The WFD in the Netherlands
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Abstract
The Water Framework Directive (WFD) is the current European legislation aiming at long-term sustainable water management based on a high level of protection of the aquatic environment. It addresses both the chemical and ecological status of surface water through a variety of parameters. According to the precautionary principle, the overall indicator is aggregated with the ‘one out/all out’ method. This means that specific improvements to improve water quality do not always have a positive effect on the final indicator. Consequently, this could also generate worse results for member states which have comprehensive monitoring which includes more parameters. Therefore, besides the final indicator of the ecological quality, it is advisable that the most important underlying indicators are also shown. The following case study illustrates the advantages and disadvantages in the implementation of this Directive to assess water quality using The Netherlands as example.

Context
The European Water Framework Directive (WFD) is the current legislation for the quality of surface water (EC, 2000). The aim of the WFD is to protect the ecological and chemical quality of the surface water and the chemical and quantitative status of the groundwater. This case focuses on the ecological and chemical status of surface water. In the Netherlands most surface water bodies are artificial, such as canals and ditches or heavily modified lakes, rivers and streams. Only some surface water bodies are in a more or less natural state.

The WFD specifies quality elements1 for the classification of ecological status that include hydro-morphological, toxic substances and physico-chemical elements supporting biological elements. To describe the surface water quality, agreements are made to define the areas of assessment, the so-called water body, and the biological elements and chemical substances that are to be monitored. Quality elements are defined for chemical status, biological quality, physico-chemical quality, and river basin specific pollutants. Standards are established for the maximum concentration of toxic pollutants and nutrients, and a method is developed to integrate the different components to report on a quality element (Figure 1). Chemical status is determined by 45 substances which are evaluated in all water bodies in Europe. The river basin specific pollutants are a group of substances specific to the river catchment depending on the kind of agriculture and other pollution sources. The physico-chemical quality is determined using eight parameters; nitrogen and phosphorus are the most important parameters. The quality elements and final indicator are aggregated

1Quality Elements - The WFD specifies the factors, referred to as quality elements, which must be used in determining the ecological status or ecological potential and the surface water chemical status of a surface waterbody. The list of quality elements for each surface water category are divided into three groups of elements:
- biological elements
- hydromorphological elements
- chemical, river basin specific pollutants and physico-chemical elements
so if one component does not meet the standard, the final indicator or the quality element does not meet the standard either (one out, all out principle). This is in line with the precautionary principle. The WFD integrates many different substances and the quality of four biological groups (phytoplankton, macro invertebrates, other aquatic flora and fish) to give an indication of overall ecological quality.

![Assessment quality surface waters according Water Framework Directive](image)

**Figure 1. The decision schema of the WFD (Source: CBS, PBL, Wageningen UR).**

**Analysis**

The results for the Netherlands are presented in Figure 2 (CBS et al, 2014). The Netherlands has 720 bodies of surface water. The chemical quality and the quality of river basin specific pollutants are classified as ‘good’ when all pollutants meet the standard or poor when one or more pollutants fail to achieve a ‘good’ classification. Half of surface water bodies have a good chemical status. The most important substances which lead to a poor chemical status are dichlorvos and tributyltin. The ecological quality across the 720 surface water bodies is moderate, poor or bad; the ‘good’ status was not achieved in any surface water bodies.

The ecological quality is determined mainly by the biological quality, which consists of quality elements including phytoplankton, other aquatic flora, macro invertebrates and fish. Again if one element does not meet the standard the ‘one out, all out’ principle applies.
out, all out’ approach is used. In the case that the biological quality is good, the physico-chemical quality and quality of the river basin specific pollutants are included in the final ecological quality. Consequently, when the ecological quality is moderate, poor or bad, this is mainly due to the biological quality. The biological quality was good in 5% of water bodies. The physico-chemical quality was good in one-third of surface water bodies; this was mainly a result of the nitrogen and phosphorus concentrations. Both parameters were in less than half of the water bodies of a good quality. The river basin specific pollutants were in 14% good, mostly due to pesticides, heavy metals and ammonium.

![Figure 2. The results of the WFD assessment for the Netherlands (Source: CBS, PBL, Wageningen UR)](image-url)
Lessons learned

The WFD is an integrated assessment of the water quality whereby the biological quality is a main aspect of the total assessment. The ‘one out/all out’ method is in line with the precautionary principle, but a consequence is that the final quality is nearly always unsatisfactory. Improvements of specific substances or of a biological quality element do not always have a positive effect on the final indicator. Therefore, the individual parameters of the physico-chemical and the biological quality elements are presented. The standards for the biological and physico-chemical quality elements are determined for each type of surface water. In situations where the objectives cannot be achieved for reasons of technical feasibility or disproportional damage to other functions, the objectives can be adapted; this is referred to as good ecological potential. In the Dutch situation, with only artificial and heavily modified surface waters, this is done for many water bodies. The WFD has ensured that methods are uniform to assess water quality and this has led to many additional measures to improve both the chemical and ecological quality. Nonetheless, it will be a challenge to reach all objectives by 2027.

References
