

Proposed Routemap for a Harmonised Leakage Reporting Index for use by EU Member States

This paper sets out a proposal from the IWA Water Loss Specialist Group (WLSG) for a Routemap towards the use of ILI for reporting performance on active leakage management across EU member states for use with the Water Framework Directive.

The Water Framework Directive

Directive (EU) 2020/2184 on the quality of water intended for human consumption that came into force on 12th January 2021 refers to ILI, stating *“In accordance with Directive 2000/60/EC, Member States shall ensure that an assessment of water leakage levels within their territory and of the potential for improvements in water leakage reduction is performed using the infrastructural leakage index (ILI) rating method or another appropriate method. That assessment shall take into account relevant public health, environmental, technical and economic aspects and cover at least water suppliers supplying at least 10 000 m³ per day or serving at least 50 000 people.”*

Resulting from this Directive, each EU Member State must set-up mechanisms to assess, monitor and benchmark leakage levels, and Member States and water suppliers must ensure that up-to-date information is accessible to consumers on-line.

Article 4 General obligations clause requires that:

- Member states shall ensure an assessment of leakage levels using the ILI or another appropriate method, and communicate the results by January 12, **2026**, at the latest to the Commission.
- The Commission will set out a **threshold**, based on the ILI or another appropriate method, by January 12, **2028**, at the latest.
- Member States having a leakage rate above the threshold shall present an action plan to the Commission within two years thereafter (by January 12, **2030**, at the latest) laying down a set of measures to be taken in order to reduce their leakage rate.

IWA Water Loss Specialist Group gave its response in a position paper in 2022.

<https://iwa-network.org/news/iwa-water-loss-specialist-group-position-statement-use-of-the-infrastructure-leakage-index-in-eu-directives-and-regulations>

This proposal contains some of the text from that position paper.

The WLSG is supportive of the use of ILI for this purpose and welcomes the standard approach using a technical performance indicator developed and promoted by IWA members. The WLSG considers this to be a collective step forward by all EU Member States. Whilst initially there may be difficulties in the implementation of these requirements, it is expected that with time there will be compliance and a common understanding and reporting on leakage and system performance (efficiency) across the current 27 countries, plus other States that may subsequently join the EU.

The IWA WLSG agree that there should be a standardised method of calculating leakage rates across the EU rather than each member state reporting using its own methodology. However, it is acknowledged that not every utility will have the data available to report ILI within the timeframe set out in the Directive. Therefore, a Routemap is required to establish a common approach starting with data that should be readily available to all organisations.

The EurEau proposal

In May 2021, EurEau published a Briefing Note on Drinking Water Supply and Leakage Management. This was the result of detailed feedback from water operators in 28 countries, and it concluded that a harmonisation process must be established in order to achieve a basic level of leakage estimation and comparability. In November 2023 EurEau issued a Position Paper presenting recommendations elaborated by EurEau's Leakage Working Group for a harmonised method of leakage measurement and reporting across the EU for the January 2026 reporting deadline.

EurEau proposed the following harmonised index to be used by operators, Member States and the Commission for the reporting mandated by the DWD. The level of leakage should be expressed using the following volumetric index:

$$\text{m}^3 \text{ of non-revenue water} / \text{km of water mains} / \text{year}$$

In line with the IWA Water Balance methodology non-revenue water (NRW) is defined as follows:

$$\text{NRW} = \text{Metered System Input Volume} - \text{Billed Consumption}$$

Volume System input volume refers to the drinking water supplied for consumption. Water mains refer to the drinking water distribution network, excluding connections as defined in standard ISO/DIS 24528.

EurEau stated that reporting this leakage index should be achievable by all drinking water operators concerned, as the required input data is routinely collected by operators of all sizes. It does not need to be used exclusively, but must be included by all operators and, in turn, Member States in order to ensure comparability of the data received by the Commission.

In March 2024 the IWA Water Loss Specialist Group (WLSG) gave its preliminary response to the Proposal from EurEau dated November 2023 for a Harmonised Leakage Reporting Index in EU Member States. This paper builds on that response with some sections being reformatted and expanded.

The WLSG agrees with EurEau that providing information about the data reported for the Directive is essential. The objective of requiring all EU member states to report using the same leakage index in order to facilitate comparisons between countries and performance against central targets is supported. However, there are concerns over the index proposed by EurEau for that purpose (NRW / km / year) and an understanding that further work is required to establish a reporting system that is meaningful and practicable within the timescales required by the Directive.

The IWA WLSG agree that any harmonised leakage index should be complemented by additional information including additional indices at the discretion of member states. It is unlikely that all water operators will be able to report with the same level of confidence and so each reported index should be given an appropriate confidence grade.

In April WLSG held the Water Loss 2024 conference in San Sebastian, Spain during which a group working on the KPI Initiative held a workshop, entitled COMPARING LEVELS OF WATER LOSS INTERNATIONALLY which was attended by over 100 people. From the feedback from the workshop and having now given the matter further consideration after a number of WLSG members have spoken with European water utilities and regulators, we have prepared this paper setting out a proposed way forward.

A Routemap towards ILI

Although the WFD proposes the use of ILI (Infrastructure Leakage Index) as the KPI for benchmarking we understand that there are several reasons being given as to why it is not appropriate at this time:

1. That all utilities do not have the data required to allow ILI to be estimated to a standard required for regulation. It is important that the KPIs used for regulation and comparison should be based on robust auditable data wherever possible rather than estimated values. Data limitations mainly consist of reliable average operating pressure considering the full extent of the network.
2. It is generally accepted that ILI should be presented with the value of average operating pressure that is the basis of the ILI calculation. When pressure is reduced to reduce leakage both the CARL and UARL will reduce and therefore the ILI, which is the ratio of these two values, may not reduce. ILI values achieved under unnecessary high operating pressure may hide a potential for water loss reduction
3. ILI should not be used for target setting unless and until all pressure management options have been exhausted. This is explained in the EU reference document good practices on leakage management from 2014:

<https://op.europa.eu/en/publication-detail/-/publication/3ff6a13c-d08a-11e5-a4b501aa75ed71a1/language-en>

Therefore, WLSG and EurEau are in agreement that an alternative measure, allowed for by the WFD, is required until such time as utilities have the data to be able to calculate ILI with confidence, and the context in which ILI is applied is better understood.

Here we propose a Routemap that each utility can follow to work towards ILI with key milestones and how they can be achieved. In summary these milestones are:



This route is a straight road. The data required to move to the next step is also required to move to the step beyond; no less and no more.

EurEau proposal for a harmonised index of Non-Revenue water scaled to network length (NRW / km / year)

The EurEau proposal from November 2023 sets out the reasoning behind the choice of this measure. Our preliminary response to EurEau gave reasons why we felt this to be inappropriate. However, we can now understand why this measure has been proposed and accept that it is a useful first step on the Routemap.

NRW is relatively simple to estimate being the difference between the volume of water put into supply and the volume sold to customers based on either metered or estimated volumes. The length of the network should be available from GIS systems or from measurements from record plans.

However, NRW/km/year is not suitable as a final measure for the following reasons, taking the numerator and denominator separately:

1. Non-Revenue Water (NRW) is very different from leakage as it includes known consumption that is not charged for (Unbilled Authorised Consumption) as well as uncertainties included in what we know as Apparent Losses. The Directive states “*In accordance with Directive 2000/60/EC, Member States shall ensure that an assessment of **water leakage levels** within their territory and of the potential for improvements in **water leakage reduction** ---*”. In some utilities NRW and leakage (or real loss) will be similar, but in others there will be significant differences.
2. The EurEau proposal is to divide the NRW rate by the length of water mains in the network. Although that is one of the denominators in regular use, it does not take account of the urban or rural nature of the supply network. The other measure in regular use is to divide by the number of properties supplied, or by the number of service connections. This is important because it is recognised that a significant proportion of leakage occurs on the branches off the water mains network.

The problem of providing fair comparisons between urban and rural networks with differing mains lengths per property-building (respectively service connection density) has been known for many years and is one of the prime reasons for the development of the ILI index. Dividing by the length of mains network (m³/km/day) tends to produce lower values for rural systems. In general, the real loss (and water loss) per km of mains length will increase at higher service connection densities i.e. more urban areas. Therefore, the alternative is to divide by the number of service connections or properties-buildings supplied (litres/connection/day) but that favours urban areas over rural ones. Ideally, the denominator in the KPI should reflect the size of the network for any service connection density, and recently proposals have been made for such an indicator which are under review by the IWA WLSG as set out below.

Real Loss / km / day

We propose that the next step on the Routemap should be to undertake a water balance in accordance with the IWA standard in order to report real loss rather than NRW. We also propose to use per day (which is in line with other IWA KPIs) rather than per year. Note that ILI is the ratio of the current real loss (CARL) to the unavoidable (or utopian level) of real loss (UARL). So, a water balance will be required at some point on the route to ILI.

System Input Volume	Authorised Consumption	Billed Authorised Consumption	Billed metered consumption	Revenue Water
			Billed unmetered consumption	
		Unbilled Authorised Consumption	Unbilled metered consumption	Non- Revenue Water
			Unbilled unmetered consumption	
	Water Loss	Apparent Losses	Unauthorised consumption	
			Data handling and billing errors	
			Underestimation of unmeasured consumption	
			Customer metering inaccuracies	
		Real Losses	Leakage on transmission and distribution mains	
			Leakage and overflows at utility's storage tanks	
Leakage on service connections up to the point of customer metering				

As can be seen NRW includes unbilled and unauthorised consumption and metering inaccuracies. These components have to be assessed in order to determine the level of real loss which is synonymous with leakage. Member states should be given guidance on the application of the IWA standard water balance including ranges of values to be applied to confidence grades for each component. Further, principles of the IWA PI Manual (Performance Indicators for Water Supply Services, Alegre et al., IWA Publishing 2017) should be followed for the calculation of the water balance and PIs and relevant context information.

The benefit of this step is that the KPI is based on real loss / leakage as required in the WFD. The next step is to ensure that the scaled measure provides fair comparisons between systems with different connection densities.

Combined Real Loss Indicator (CRLI)

CRLI is the level of real loss scaled to the size of the water supply network. It takes account of the number of service connections as well as the length of mains and therefore provides a fairer comparison between urban and rural networks.

CRLI is calculated as:

$$\text{Litres per Day} / (\text{Connections} * \text{meter of mains})^{0.5}$$

The only additional data that is required to calculate CRLI is the number of service connections. That may be available from GIS records, or it could be estimated as a ratio to the number of properties supplied, which should be available from the utility billing systems.

Note that the number of service connections is also required for the estimation of ILI.

Although CRLI is a relatively new concept, having been first proposed in 2018, it has been applied successfully in several countries and has been proven to be a useful indicator for comparing leakage levels between different systems. Several PowerPoint presentations are available on the use of the measure and it is explained in more detail in a YouTube video from 2020:

<https://www.youtube.com/watch?v=jrs1V-eDitU>

Infrastructure Leakage Index (ILI)

ILI is estimated as:

$\text{CARL (current annual real loss) / UARL (unavoidable annual real losses)}$.

UARL requires an assessment of:

Lm = mains length (km).

Nc = number of service connections.

Lt = total length (km) of service connections

Pc = current average operating pressure (metres).

So, in addition to the data required to calculate CRLI, utilities will need to estimate Lt and Pc.

Note that:

1. ILI takes account of system pressure. It indicates the magnitude of current leakage (CARL) compared to the unavoidable leakage (UARL), at the current average operating pressure. Therefore, it is effectively a measure of performance on active leakage control given the current state of the infrastructure and the current operating pressure rather than a measure of the leakage rate.
2. ILI is recommended for use in systems with more than 5,000 service connections and system pressure between 45m and 60m head. Outside of those limits the use of system correction factors (SCFs) is recommended.

WLSG recommends that when reporting ILI, reference is also made to the system pressure which impacts both the current level of leakage (CARL) and the lowest achievable leakage level (UARL); the two values used to calculate the ILI (CARL/UARL).

The four stages of the Routemap

Each utility has the option to enter the Routemap at any of the four stages. A utility that has already calculated ILI will be able to work back along the route to provide data on CRLI, Real loss/ km and NRW/ km because it has all the necessary data. Similarly, those with CRLI values can work back to the other 2 stages etc. A utility entering the Routemap at NRW/km can then work along the route as and when additional data becomes available.

This approach allows EC to commence comparisons and benchmarking using NRW/km and can see which utilities / member states have access to the data required to provide a more appropriate (in the view of WLSG) technical measure.

Benchmarking and comparing leakage rates

The Directive appears not to make clear whether data has to be provided for the whole of the member state or only for certain supply systems. It is important that the harmonised index be used for the purposes intended by the Directive and this needs to be defined in a careful and unambiguous manner.

The target of calculating an "EU-wide average leakage rate" has to be questioned, as the "average leakage rate" may not represent a best practice value, which should be used as a long-term target for all EU member states without consideration of individual framework conditions of each country (including public health, environmental, technical and economic considerations), and for each water supply system within a member country.

It is also pointed out that averaging the individual utility or EU state leakage rates will not provide the EU-wide average leakage rate. At best the median leakage rate could be provided but this would require careful interpretation. It would be necessary for each utility to provide the prime data (e.g. volumetric leakage, number of connections, length of mains etc) in order to work out the EU-wide average leakage rate.

Beside the indicators themselves, best practice in benchmarking has shown that context information on certain framework conditions (including public health, environmental, technical and economic considerations) is necessary to achieve comparability between water supply systems on a national and international level.

Threshold levels and Targets

The WLSG considers that the threshold level proposed in the WFD should be appropriate to individual system characteristics, such as system size and factors other than technical achievability. It is not appropriate to have a single threshold level that is viewed as a target for every water supply system.

The WLSG welcomes the reference in the Directive “*that assessment shall take into account relevant public health, environmental, technical and economic aspects*”. The WLSG recommend using a PESTLE approach to target setting for water loss taking account of all **Political, Economic, Social, Technical, Legislative and Environmental** considerations. Therefore, WLSG proposes reconsideration of the stipulated ILI threshold of 1.5 set out in ANNEX 1 to the EU Taxonomy Climate Delegated Act to reflect the above relevant aspects considered in the assessment.

The WLSG recommends that further consideration is given to the threshold level based on the responses from European member states between January 2026 and January 2028 and that utilities should be encouraged to achieve the CRLI stage on the Routemap by then in order to provide fair comparisons of leakage rates.

Stuart Hamilton
Chair
IWA Water Loss Specialist Group
Draft 3.0
6th June 2024