|  |  |
| --- | --- |
| **EEA/NSV/13/002 – ETC/ICM**  |  |

2015 Freshwater Eionet Workshop

Background document for Session 2

Content related SoE review

- Maintenance and content development of data flows
(SoE and WFD) -

Prepared by / compiled by:

Sandra Richter, Anita Künitzer (UFZ), Ursula Schmedtje (UBAD)

Peter Kristensen , Nihat Zahl , Bo Jacobsen (EEA)

Anne-Lyche Solheim, Kari Austnes (NIVA)

Benoit Fribourg-Blanc (OIEau)

Hana Prchalova (CENIA)

Vit Kodes (CHMI)

Demetrios Panagos, George Bariamis, Alexandros Zachos,

Alexandros Psomas, Dimitra Konsta, Evangelos Baltas, Maria Mimikou (NTUA)

EEA project manager: Peter Kristensen

**Contents**

[1 Introduction 2](#_Toc420923957)

[2 Eionet priority data flows 3](#_Toc420923958)

[3 Content review of SoE determinants 4](#_Toc420923959)

[3.1 Content review of water quality data 4](#_Toc420923960)

[3.1.1 Pollution from oxygen consuming substances 7](#_Toc420923961)

[3.1.2 Nutrient enrichment / eutrophication 9](#_Toc420923962)

[3.1.3 Hazardous substances and emerging chemicals 11](#_Toc420923963)

[3.1.4 Other pressures affecting water quality (Salinisation, acidification, thermal pollution including climate change impacts and cooling water) 14](#_Toc420923964)

[3.2 Content review of water quantity data 16](#_Toc420923965)

[3.2.1 Planned products and assessments 17](#_Toc420923966)

[3.3 Content review of data on emissions to water 19](#_Toc420923967)

[3.3.1 Planned products and assessments 20](#_Toc420923968)

[4 Conclusions 22](#_Toc420923969)

# Introduction

It is the European Environment Agency’s (EEA) task to provide objective, reliable and comparable information on the environment in order to allow the European Commission, member countries and the general public to judge the effectiveness of environmental policy and the needs for policy development. This comprises ‘state of the environment’ assessments using indicators to assess current status, pressures and impacts as well as trends in the mid and long-term.

The next EEA assessment on the state of Europe’s water will be published in 2017 and will again cover a wide range of water related topics. The EEA is currently preparing the conceptual framework for these assessments. The analyses will be based on data reported by EU Member States to WISE WFD for the 2nd River Basin Management Plans as well as on data reported from EEA Member Countries under SoE.

To ensure that these assessments and analyses can be carried out, it is necessary to make the best possible use of the large amount of data and other information from the various European reporting streams on water. At the Eionet Workshop in 2014 the EEA presented the planned activities for streamlining the reporting pathways under WISE SoE and WFD[[1]](#footnote-1). This included

1) A quality review of the data reported by member countries using country quality fact sheets (for details see separate report, in preparation), and

2) A content review of reported determinants to assess their relevance in producing high quality assessments including the possibility to derive key messages on water policies.

The aim of this content related review of SoE data flows is to:

* ensure EEA assessments to be carried out during 2016 – 2018;
* ensure a stable and well defined reporting of “high priority” parameters for EEA uses (European, pan-European and regional integrated environmental data and indicator sets, assessments and thematic analyses);
* improve integrated assessments with Water Framework Directive and other Water Directives;
* reduce the reporting burden for countries.

A review of the WISE SoE databases has been performed from the second half of 2014 onwards. The activity focused on the established data flows to ensure both State of Environment (SoE) priority data flows and established data flows of the WFD and other EU Water Directives are to be updated in a more consistent way in the mid and long-term. The review is being used to prepare specifications for the new SoE data model, which is required for the WISE 2.0 SoE data request in 2015. The changes in the SoE data flows will be presented at the Freshwater Eionet Workshop in June 2015.

# Eionet priority data flows

The EEA Eionet priority data flow identifies a set of agreed, stable, well-defined objectives to provide a focus for countries when they are putting procedures in place for regular reporting.

The European Environment Agency (EEA) collects inland data sets reported voluntarily by EEA member countries (water quality in groundwater, rivers, lakes; emissions of pollutants and water quantity). These data reflect a sub-set of national sampling. The data is transferred annually from the member countries to the EEA using electronic reporting and quality assurance tools. The data is stored in the Agency’s ‘Waterbase’[[2]](#footnote-2).

The WISE‑SoE data flows have successfully provided a solid basis of information for several of the EEA indicators and water assessments[[3]](#footnote-3):

* The current Waterbase data sets contain a vast amount of water quality information covering more than 15,000 river stations in 38 countries, 4,200 lake stations in 36 countries, and around 24,200 groundwater stations in 36 countries.
* For rivers, around 1000-1700 time series (dependent on the pollutant) are available, covering the period from 1992 to 2012 (with some longer time series and many shorter time series).
* The Waterbase data sets also include data on emissions and loads as well as on on freshwater resource availability, abstraction and use. The data on water quantity and emissions have been collected annually since 2009. Data on water quantity have been used as a basis for EEA indicators, water accounting and assessments. Data on emissions to water per river basin district, typically based on information from River Basin Management Plans or reporting to International River and Sea Conventions, has the potential to serve as the primary data source for EEA indicators in emission intensities provided reporting from more countries and full territory coverage.
* The data in Waterbase are the basis for the EEA's water quality indicators and the WISE interactive maps that provide European overviews.

All the databases (e.g. rivers, lakes, and groundwater) are available for download here: <http://www.eea.europa.eu/data-and-maps/data#c11=water&c17=&c5=all&c0=5&b_start=0>

# Content review of SoE determinants

## Content review of water quality data

The data in Waterbase is the basis for the EEA’s water quality indicators and the WISE interactive maps. The specific data used in the indicators is also available for viewing and download.

European freshwaters are affected by the following water pollution and water quality problems:

* Pollution from oxygen consuming substances
* Nutrient enrichment resulting in eutrophication
* Hazardous substances and emerging chemicals
* Bacterial/faecal pollution
* Salinisation
* Acidification
* Sediments
* Thermal pressures including climate change impacts and cooling water

The current water quality Waterbase (rivers, lakes and groundwater) have been primarily used for providing European overviews of wide-spread European problems related to 1) pollution from oxygen consuming substances and 2) nutrient enrichment resulting in eutrophication.

EEA water indicators aim at presenting the following information:

* European overviews of concentration levels in the form of maps, diagrams and tables.
* Country or river basin comparison of concentration levels
* Illustrating of areas with higher and lower concentrations
* Comparison (current situation or trends) on other levels of aggregation (broad types, biogeographical regions, ecological status classes)
* Trend information
* (Policy) evaluation of concentration level in relation to certain factors affecting pollution (e.g. concentration levels in relation to percentage of agricultural land and population density) and trend in concentration in relation to change in pressures (e.g. nitrate in rivers in relation to nitrate surplus), and implementation of measures (e.g. upgrade of waste water treatment).

Table 1 lists both planned assessments/products and suggestions for new assessments. For existing indicators and maps, both determinants and data extraction/analysis procedures are in place, but discussions of possible additional determinants are listed. For the other planned assessments and suggested assessments there is a range of possibilities regarding selection of determinants, combinations of determinants and types of analysis/visualisation. The tables list examples of products, with different variants of the same product (same analysis, different determinants) and what they can be used for. The chosen examples are considered to be the most important ones, and they include the determinants that should be kept.

The two greatest benefits of the SoE data are the long time series and that they are “real” data on a continuous numeric scale, i.e. nutrient concentrations and EQRs rather than categorical status classes. The SoE data are also reported more frequently than e.g. WFD data. For the biology data most of the BQEs (macroinvertebrates, phytobenthos and phytoplankton) have been reported twice or more from many countries during the first three years of reporting (2010 – 2012), allowing time series and trend analyses at EQR level in a few years. Another benefit with the SoE biology data compared to the WFD BQE data is that they are impact specific (eutrophication, acidification, hydromorphological alterations, climate change) and can be combined with physico-chemical determinants such as SoE nutrients, pH, river flow or temperature. The SoE biology data can therefore be used to supplement and interpret WFD data, e.g. showing improvement of a BQE both within and across WFD status classes and within and between the RBMP cycles. However, better spatial coverage of stations reported is needed to ensure representativeness relative to the WFD status classes for each BQE, as well as geographically.

The long time series of SoE nutrients are used in indicators, but more in-depth assessments on different nutrients and biology determinants are possible when linking the data to other data sources, e.g. efficiency of WFD nutrient reduction measures using WFD data on measures in combination with SoE nutrients for the same water bodies, WFD status class versus nutrients, chlorophyll, Secchi depth or cyanobacteria, Eurostat data on nitrogen surplus versus nitrate concentration in rivers, UWWT or emissions versus concentration of phosphate, ammonium and BOD in rivers. Time series for nutrient determinants can also be used to explain current conditions for other determinants without long time series, i.e. showing the nutrient trends leading up to the current ecological status/BQE status/EQR.

The biological SoE data can also be further explored for links to ecosystem services and to biodiversity, using both the EQR data and the additional biological data (such as chlorophyll a). The Habitats Directive conservation status assessment includes several parts, such as the “structure and function” component, that could be explored for potential links to EQRs for selected BQEs or to additional biological data (chlorophyll, cyanobacteria, macrophyte depth limit), using appropriate spatial scale (e.g. broad types matching HD freshwater habitats).

Table 1: Overview table of EEA topics and existing and planned products based on water quality databases

| **Topic** | **European overviews** | **Country comparisons** | **Trend analyses** | **Pressures-status-measures analyses** | **Used for** **(indicators, reports, assessments)** |
| --- | --- | --- | --- | --- | --- |
| Oxygen consuming substances/organic pollution | X | (X) | X | X | - WISE maps- CSI 19- EEA 2010: Freshwater quality - SOER 2010 thematic assessment.– EEA ETC/ICM 2010: Freshwater Eutrophication Assessment - Background Report for EEA European Environment State and Outlook Report 2010.– EEA, 2012 European waters - assessment of status and pressures, EEA Report No 8/2012– EEA ETC/ICM 2012: Ecological and chemical status and pressures. Thematic assessment for EEA Water 2012 - EEA, 2015: SOER 2015 — The European environment — state and outlook 2015 |
| Nutrient enrichment / eutrophication | X | (X) | X | X |
| Hazardous substances and emerging chemicals | X | X | X | X | - WHS2- AEI 27.2 Pesticide indicator– EEA Technical Report no. 8 / 2011. – ETC/ICM Technical Report no. 1 / 2013.– ETC/ICM Technical Report no. 1 / 2015. - PRTR-Viewer, HS Viewer |
| Salinisation | X | (X) | (X) | (X) | Assessment of trends in conductivity, European overview possible, but maybe more relevant for different climate regions (north - road salt, Mediterranean - irrigation etc), country comparison within regions.Cyanides, fluorides, chlorides emission by (industrial) sector. |
| Acidification | X | (X) | (X) | (X) | Trends and current status in Europe and regions, country comparison within regions with issues. |
| Changes in hydromorphology and degradation of habitats | X | X | X |  | WISE map, trends and current status bar-plots, background for WFD 2024, SOER 2020, new HyMo assessment reports  |
| Climate change  | X |  | X |  | CLIM 019 and 020, trends in lake and river surface mean and max temperature, ice cover (on, off, duration). Background for climate assessments (coupling with information e.g. CLIM 001, 002 and 016, SoE Water quantity).Time series diagrams showing temperature, river flow and SoE nutrients or SoE biology data. Bar-plots comparing change in temperature and river flow with change in SoE biology and or SoE nutrients data for the same stations. Input to new Climate change report or to SOER 2020. |
| Multiple pressures and their impacts in rivers and lakes | X |  |  |  | Pressure-status-measures report, input to SOER 2020, incl. ecological status, conservation status for freshwater habitats and species and ecosystem services of rivers and lakes. |

For the analysis the following categories were used for whether a determinant should be kept or dropped in future reporting: “must keep”, “should keep”, “could keep” and “drop”. These were defined as follows (see table below).

Table 2: Definition of Must keep, Should keep, Could keep and Drop

| **Step** | **Criteria** | **Value** | **Decision** |
| --- | --- | --- | --- |
| 1 | Priority Substance according to relevant Directive | Yes | Must keep |
|   |   | No | Go to 2 |
| 2 | Required for current EEA products (indicators, assessments, reports, etc.).  | Yes | Must keep |
|   |   | No | Go to 3 |
| 3 | Required for future planned assessments (i.e. complementing WFD with relevant time series). | Yes | Must keep |
|   |   | No | Go to 4 |
| 4 | Frequently monitored and reported information. | Yes | Go to 5 |
|   |   | No | Go to 6 |
| 5 | Information that can be derived from other reliable data sources currently available to the EEA | Yes | Drop |
|   |   | No | Go to 6 |
| 6 | Useful and usable ancillary information for current EEA products, including QC of other "Must" parameters. | Yes | Should keep |
|   |   | No | Go to 7 |
| 7 | Useful and usable ancillary information for planned EEA products. | Yes | Could keep |

All determinants in the categories “must keep”, “should keep” and “could keep” will be kept in future reporting, the ones in “drop” will be dropped.

### Pollution from oxygen consuming substances

EEA has been using biochemical oxygen demand (BOD) and total ammonium as key indicators of organic pollution. Severe organic pollution may lead to rapid deoxygenating of the water, high concentrations of ammonia and the disappearance of fish and aquatic invertebrates. Organic pollution causing oxygen consumption is mainly a problem in rivers and is generally less relevant in lakes or in groundwater; therefore the following analysis will deal only with rivers.

Table 3: Overview table of EEA products on pollution from oxygen consuming substances

| **Name of product/ information displayed** | **European overviews** | **Country comparisons** | **Trend analyses** | **Pressures-status-measures analyses** | **Used for**  |
| --- | --- | --- | --- | --- | --- |
| Oxygen consuming substances in rivers | X | X | X | -- | WISE maps, CSI 019, background for WFD, SOER and in-depth assessments |
| Ecological status of macro-invertebrates in rivers | X | X | X | -- | WISE maps, trends on possible improvements towards good ecological status for invertebrates (also within single WFD classes), bar plots to compare invertebrate current status among broad types and biogeographic regions or grouped by WFD ecological status classes. |
| Oxygen consuming substances and ecological status/potential in rivers | X | -- | X | X | WFD, SOER and in-depth assessments. Trends or current status of oxygen consuming substances grouped by ecological status/potential.  |
| Pressures-measures-status organic pollution rivers | X | -- | X | X | Assessments on organic pollution, background for WFD and SOER. Combining different determinants, coupling e.g. BOD or ammonium and macroinvertebrates EQR , dissolved oxygen and BOD, coupling to pressure and measures information |

In Waterbase rivers the determinants in Table 4 have been reported to describe pollution from oxygen consuming substances[[4]](#footnote-4).

Table 4: Determinants to describe pollution from oxygen consuming substances (SoE data flows: nutrients, organic matter in rivers and biology in rivers)

| **Determinant**  | **Number of reporting countries**  | **Must keep** | **Should keep** | **Could keep** | **Drop** | **Used for existing EEA products** |
| --- | --- | --- | --- | --- | --- | --- |
| Ammonium Total Ammonium | 18 27 | X |  |  |  | CSI19, WISE maps |
| BOD5 BOD7 | 28 5 | X |  |  |  | CSI19, WISE maps |
| CODCr CODMn | 23 14 |  | X |  |  | CSI19 |
| Total Organic Carbon (TOC) | 25 |  | X |  |  |  |
| Dissolved Organic Carbon (DOC)  | 12 |  |  |  | X |  |
| Dissolved Oxygen Oxygen saturation | 31  26  |  |  | X |  X |  |
| Non-ionised Ammonia | 9 |  |  |  | X |  |
| Invertebrate EQR\_G | 18 | X |  |  |  |  |

Arguments to keep or drop a determinant

* Currently, the CSI019 includes the determinants BOD5/BOD7 and ammonium in rivers. They are the main indicators of oxygenation status of water bodies in European rivers.

There are, however, other determinants available in WISE-SoE which can be used to understand the oxygenation conditions in European freshwaters.

* TOC can be used for countries which are not reporting BOD, but is not necessarily a good indicator for oxygen pollution. In humic rivers, TOC is not an adequate measure of oxygen-consuming substances – much of it is rather recalcitrant. On the other hand, the BOD indicator is less significant for the Scandinavian region due to low freshwater temperatures and consecutive lower microbiological activity. COD (CODCr and CODMn) might be a better indicator of river pollution than BOD in these regions (e.g. Scandinavian region due to low freshwater temperatures and consecutive lower microbiological activity). CODCr is frequently reported and can be included in assessments of organic pollution (or possibly in CSI19). CODMn can be used if more data is available than for CODCr. DOC is not very frequently reported, only combined with TOC, the coverage is good.
* Dissolved oxygen and oxygen saturation are frequently reported and can be used in QA for other determinants. Because of reporting only annual values to Waterbase, they are no good indicators for the overall oxygen conditions. Oxygen saturation is a more general determinant than dissolved oxygen, as 100% depends on salinity and temperature.
* Non-ionised Ammonia is less frequently reported and no good indicator.
* Invertebrate EQR\_G is reported by most countries and is mainly sensitive to organic pollution, so easy to use in assessments. Relevant for WFD reporting as well.

### Nutrient enrichment / eutrophication

EEA has been using groundwater and river nitrate (NO3), river orthophosphate (o-PO4) and lake total phosphorus (TP) as the key indicators of nutrient enrichment, which is a relevant problem for rivers, lakes and groundwater. Nutrient enrichment leads to eutrophication in many rivers and lakes in Europe. Table 5 provides an overview on already existing and planned products on pollution from nutrient enrichment or eutrophication.

Table 5: Overview table of EEA products on pollution from nutrient enrichment / eutrophication

| **Name of product/ information displayed** | **European overviews**  | **Country comparisons**  | **Trend analyses**  | **Pressures-status-measures analyses**  | **Used for**  |
| --- | --- | --- | --- | --- | --- |
| Nutrient concentrations in rivers / lakes | X | X | X | -- | WISE maps, CSI 020, AEI 27.1, EEA agricultural indicator, background for WFD, SOER and in-depth assessments  |
| Nitrate concentrations in groundwater | X | X | X | X | WISE maps, CSI 020, AEI 27.1, EEA agricultural indicator |
| Eutrophication of lakes: Ecological status of phytoplankton and macrophytes / of phytobenthos in rivers | X | X | X |  -- | WISE maps, trends on possible improvements towards good ecological status for each of the determinants (also within single WFD classes), bar plots to compare status among broad types and biogeographic regions or grouped by WFD ecological status |
| Nutrient concentrations and ecological status/potential in rivers / in lakes | X | -- | X | X | WFD, SOER and in-depth assessments. Trends or current status of nutrient concentrations grouped by WFD ecological status/potential.  |
| Pressures-measures-status eutrophication rivers/lakes | X | -- | X | X | Assessments on eutrophication and agriculture, background for WFD and SOER. Combining different determinants, coupling e.g. nutrients vs.-BQE-EQR (trends for the same stations), river and groundwater nitrate, river total phosphorus and orthophosphates (trend in ratio, to analyse the contribution from waste water), lake chlorophyll a and total phosphorus and dissolved oxygen (trends for the same stations), coupling to pressure and measures information |

Currently, the CSI 020 includes the determinants total phosphorus, orthophosphates and nitrate in rivers, lakes and groundwater. There are, however, other determinants available in WISE-SoE which can be used to understand the nutrient conditions and impacts resulting from nutrient inputs. In Waterbase the determinants shown in Table 6 have been reported to describe pollution from nutrient enrichment.

Table 6: Determinants to describe pollution from nutrient enrichment and eutrophication (SoE data flows: Nutrients, organic matter in rivers, lakes, groundwater and biology in rivers and lakes)

| **Determinant** | **No of reporting countries** | **Must keep** | **Should keep** | **Could keep** | **Drop** | **Used for existing EEA product** |
| --- | --- | --- | --- | --- | --- | --- |
| Data flows: Nutrients in rivers, lakes, groundwater | Rivers | lakes | GW |  |  |  |  |  |
| Total Phosphorus Orthophosphates | 33 32 | 32 29 | 6 11 | XX |  | X GWX GW |  | CSI 020, WISE maps |
| Nitrate | 34 | 34 | 31 | X |  |  |  | CSI 020, WISE maps |
| AmmoniumTotal Ammonium | 1827 | 1717 | 31 | X |  |  |  | CSI 020, WISE maps |
| Nitrite  |  |  | 27 |  |  | X |  | WISE map |
| Total Oxidised Nitrogen | 14 | 13 |  | X |  |  |  |  |
| Total Nitrogen | 28 | 25 | 7 | X |  |  | X GW |  |
| Kjeldahl nitrogen | 13 | 14 |  |  |  | X |  |  |
| Total inorganic nitrogenTotal organic nitrogen | 1211 | 66 |  |  |  |  | XX |  |
| Dissolved Inorganic Nitrogen Non-ionised Ammonia Particulate Organic Nitrogen | 3 90 | 1 50 |  |  |  |  | XXX |  |
| Dissolved Oxygen Oxygen saturation | 31 26 | 28 25 | 25  |  |  | X | X |  |
| Data flows: Biology in rivers and lakes |  |  |  |  |  |  |  |  |
| PhytobenthosEQR\_E PhytoplanktonEQR\_E MacrophyteEQR\_E | 10 | 16 8 |  | X X |  X |  |  |  |
| Cyanobacteria Biomass |  | 5 |  |  | X |  |  |  |
| Chlorophyll\_a | 18 | 27 |  | X |  |  |  |  |
| Secchi depth |  | 25 |  |  | X lakes |  | X rivers |  |

Arguments to keep or drop a determinant

Data flows on nutrients in rivers, lakes and groundwater:

* Total phosphorus and orthophosphates as well as nitrate are the main relevant parameters for indicator CSI 020 on nutrients in freshwaters. There is good reporting from countries and long-time series are available. Total oxidised nitrogen is used in CSI20 whenever nitrate data are not available or available for fewer years. Total nitrogen is highly relevant for future assessments (including CSI 020 and the WFD assessment), indicating the total nutrient load, also to the sea, and is frequently reported. Good time series for total nitrogen are available, especially in rivers.
* Kjeldahl nitrogen: Frequently reported by some countries, can be used to supplement time series on total nitrogen. Countries already reporting Kjeldahl N and that do not report total nitrogen should continue reporting, otherwise there is no need to report this determinant.
* Total inorganic nitrogen can be derived from the individual nitrogen species (although it is more correct to calculate the sum for individual samples). Total organic nitrogen is frequently reported in quite a few countries. They are not used in indicators, so they can be dropped from reporting.
* Dissolved inorganic nitrogen is rarely reported and it can be derived from the individual nitrogen species (although more correct to calculate the sum for individual samples). Non-ionised Ammonia Less frequently reported, and unstable, so not a very good indicator. On particulate organic nitrogen, no records are available. These determinants don`t have to be reported in the future.
* Dissolved oxygen and oxygen saturation are frequently reported and used in QA for other determinants, but only annual values are reported, which are not meaningful for eutrophication assessments. Oxygenation conditions are to be reported under the WFD, so maybe they will become useful in this context. Oxygen saturation generally is a vaguer determinant than dissolved oxygen, as 100% depends on salinity and temperature, so only dissolved oxygen should be reported.

Data flows on biology in rivers and lakes:

* PhytobenthosEQR\_E has been reported by ten countries, phytobenthos is highly sensitive to eutrophication of rivers and is very relevant to use in assessments.
* PhytoplanktonEQR\_E has been reported by most countries (16) and is regarded as the most sensitive BQE to eutrophication of lakes, so easy to use in assessments. Most countries include both biomass (chlorophyll and or biovolume) and species composition into their national metric, so this is more informative than chlorophyll alone.
* MacrophyteEQR\_E: Reported by eight countries. The determinant is based on intercalibrated metrics used by many countries, so more countries may report this determinant in the coming years. Macrophytes are highly sensitive to eutrophication in lakes and they are a crucial BQE in very shallow lakes. EQRs can give more precise assessments than the WFD status class data. Maybe possible to link with HD conservation status. However, the monitoring and reporting is less frequently reported than the other BQEs, so time series is more difficult to construct compared to the other BQEs.
* Cyanobacteria Biomass is a new metric requested only in 2013, so reported by only five countries so far. The determinant can be linked to ecosystem services (drinking water, bathing water) and is negatively correlated to biodiversity in lakes. Data from more countries can be calculated by multiplying CyanobacteriaProportion with TotalPhytoplanktonBiomass.
* Chlorophyll\_a: An essential determinant when discussing lake eutrophication (in separate assessments or the WFD assessment), and is a valuable supplement to the biology and WFD phytoplankton data as it provides time series. Chlorophyll\_a is frequently reported.
* Secchi depths are frequently reported, and a good indicator of general light conditions. Useful supplement in the assessment of nutrient and eutrophication status, e.g. Secchi depth and DOC/TOC can supplement the interpretation of relationships between nutrient concentration and chlorophyll a.

### Hazardous substances and emerging chemicals

The EEA will use the information to formulate indicators to assess the state and trend of the determinant and monitor progress with European policy objectives. There are estimated to be between 20,000 to 70,000 different chemicals on the market. Many of these will end up in the aquatic environment, and in many cases have potentially harmful effects on aquatic biota and man. Many slowly degrade and accumulate in the environment and along food chains. It is important therefore that the levels of these potentially harmful substances are monitored in the environment.

Hazardous substances data in Waterbase is also being used by other stakeholders besides the EEA, e.g.:

* Extracts of disaggregated data have been shared with JRC for ongoing review of the list of PS
* Can function as source data for a new Information Platform on Chemical Monitoring (IPCheM)
* Has been used and has further potential for use by technical/scientific community for reference scenarios as well as for European level projects.

In the following table you can see an overview on existing and planned EEA products on hazardous substances.

Table 7: Overview table of EEA products on pollution from hazardous substances and emerging chemicals

| **Topic** | **Name of product/ information displayed** | **European overviews**  | **Country comparisons**  | **Trend analyses**  | **Pressures-status-measures analyses**  | **Used for**  |
| --- | --- | --- | --- | --- | --- | --- |
| Hazardous substances and emerging chemicals  | Concentration of HS in aquatic environment | X  | X  | X  | X  | WHS2 Hazardous substances in rivers, PRTR viewer, Hazardous substances in the European marine environment: Trends in metals and persistent organic ; pollutants (topic report 2/2003), EEA and ETC/ICM Technical Reports (8/2011; and 1/2013 + 1/2015 respectively), HS viewer and/or IPCHEM, maybe for WFD2016 assessment and 2017SoW assessment |
| Pesticides groundwater | X | X | X | X | AEI 27.2 Pesticide indicator  |
| Hazardous substances in surface and groundwater | X | X | X | -- | Technical reports on hazardous substances in Europe’s fresh and marine waters |
|   | Emerging pollutants in surface and groundwater | X | X | -- | -- | Future extension of hazardous substances technical report  |

In Table 8 you can find an overview per groups of hazardous substances. Hazardous substances parameters cover a very wide set of parameters, it is therefore necessary to use a specific approach by defining some grouping criteria, to ease the identification of priority parameters and allow evolution. Four grouping criteria are relevant for hazardous substances: the chemical families, the uses, the European legislation and the properties. For each criterion a set of groups can be defined and each individual substance can be linked to these groups. The combination of them allows defining 6 key groups as described in the following table. Some substances can belong to more than one group, for instance some metals are covered by EU legislation and this is reflected in the detailed tables in the annex.

Table 8: Groups of determinants to describe pollution from hazardous substances and emerging chemicals (SoE data flows: Hazardous substances in rivers, lakes, groundwater)

| **Group name** | **Must keep** | **Should keep** | **Could keep** | **Drop** | **Used for existing EEA product** |
| --- | --- | --- | --- | --- | --- |
| EU-Legislation | X | X |  |  | EEA assessments (currently SoE, WFD in the future) |
| RBD specific pollutants |  | X | X | X | EEA assessments (currently SoE, WFD in the future) |
| Pesticides | X | X |  |  | EEA assessments (SoE, WFD), AEI 27.2 on pesticides |
| Metals and metalloids | X | X | X | X | EEA assessments (currently SoE, WFD in the future) |
| Other Organics | X | X | X | X | EEA assessments (currently SoE, WFD in the future) |
| Supportive and inorganic determinands | X | X | X | X | EEA assessments (currently SoE, WFD in the future) |

Arguments to keep or drop a determinant/ a group of determinants

In general the substances in the groups may be discarded for one of the water categories if the substance is not relevant for a given water category (in particular for groundwater) due to its environmental properties. It should be noted also it does not preclude the matrix (water, sediment, biota) in which the substance is monitored, which should be specified with reporting.

* Legislation: all substances covered under the relevant legislation (GWD, DWD, WFD) should be reported in the future unless certain compound is not relevant for given water category (groundwater) due to its environmental properties.
* River Basin Specific Pollutants (RBSP): should be kept, because their relevancy has been proven by monitoring and they may be candidates for inclusion into EU legislation if monitored in more than one RBD. They are in particular relevant in the case of international districts.
* Pesticides: pesticides should be reported if covered by relevant legislation (in case of groundwater all pesticides are covered by the Groundwater Directive). Selected pesticides (currently used in EEA products) must be reported where available, the rest should be reported. Only obsolete (legacy) pesticides can be dropped from reporting if they have not been used for a long time and they do not occur in the relevant water category(ies) anymore. In any case and in particular if these are mentioned in the EU legislation (like DDT), a reason for their discard has to be given.
* Metals and metalloids: must be reported if covered by relevant legislation, those not covered by legislation should be reported were justified based on expert knowledge (especially when on a watch list or in a RBSP).
* Other organics: must be reported if covered by relevant legislation and currently covered by EEA products, should be reported if covered by legislation or justified by the expert knowledge, could be reported based on expert knowledge only and won’t be reported where not useful due to environmental properties, scarce data or inappropriate for an assessment.
* Supportive and inorganic determinants: must be reported if covered by relevant legislation and necessary for an assessment of HS, should be reported if important for an assessment, could be reported if useful for an assessment, won’t be reported if not useful. When assessing heavy metals, these parameters are essential to determine the potential effects of the concentration monitored. This goes beyond individual substances with parameters like pH or hardness.

### Other pressures affecting water quality (Salinisation, acidification, thermal pollution including climate change impacts and cooling water)

A number of other pressures can affect water quality that have not been addressed above, such as bacterial/faecal pollution, salinisation, acidification, sediments as well as thermal pressures which may result from cooling water or are due to impacts from climate change. Table 9 provides an overview of possible additional EEA products on such pressures.

Table 9: Overview table of EEA products on different pressures affecting the water quality

| **Topic** | **Name of product/ information displayed** | **European overviews**  | **Country comparisons**  | **Trend analyses**  | **Pressures-status-measures analyses**  | **Used for**  |
| --- | --- | --- | --- | --- | --- | --- |
| Salinisation | River and lake salinisation | X | (X) | (X) | (X) | Trends in conductivity, European overview possible, but maybe more relevant for different climate regions (north - road salt, Mediterranean - irrigation etc), country comparison within regions.Cyanides, fluorides, chlorides emission by (industrial) sector. |
| Acidification | Lake and river acidification | X | (X) | (X) | (X) | Trends and current status in Europe and regions, country comparison within regions with issues. |
| Changes in hydro-morphology and degradation of habitats | Ecological status of fish in rivers  | X | X | X | X | WISE map, trends and current status bar-plots, background for WFD 2024 (after 3rd RBMPs), SOER 2020, new HyMo assessment reports. |
| Climate change  | Climate change and lake and river temperature and river flow | X | -- | X | -- | CLIM 019 and 020, trends in lake and river surface mean and max temperature, ice cover (on, off, duration). Background for climate assessments (coupling with information e.g. CLIM 001, 002 and 016, SoE Water quantity). |
| Climate change impacts on water quality and biodiversity | X | -- | X | X | Time series diagrams showing temperature, river flow and SoE nutrients or SoE biology data. Bar-plots comparing change in temperature and river flow with change in SoE biology and or SoE nutrients data for the same stations. Input to new Climate change report or to SOER 2020. |
| Multiple pressures and their impacts in rivers and lakes | Impacts of multiple pressures on ecological status and ecosystem services of rivers and lakes | X | -- | -- | X | Diagrams (chained relations) combining info from several data flows (example can be explored). Pressure-status-measures report, input to SOER 2020, incl. ecological status, conservation status for freshwater habitats and species and ecosystem services of rivers and lakes |

An overview of the determinants to describe these pressures is given in Table 10.

Table 10: Determinants to describe pollution from different pressures (SoE data flows: nutrients, organic matter in rivers and lakes)

| **Topic/****Determinants** | **No of reporting countries** | **Must keep** | **Should keep** | **Could keep** | **Drop** |
| --- | --- | --- | --- | --- | --- |
| **Salinisation**   | **rivers** | **lakes** | **GW** |  |  |  |  |
| Electrical Conductivity | 29 | 29 | 20 |  |  | X |  |
| **Acidification**  |  |  |  |  |  |  |  |
| pH | 31 | 30 | 19 |  |  | X |  |
| Alkalinity | 16 | 19 |  |  |  | X |  |
| Fish EQR\_A | 0 | 0 |  |  | X |  |  |
| **Thermal pollution including climate change impacts**  |  |  |  |  |  |  |  |
| BOD5/ BOD7Total NitrogenTOC Total Phosphorus | 28/5282533 | 22/3251832 |  | X |  |  |  |
| all SoE BQEs incl. fish EQR | <18 | <18 |  | X |  |  |  |
| Cyanobacteria biomass | 5 | 5 |  |  | X |  |  |
| Secchi depth | 3 | 25 |  |  | X lakes |  | X rivers |
| Temperature (water)  | 32 | 29 |  |  |  | X |  |
| **Changes in hydromorphology/ degradation of habitats**  |  |  |  |  |  |  |  |
| Fish EQR\_GFish EQR\_H | 00 | 00 |  |  | XX |  |  |

Arguments to keep or drop a determinant

Topic: Salinisation

* Electrical conductivity is used in QA-checks of other determinants and a useful background determinant which is frequently reported.

Topic: Acidification

* pH is a useful background determinant for acidification assessments and in general to understand the system, which is frequently reported.
* Alkalinity is a useful background determinant, especially for acidification assessments. It is fairly frequently reported in many countries, but has not got full coverage.
* Fish EQR\_A is the most sensitive BQE to acidification and may be reported in future.

Topic: Thermal pollution including climate change impacts

* BOD5, BOD7, Total Nitrogen, TOC, Total Phosphorus / all SoE BQEs incl. fish EQR / Cyanobacteria biomass are relevant parameters to give an indication of thermal pollution including climate change impacts. They are fairly reported both in rivers and lakes.
* Temperature (water) is frequently reported, and very relevant in future climate assessments. But this provides more information on methodology for past data (time of day, frequency, depth; consistency is very important in temperature monitoring. As annual values they can be used as long-term trends and for this purpose they should be reported. Temperature is also required in WFD reporting (thermal conditions).

Topic: Changes in hydromorphology/degradation of habitats

* Fish EQR\_G and fish EQR\_H are a sensitive BQE to degradation of habitats and may be reported in future.

## Content review of water quantity data

Eionet Water includes collection of water quantity data (Waterbase - Water Quantity) for producing comparable information on water resources in Europe. Water quantity database covers important parameters to assess water scarcity, freshwater availability, abstraction and water use. These data are primarily used by the EEA to update indicators related to freshwater use for the purpose of assessing the state and trends in freshwater resources, identifying associated pressures as well as in evaluating the progress with European policy objectives. The Water Exploitation Index (CSI 0018) which is one of the EEA CSI indicators identifying the level of pressure that human activity exerts on the natural water resources in a particular territory. That indicator is helping to identify those areas prone to encounter with water scarcity.

Traditionally the WEI has been defined as the annual total water abstraction as a percentage of available long-term freshwater resources. It has been calculated so far mainly on a national basis. Previous experiences on assessing freshwater availability and use have revealed that water scarcity conditions and pressures can be better captured at lower scales than at country level on a monthly or seasonal temporal resolution. Based on this experience the current EEA water accounts implementation for Europe has been revised and a number of existing parameters reported under the SoE WQ data flow have been eliminated while some new parameters have been introduced. In addition to that, further alignment has been considered with the WFD reporting guidance for 2015 in which WEI is defined as one of the parameters to be reported under PoM. WISE SoE water quantity data flow (SOE WQ DF) is expected to support the Directive, so these particular parameters must be included and aligned in definitions in SoE data flow by following the principle: Report once, use many times. Finally, OECD/Eurostat JQ requests water quantity data to be reported biannually in a mandatory basis. SoE WQ DF can play a significant role in cooperation with OECD/Eurostat in water quantity data collection.

Waterbase WQ data is made publicly available for viewing and downloading. Data for quantitative assessment of water resources are collected annually through the WISE-SoE annual data flow. The databases on water quantity are available for download here: <http://www.eea.europa.eu/data-and-maps/data#c11=water&c17=&c5=all&c0=5&b_start=0>.

### Planned products and assessments

In addition to updating the CSI 0018 water quantity data are needed for a wide range of the EEA’s assessments such as pressures of water use by economic sectors including irrigation. Assessing the impacts of climate change, water scarcity and drought conditions across Europe and flood are some of the areas in which the WQ data are used by the EEA.

Another group of assessments is relevant to efficiency on water use practices. The water footprint, public water supply network losses, efficiency in irrigation practices or in industrial use, are only some of the assessments that can be derived with the use of water quantity data. Finally many assessments have a specialized subject such as the use of desalinated, reused cooling water, or water for hydropower production. In Table 11 the possible products and assessments of water quantity data flow are presented.

Table 11: Overview table of EEA products based on the water quantity database

| **Topic** | **Name of product/ information displayed** | **European overviews**  | **Country comparisons**  | **Trend analyses**  | **Pressures-status-measures analyses**  | **Used for**  |
| --- | --- | --- | --- | --- | --- | --- |
| Over abstraction of water and its impacts | Water exploitation index plus (WEI+)/ Indication of the pressure on the water resources at national- RBD or SU level as a consequence of water withdrawals. Share of abstraction between surface, soil and groundwater resources. | X | X | X | X | CSI 018 |
| Irrigated crops' efficiency | Water Use Intensity (WUI) of irrigated crops (m3/€ PPS). Trends in agricultural management | X | X | X | X | WREI 004 |
| Water accounts | Water accounts/Volumes of water abstracted and used from the environment to the economy | X | X | X | X | Support of EEA’s assessments and water accounts module |
| Water scarcity & droughts, floods | Water scarcity & droughts, floods | X | X | X | X | Support of EEA’s assessments, Pressure-status-measures report, input to SOER 2020 |
| Water Consumption | Water use by source/ Identification of the main water users across Europe | X | X | X | X | Support of EEA’s and WFD assessments, WISE map, trends and current status bar-plots |
| Water efficiency | Trends in aquaculture hydropower production, desalination, non-freshwater abstraction, water recycling, water reuse,, water supply system losses  | X | X | X | X | Support of EEA’s and WFD assessments |
| Thermal pressures and their impacts | Trends in cooling water | X | X | X | X | Background for climate assessments (coupling with information e.g. CLIM 001, 002 and 016) |

The determinants to describe water quantity pressures are listed in Table 12.

Table 12: Determinants to describe pressures on water quantity

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Topic** | **No of countries reporting \*** | **Must keep** | **Should keep** | **Could keep** | **Drop** | **Existing EEA products** |
| **Point Data** |
| Stream Flows | 26 | X |  |  |  | Water accounts module, WEI+ |
| Artificial Reservoirs | 9-10 | X |  |  |  | WEI+ |
| Groundwater  | 18 | X |  |  |  | WEI+ |
| **Areal Data** |
| Water Use | 4-16  | X | X |  | X | Water accounts module, WREI 004 |
| Water Balance | 0-21 | X | X |  | X | Water accounts module |
| Freshwater Abstraction  | 0-24 | X | X |  | X | Water accounts module, WEI+ |
| Non Freshwater Abstraction  | 0-7 | X | X |  | X | Water accounts module |
| Reused Water | 2-3 | X | X |  | X | SOER |
| Desalinated Water | 3 | X |  |  | X | SOER |
| Recycled Water | 2-3 | X |  |  | X | SOER |
| Exchanges inside the reference area | new |  | X |  |  | Water accounts module |

\*: the number of reporting countries varies in each group depending on specific determinant.

Arguments to keep or drop a determinant/groups of determinants

Point Data:

* Stream flows are frequently reported and is basic for the water accounts module so are proposed to remain.
* Artificial reservoirs are requested by the WFD, participate in the estimation of WEI+ formula and are moderately reported so are also proposed to remain.
* Groundwater levels data are frequently reported and constitute an alternative way to estimate ΔSnat of the WEI+ formula and are proposed to remain.

Areal Data:

* Water Use category was divided into three subgroups: “Total”, “Public” and “self” supply. “Total” supply subgroup is aborted as it can be derived and some new parameters have been inserted into the other remaining two subgroups in order to streamline with the Water Accounting Module.
* Water Balance category has undergone major reconstruction in “returns” subgroup as well as some parameters have been aborted like “internal flow”, which can be derived.
* In Freshwater abstraction category, the “Public Supply” subgroup was enriched with more determinants following the UNSEEA-W framework, the “Self Supply” subgroup finally remained almost the same in the number of determinants with almost equal number of aborted and newly inserted ones. One of the reasons for the abortion some determinants was small reporting participation. In this category some determinants are classified as “should” because are only needed in OECD/Eurostat JQ.
* Non Freshwater category was reduced in the number of determinants due to overall small reporting participation.
* Reused, desalinated and recycled categories were reduced in the number of determinants due to overall small reporting participation, although in some cases new determinants have been inserted especially in the desalinated category, in order to support the water accounts module.
* A new category of determinants is proposed, the exchanges between various water resources in a reference area. This category envisages better understanding of the water flows for water accounting reasons.

## Content review of data on emissions to water

Eionet Water also includes data on emissions and loads to all water categories (Waterbase – Emissions to water). Data on emissions are collected annually through the WISE-SoE Reporting process. Following the test data request in 2008, data on emissions to water are requested as regular data flow from 2009 onwards. The information reported will be used in the assessments of pressures from diffuse and point sources on Europe`s waters.

The databases on emissions are available for download here: <http://www.eea.europa.eu/data-and-maps/data#c11=water&c17=&c5=all&c0=5&b_start=0>.

The data in Waterbase is the basis for the EEA’s water quality indicators and the WISE interactive maps. The specific data used in the indicators is also available for viewing and download separately. Emissions to water are an important element (describing the pressure) in assessment of the state of Europe’s environment (SoE). This database contains data on emissions of nutrients and hazardous substances to water, aggregated within River Basin Districts (RBDs), in the EEA member countries.

The future harmonisation of WFD pressures and SoE source categories should be promoted. The WFD emission reporting includes two levels of emission data – total point and diffuse emission load per RBD or sub-unit and a more detailed source or pathway emission load (also per RBD or sub-unit). In order to obtain comparable source apportionment, it is recommended to revise the SoE emission source categories to match the WFD pressure list (when the latter has sub-categories) and also to sub-divide the SoE direct discharges to sea to allow a summation of the sector categories at country level, which is not possible with the current data model. An estimation of emission loads to the sea depends on the type of emission load: net emission load from RBD area could be used from riverine load; rough emission input (discharges without losses in water bodies) could be counted from all related RBD emission loads. Specific information is necessary about direct discharges to coastal waters and atmospheric deposition directly to sea surface – these emissions to coastal waters should be included in SoE data, but not for marine waters (outside of coastal waters).

### Planned products and assessments

During the years, the EEA has in its state of the environment reports and water reports presented results on the sectoral contribution of in particular nutrient to the pollution of the aquatic environment. Source apportionment is the estimation of the contribution by different sectors to water pollution. In the coming years the EEA aims at updating this information on the source apportionment of the load of pollutants to the aquatic environment on a large scale: country, WFD river basins districts and sub-units, and sea areas.

Emissions to water are an important element - describing the pressure - in assessment of the state of Europe’s environment (SoE). The following charts, tables and/or maps will be developed. The extent to which products relating to non-EQS-Directive substances can be developed will depend upon the extent of reporting. The extent to which products relating to trends can be produced will depend upon the provision of data for more than one year.

Table 13: Overview table of EEA products based on water emissions database

| **Topic** | **Name of product/ information displayed** | **European overviews**  | **Country comparisons**  | **Trend analyses**  | **Pressures-status-measures analyses**  | **SoE determinants** (or groups of determinants) **needed for assessment** | **Used for** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Oxygen consuming substances/ organic pollution        | Total point and/or diffuse emission load value; Total point/diffuse emission load value per source; Point/diffuse emission load values – detailed apportionment according to the size (tonnes/year) | -- | X | (X) | X  | COD, BOD, TOC | tables, figures, maps - RBD or country level (other aggregation is also possible - e.g. Regions; new proposed indicator |
| Nutrient enrichment / eutro-phication        | Total point and/or diffuse emission load value; Total point/diffuse emission load value per source; Point/diffuse emission load values – detailed apportionment according to the size (tonnes/year) | -- | X | (X) | X  | N tot, P tot | tables, figures, maps - RBD or country level (other aggregation is also possible - e.g. Regions; new proposed indicator |
| Hazardous substances and emerging chemicals        | Total point and/or diffuse emission load value; Total point/diffuse emission load value per source; Point/diffuse emission load values – detailed apportionment according to the size (tonnes/year) | -- | X | (X) | X  | Priority substances (Annex I) | tables, figures, maps - RBD or country level (other aggregation is also possible - e.g. Regions; new proposed indicator |

An overview on the determinants to describe emission pressures is given in Table 14.

Table 14: Determinants to describe emission pressures (SoE data flow: Emissions)

| **Name** | **No of countries reporting** | **Must keep** | **Should keep** | **Could keep** | **Drop** |
| --- | --- | --- | --- | --- | --- |
|  | **Diffuse sources** | **Point sources** |  |  |  |  |
| **Nutrients** |  |  |  |  |  |  |
| Total Organic Carbon (TOC) | 2 | 30 |  | x |  |  |
| CODMnCODCr | -1 | 411 |  | x |  |  |
| BOD5BOD7 | 1- | 94 |  | x |  |  |
| Total NitrogenTotal Phosphorus | 66 | 3131 |  | x |  |  |
| NitrateAmmonium | 1- | 87 |  |  |  | x |
| Total suspended solids | 2 | 7 |  |  |  | x |
| **Hazardous substances (groups)** |  |  |  |  |  |  |
| Priority substances (EQS, Annex I) |  |  | X |  |  |  |
| Other substances (RBSP), mentioned in WFD products  |  |  |  | X |  |  |
| Not priority substances and not RBSP  |  |  |  |  |  | X |

Arguments to keep or drop a determinant

* CODMn/CODCr, BOD5/BOD7: Can be used for country comparison of total diffuse and total point source input for WFD related assessments5. They are only rarely reported, especially inputs from diffuse sources.
* Total nitrogen, Total phosphorus, TOC: Can be used for country comparison of total point and diffuse source input for WFD related assessments[[5]](#footnote-5) and should be reported. Diffuse sources input is rarely reported.
* Priority substances (EQS, Annex I) and River Basin Specific Substances (RBSP) can be used for country comparison of total point and diffuse source input for WFD related assessments5. They should be reported.
* Not priority substances / not River Basin Specific Substances (RBSP) can be dropped from reporting. They are not relevant for emissions reporting.
* Total suspended solids, nitrate and ammonium are not relevant for reporting of emissions and they are only rarely reported, so they can be dropped from reporting.

# Conclusions

The activity focused on the established data flows to ensure both State of Environment (SoE) priority data flows and established data flows of the WFD and other EU Water Directives to be updated in a more consistent way in the mid and long-term. The review is being used to prepare specifications for the new SoE data model, which is required for the WISE 2.0 SoE data request in 2015. Based on the results of the above analyses the determinants which are presented in the Annex shall be reported under WISE SoE in the future. The changes in the SoE data flows will be presented and discussed at the Freshwater Eionet Workshop in June 2015.

1. For more information see background note on content related WISE-SoE review: <http://forum.eionet.europa.eu/nrc-eionet-freshwater/library/copenhagen-eionet-freshwater-workshop-2014/freshwater-eionet-workshop-2014/background-documents/content-related-soe-review> [↑](#footnote-ref-1)
2. Waterbase is the generic name given to the EEA's databases on the status and quality of Europe's rivers, lakes, groundwater bodies and transitional, coastal and marine waters, and on the emissions to and on the quantity of Europe's water resources. [↑](#footnote-ref-2)
3. See also background note on content related WISE-SoE review: <http://forum.eionet.europa.eu/nrc-eionet-freshwater/library/copenhagen-eionet-freshwater-workshop-2014/freshwater-eionet-workshop-2014/background-documents/content-related-soe-review> [↑](#footnote-ref-3)
4. Definition of “must”, “should, “could, “won’t” see Annex 1. Determinants in categories “must”, “should” and “could” will be kept in future reporting, determinants in category “won`t” will be dropped. [↑](#footnote-ref-4)
5. See chapter 9.3.2.1 and 9.3.3.2 in WFD Reporting Guidance 2016. [↑](#footnote-ref-5)