBLs are no longer part of the TVs but should be considered later in the status assessment. This would lead to the effect that especially the TVs of naturally occurring substances will be much more comparable, as they will only reflect the different receptor needs and the pollutant properties.

4.4 Policy options in relation to insufficient transparency and reporting

There is a clear need to enhance transparency by optimising the quality of reporting and removing reporting deficits, thus providing the public with sufficient information and allow correct interpretation of reporting results and drawing appropriate conclusions.

Option C1: No change

This option would mean continuing as now. The baseline is explained in section 2.3.

Option C2: Amendment of Annex II Part C

This option proposes to amend the following elements of Annex II Part C:

- a) It should be distinguished more clearly between reporting obligations which are mandatory and those which are to be reported 'where feasible'. All information which is available or created during the implementation of the directives could be considered as feasible to be reported.
- b) Annex II Part C should be extended in such a way that for each of the groundwater bodies identified at risk reporting is done of each pollutant and indicator of pollution which contributes to this classification, to which environmental objectives (the relevant criteria for assessing good status – usage criteria / environmental criteria) the risk is related, the ranges of NBLs and the extent of exceedance.
- c) It should be made mandatory to report on the methodology for deriving the natural background levels, especially information on the pre-selection criteria for the identification of analytic results which are not influenced by anthropogenic pressures; and the percentile criterion which was used for the NBL selection.
- d) It should be made mandatory to report about the reasons for not having established threshold values for the pollutants and indicators subject to Part B of Annex II.
- e) In case of non-reporting of requirements listed under (a) to (d), Member States should provide information about the reasons why reporting was not feasible.

In order to avoid any misinterpretations leading to non-reporting, all reporting requirements should be specified unambiguously.

Option C3: Reporting of key elements of the compliance regime

This option proposes to make mandatory the reporting of certain elements of the compliance regime, going beyond the threshold values' establishment, but which could considerably contribute to enhanced transparency and comparability of status assessment results. Such elements would comprise e.g. the level, method and period of aggregation of monitoring results and the definition and identification of the acceptable extent of exceedance (according to GWD Article 4.2.c.i and Annex III 3) when assessing chemical status.

4.5

Policy options in relation to knowledge gaps

Option D1: No change

This option would mean continuing as now. The baseline is explained in section 2.2.1.

Option D2: Establish a voluntary or compulsory mechanism for systematic gathering of monitoring data on pollutants of concern, including emerging contaminants

This option proposes to establish a voluntary or mandatory procedure for systematic gathering of monitoring data on pollutants of concern, including emerging contaminants.

As a result of the revision of the Environmental Quality Standards Directive (EQSD), a watch list mechanism will be established which is designed to allow targeted EU-wide monitoring of substances of possible concern to support the prioritisation process in future reviews of the priority substances list⁴.

Analogously, EU-wide monitoring data on pollutants of concern, including emerging contaminants in groundwater could be gathered for the purpose of supporting future considerations of amending Annex I or II of the GWD respectively. A data gathering mechanism could be established for pollutants of concern for which no strong scientific base is currently available. Selected contaminants would need to be monitored at an EU-wide network of locations, providing targeted high-quality monitoring data on the occurrence, the distribution and the concentration of substances in the aquatic environment and contributing to the assessment of their relevance for good groundwater status.

The CIS (Common Implementation Strategy) and in particular the Working Groups 'Groundwater' and 'Chemicals' under the Water Status Cluster (according to the draft Organisational structure of CIS 2013-2015) could contribute to aspects such as the selection of substances to be monitored, the identification and selection of a representative monitoring network, the development of sampling and monitoring procedures, the selection of the analytical reference methods, aspects of quality assurance and to technical aspects on the reporting etc.

Option D3: Include a voluntary or compulsory reporting requirement to an EU-wide chemical monitoring database

This option proposes a voluntary or mandatory requirement that Member States can or should report their available and relevant monitoring data on pollutants of concern, including emerging contaminants, to an EU-wide chemical monitoring database.

Such an EU-wide chemical monitoring database could be the Information Platform for Chemical Monitoring (IPChem). IPChem is not yet operational but it is being designed and developed across the Joint Research Centre (JRC) in a collaborative activity of the Digital Earth & Reference Data Unit and the Water Resources Unit of the Institute for Environment and Sustainability (IES) under lead of DG Environment. It is planned that it will promote a more coherent approach to the generation, collection, storage and use of chemical monitoring data in relation to exposure to humans and the environment at the European level.

Option D4: Include a provision to make TV establishment and monitoring mandatory for all Annex II Part B substances

This option proposes to make the establishment of threshold values for and monitoring of all substances listed in Annex II Part B mandatory. This option would deviate from the risk-based approach but it would force those Member States which did not identify any risk so far to have a more detailed look at the Annex II Part B substances (monitoring, TV establishment). A complete European overview of TVs for these pollutants/indicators would become available and ensure greater comparability across Member States. Monitoring of all substances listed in Annex II

⁴ Three pharmaceuticals (17 alpha-ethinylestradiol (EE2), 17 beta-estradiol (E2), Diclofenac) will be included in the watch list of emerging pollutants.

Part B could strengthen the knowledge base on substances of concern and there would be a higher degree of certainty that possible risks or poor status for these substances do not remain undetected.

5 List of References

- Aulong, S.; Rinaudo, J-D.; Bouscasse, H. (2006). Assessing the costs and benefits of groundwater quality improvement in the Upper Rhine valley quaternary aquifer (France), BRIDGE research project, Background cRiteria for the IDentification of Groundwater thrEsholds, co-funded by the European Commission within the Sixth Framework Programme, D25 report, BRGM (French Geological Survey)
- Bouscasse, H. & Strosser, P. (2006). Assessing socio-economic impacts of different groundwater protection regimes - Slovenian case study report, BRIDGE Research Project Background cRiteria for the IDentification of Groundwater thrEsholds co-funded by the European Commission within the Sixth Framework Programme, D42 report, ACTeon
- Brouwer, R. & Strosser, P. (2007). Synthesis report from case studies with recommendations for setting groundwater thresholds from an integrated environmental and socio-economic perspective, BRIDGE research project Background cRiteria for the IDentification of Groundwater thrEsholds co-funded by the European Commission within the Sixth Framework Programme, D30 report, Institute for environmental studies & ACTeon
- Brouwer, R. (2005). Integrated Groundwater Assessment and the Economics of Groundwater Protection, BRIDGE research project, Background cRiteria for the IDentification of Groundwater thrEsholds, co-funded by the European Commission within the Sixth Framework Programme, D24 report, Institute for Environmental Studies (IVM).
- Brouwer, R.; Hess, S.; Bevaart, M.; Meinardi, K. (2006) The socioeconomic costs and benefits of environmental groundwater threshold values in the Scheldt basin in the Netherlands, BRIDGE research project, Background cRiteria for the IDentification of Groundwater thrEsholds, co-funded by the European Commission within the Sixth Framework Programme, D26 report, Institute for Environmental Studies (IVM)
- European Commission (2009). CIS Guidance on groundwater status and trend assessment. Guidance Document No 18.
- European Commission (2009). Impact Assessment Guidelines
- European Commission (2010). Report from the Commission in accordance with Article 3.7 of the Groundwater Directive 2006/118/EC on the establishment of groundwater threshold values. C(2010) 1096 final. <http://ec.europa.eu/environment/water/water-framework/groundwater/reports.htm>. Accessed 27 May 2013.
- European Commission (2012). Report from the Commission to the European Parliament and the Council on the Implementation of the Water Framework Directive (2000/60/EC) River Basin Management Plans. COM(2012) 670 final. http://ec.europa.eu/environment/water/blueprint/index_en.htm. Accessed 27 May 2013.
- European Commission (2012a) Fitness Check of EU Freshwater Policy (Staff Working Document) – SWD(2012) 393. http://ec.europa.eu/environment/water/blueprint/fitness_en.htm Accessed 27 May 2013

European Commission (2012b): Technical Report on Recommendations for the Review of Annex I and II of the Groundwater Directive 2006/118/EC. Technical Report No 7.

European Commission (2012c): Commission Staff Working Document. European Overview (2/2) accompanying the document: Report from the Commission to the European Parliament and the Council on the Implementation of the Water Framework Directive (2000/60/EC) River Basin Management Plans, SWD(2012) 379 final.

European Parliament (2005) Report on the proposal for a directive of the European Parliament and of the Council on the protection of groundwater against pollution (COM(2003)0550 – C5-0447/2003 – 2003/0210(COD)). Committee on the Environment, Public Health and Food Safety. March 21, 2005. Final A6-0061/2005.

Hart, A.; Müller, D; Blum, A.; Hookey, J.; Kunkel, R.; Scheidleder, A; Tomlin, C.; Wendland, F. (2006). Preliminary Methodology to derive Environmental Threshold Value, BRIDGE research project, Background cRiteria for the IDentification of Groundwater thrEsholds Research, co-funded by the European Commission within the Sixth Framework Programme D15 report, EA Environment Agency

Hinsby, K. and Melo MT (2006). Application and evaluation of a proposed methodology for derivation of groundwater threshold values – a case study summary report, BRIDGE research project, Background cRiteria for the IDentification of Groundwater thrEsholds, co-funded by the European Commission within the Sixth Framework Programme, D22 report, GEUS

Kosola, M-L.; Gustafsson, J. (2006). The socio-economic effects of road salting and groundwater protection in Lahti, BRIDGE research project, Background cRiteria for the IDentification of Groundwater thrEsholds, co-funded by the European Commission within the Sixth Framework Programme, D27 report, SYKE

Lapworth, D.J., Baran N., Stuart, M.E., Ward, R.S. (2012). Emerging organic contaminants in groundwater: A review of sources, fate and occurrence. Environmental Pollution 163 (2012) 287–303

Müller, D.; Blum, A.; Hart, A.; Hookey, J.; Kunkel, R.; Scheidleder, A.; Tomlin, C.; Wendland, F. (2006). Final proposal for a methodology to set up groundwater threshold values in Europe, BRIDGE research project, Background cRiteria for the IDentification of Groundwater thrEsholds, co-funded by the European Commission within the Sixth Framework Programme, D18 report, UBA-A Umweltbundesamt GmbH

OECD (2012). Water Quality and Agriculture - Meeting the Policy Challenge. Water Quality and Agriculture - Meeting the Policy Challenge, Paris

Ordens, C.M.; Bertin, S.; Brouwer, R.; Condesso de Melo, T. (2006). The socio-economic costs and benefits of groundwater protection in the Aveiro Quaternary Aquifer in Portugal, BRIDGE research project, Background cRiteria for the IDentification of Groundwater thrEsholds co-funded by the European Commission within the Sixth Framework Programme, D28 report, Universidade de Aveiro, Departementes de Geociências

Pakelniete, K.; Bouscasse, H.; Strosser, P. (2006). Assessing socio-economic impacts of different groundwater protection regime – Latvian case study report, BRIDGE Research Project Background cRiteria for the IDentification of

Groundwater thresholds co-funded by the European Commission within the Sixth Framework Programme, D29 report, ACTeon

Pulido-Velásques, M.; Koundouri, P.; Pena-Haro, S.; Kountouris, Y.; Sauer, J.; Tsagarakis, K. (2010). Proposal of sustainable measures to protect groundwater bodies. GENESIS Research project co-funded by the European Commission within the Seventh Framework Programme.

Görlach, B. & Interwies, E. European Commission (2003) Economic Assessment of Groundwater Protection: A survey of the Literature and Executive summary. Berlin: Ecologic (study contract B4-3040/2002/339770/MAR/A1), April 2003

Scheidleder A. (2012) Groundwater threshold values. In-depth assessment of the differences in groundwater threshold values established by Member States. Umweltbundesamt Austria. http://ec.europa.eu/environment/water/water-framework/implrep2007/pdf/In-depth_assessment_GW_TV-FinalReport.pdf. Accessed 22 May 2013.

Offices		www.arcadisbelgium.be
Antwerp – Berchem Posthofbrug 12 B-2600 Berchem T +32 3 360 83 00 F +32 3 360 83 01	Hasselt Eurostraat 1 – bus 1 B-3500 Hasselt T +32 11 28 88 00 F +32 11 28 88 01	Ghent Kortrijksesteenweg 302 B-9000 Ghent T +32 9 242 44 44 F +32 9 242 44 45
Brussels Koningsstraat 80 B-1000 Brussels T +32 2 505 75 00 F +32 2 505 75 01	Liège 26, rue des Guillemins, 2ème étage B-4000 Liège T +32 4 349 56 00 F +32 4 349 56 10	Charleroi 119, avenue de Philippeville B-6001 Charleroi T +32 71 298 900 F +32 71 298 901
ARCADIS Belgium nv/sa BTW BE 0426.682.709 RPR BRUSSELS ING 320-0687053-72 IBAN BE 38 3200 6870 5372 SWIFT BIC BBRUBEBB		Main office: Brussels Koningsstraat 80 B-1000 Brussels



Consultancy, study and design of buildings, infrastructure, environment and environmental planning. Outsourcing of project staff on site.
 This report has been printed on 100% recycled paper.