IWA Water Loss Specialist Group (WLSG)

Position Statement (March 2022)

Use of the Infrastructure Leakage Index (ILI) in EU Directives and Regulations

The WLSG is a specialist group of the International Water Association (IWA) that promotes best practice in the management of water loss and non-revenue water across the world.

Purpose

This Position Statement outlines the key issues associated with the use of the Infrastructure Leakage Index (ILI) for benchmarking performance as set out in the Directive (EU) 2020/2184 and the EU Taxonomy Climate Delegated Act referenced below. The WLSG considers that clarification is needed on several points, to avoid the Directive and Taxonomy Act being interpreted as a requirement to set targets for water loss in terms of ILI with the threshold reference levels proposed therein; particularly regarding existing networks.

The 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.

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.

Based on the above, the WLSG:

- Considers that the proposed threshold level should be appropriate to individual system characteristics, such as system size and factors other than technical achievability.
- Welcomes the reference in the Directive "*that assessment shall take into account relevant public health, environmental, technical and economic aspects"* and therefore 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.
- 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).

A briefing note from Eureau entitled 'Drinking Water Supply and Leakage Management' issued in May 2021 in response to the EU Drinking Water Directive recast (https://www.eureau.org/resources/briefing-notes/5735-eureau-briefing-note-on-drinking-water-supply-and-leakage-management/file) refers to the use of ILI. It states "One very important point to underline is that no one single indicator gives an absolute picture about the utilities of a single country, especially as an average or even as a weighted average"; a point endorsed by WLSG.

EU Taxonomy

The EU Taxonomy Climate Delegated Act (Commission Delegated Regulation (EU) 2021/2800) was formally adopted on 4 June 2021 and is applicable from 1 January 2022 in all Member States. It references Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment and amending Regulation (EU) 2019/2088.

ANNEX 1 to the Commission Delegated Regulation 2021/2800, supplementing Regulation (EU) 2020/852 of the European Parliament and of the Council by establishing the technical screening criteria for determining the conditions under which an economic activity qualifies as contributing substantially to climate change mitigation or climate change adaptation and for determining whether that economic activity causes no significant harm to any of the other environmental objectives.

Section 5 of the ANNEX 1 reads:

"5. WATER SUPPLY, SEWERAGE, WASTE MANAGEMENT AND REMEDIATION

5.1. Construction, extension and operation of water collection, treatment and supply systems

Description of the activity:
Construction, extension and operation of water collection, treatment and supply systems. The economic activities in this category could be associated with several NACE codes, in particular E36.00 and F42.99 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006.

The water supply system complies with one of the following criteria:

(a) the net average energy consumption for abstraction and treatment equals to or is lower than 0.5 kWh per cubic meter produced water supply. Net energy consumption may take into account measures decreasing

energy consumption, such as source control (pollutant load inputs), and, as appropriate, energy generation (such as hydraulic, solar and wind energy),

(b) the leakage level is either calculated using the Infrastructure Leakage Index (ILI) rating method and the threshold value equals to or is lower than 1.5 or is calculated using another appropriate method and the threshold value is established in accordance with Article 4 of Directive (EU) 2020/2184 of the European Parliament and of the Council. That calculation is to be applied across the extent of water supply (distribution) network where the works are carried out, i.e. at water supply zone level, district metered area(s) (DMAs) or pressure managed area(s) (PMAs).

5.2. Renewal of water collection, treatment and supply systems

Description of the activity:
Renewal of water collection, treatment and supply systems including renewals to water collection, treatment and distribution infrastructures for domestic and industrial needs. It implies no material changes to the volume of flow collected, treated or supplied. The economic activities in this category could be associated with several NACE codes, in particular E36.00 and F42.99 in accordance with the statistical classification of economic activities established by Regulation (EC) No 1893/2006.

The renewal of the water supply system leads to improved energy efficiency in one of the following ways:

(a) by decreasing the net average energy consumption of the system by at least 20% compared to own baseline performance averaged for three years, including abstraction and treatment, measured in kWh per cubic meter produced water supply,

(b) by closing the gap by at least 20% either between the current leakage level averaged EN 116 EN over three years, calculated using the Infrastructure Leakage Index (ILI) rating method and an ILI of 1.5, or between the current leakage level averaged over three years, calculated using another appropriate method, and the threshold value established in accordance with Article 4 of Directive (EU) 2020/2184. The current leakage level averaged over three years is calculated across the extent of water supply (distribution) network where the works are carried out, i.e. for the renewed water supply (distribution) network at district metered area(s) (DMAs) or pressure managed area(s) (PMAs)."

WLSG's Position on ILI for this purpose set out in the EU Taxonomy

General

1. The WLSG supports a holistic approach to leakage management, considering the different components of leakage (overflows, breaks, leaks) on each part of the distribution system (storage tanks, mains, service connections, households), and selection of appropriate policies and techniques, such as active leakage control, management of pressures to reduce leak flow rates and burst frequencies and to extend asset life and renewal.
2. All water distribution systems suffer some leakage. It is generally accepted that it is not technically possible, or indeed desirable economically, to achieve zero leakage. The WLSG encourages leakage reduction to an appropriate level and promotes best practice in doing so.

Economic level of leakage and leakage targets

3. The WLSG promotes an approach by which the targets set for leakage reduction by water supply companies take account of what is technically and financially possible, and consider the views of all stakeholders including environmental, social and other factors as well as economics.

4. The WLSG supports the use of a volume metric such as m³/d or Ml/day for target setting rather than any scaled measure.

5. The WLSG recommends that ILI should not be used to set targets in isolation from other parameters. As the current pressure regime may not be optimal, ILI should always be interpreted with some measure of pressure, and only used for tracking progress provided all justifiable pressure reduction is achieved.

Performance measures

6. The WLSG promotes the use of leakage performance indicators which are fit for purpose for European comparisons; this does not include any measure based on percentages of System Input Volume. Percentages are misleading for comparisons because of differences and changes in consumption, and it is a zero-sum calculation which cannot identify true reductions in leakage and consumption in the same time period.

7. The WLSG supports the conclusion of the 2015 EU Reference Document 'Good Practices on Leakage Management WFD CIS WG PoM' (© European Union, 2015) that there is no single leakage performance indicator that is suitable for all purposes, and measures used should be fit for the particular purpose. For expressing targets and tracking progress in individual organisations and systems, m³/d (Ml/day) and litres/connection/day (l/conn/d) are preferred; m³/km mains is acceptable for very low connection densities. Infrastructure Leakage Index (ILI) used in conjunction with some measure of operating pressure is more reliable for international comparisons of technical performance.

8. European and other international evidence suggest that an ILI between 1 and 3 is appropriate for most water resource zones in a high-income country. Where the estimated sustainable economic level of leakage is an ILI of below 1 or above 3, the local circumstances should be reviewed to ensure that the methodology and data used are robust. Whilst measures of total water lost are useful, they should not be the sole criteria on which water utilities are judged.

Environment

9. The WLSG recognises that a considerable amount of energy is used to abstract, treat, and pump potable water and as a result water loss contributes to the electricity use and carbon footprint of water supply. However, works to control water loss also contribute to reduce carbon emissions, particularly ongoing work to detect and repair leaks. Therefore, a balanced approach is required.

Managing Leakage

The WLSG promotes the importance of leakage reduction in the management of water supplies and its contribution to the sustainable management of water resources. In this context it supports the efforts of all stakeholders in the water industry to manage leakage effectively and economically.

The WLSG recognises that there is high political and media interest in leakage, and whilst low leakage is desirable, the cost to achieve and maintain low leakage levels needs to be understood by all stakeholders. In this respect there is a need to effectively communicate the measurement of leakage performance, the economics and environmental benefits of leakage and how leakage targets are set and expressed.

The WLSG supports the approach set out in the 2015 EU Reference Document (see Appendix 1), which is a key source document for this Position Statement.

The WLSG understands that the threshold values set in the Directive (EU) 2020/2184 and Annex 1 of the EU Taxonomy Climate Delegated Act for ILI and Energy Consumption are for determining the conditions under which an economic activity qualifies as contributing substantially to climate change mitigation or climate change adaptation and for determining whether that economic activity causes no significant harm to any of the other environmental objectives. The WLSG considers that to meet these it may be necessary to aim below simple economic levels of water loss, particularly in countries where the cost of water production and distribution is very low, which financially may be undesirable, particularly by "water rich" countries.

Measuring Leakage

Comparison of levels of leakage in Europe has historically been problematical because of the wide range of performance measures used in different countries for setting targets and reporting performance. The recommendations of the 2015 EU Reference document of 'fit for purpose' leakage performance indicators are summarised in the Table below.

OBJECTIVE	GOOD PRACTICE PERFORMANCE INDICATOR FOR LEAKAGE, FIT FOR PURPOSE						
	Volume per year	litres/ service connection	m^3/km mains	litres/ billed property	% of System Input Volume	% of Water Supplied	Infrastructure Leakage Index, with Pressure
SET TARGETS AND TRACK PERFORMANCE, FOR AN INDIVIDUAL SYSTEM	YES, for large systems	YES*	YES*	YES (UK)	NO	NO	Only if all justifiable pressure management completed
TECHNICAL PERFORMANCE COMPARISONS OF DIFFERENT SYSTEMS	NO	NO	NO	NO	NO	NO	YES
DRAW GENERAL CONCLUSIONS FROM SINGLE OR MULTIPLE SYSTEMS	NO	NO	NO	NO	NO	NO	YES, together with other context factors
* Choose services connection density > 20/km; if not, choose mains; or base choice on country custom and practice							

Based on EU Reference document 'Good Practices on Leakage Management WFD CIS WG PoM' 2015

In a diminishing number of countries leakage is still expressed as a percentage of System Input Volume. This is very misleading as % leakage is a zero-sum indicator which is distorted by changes and differences in consumption and cannot show reductions for both leakage and consumption in the same year.

The Infrastructure Leakage Index (ILI) was developed by the IWA Water Loss Task Force (a forerunner to WLSG) in 1999 for international comparisons and is commonly used in Europe and elsewhere. ILI is the ratio of current annual average leakage (CARL) to an assessed technical minimum leakage achievable level (UARL) which allows for system infrastructure parameters and operating pressure. In combination with pressure and other context factors, ILI is useful for comparing performance between zones in the same Utility. Only where all practical pressure management has been completed, can ILI be used for regulatory targets.

Comments of the wording of the EU Taxonomy

Threshold values

The threshold values of ILI = 1.5 and energy consumption = 0.5 kWh/m^3 appear in Table 6 of the 2015 EU Reference document as shown below. However, it is important to understand the context in which they are used.

Directive (EU) 2020/2184 applies to water suppliers supplying at least 10,000 m^3/day or 50,000 people. In Table 6 of the 2015 EU Reference document (see table below) the above-described systems would probably fall into the “Small” systems category. The EU Reference document distinguishes between the approach to be adopted in Very Small / Small systems, and systems that are Medium and larger. The WLSG considers that system size and other influencing factors (such as availability of water resources, structural parameters like topology and network structure in terms of geographic preconditions) should be considered when setting the ILI threshold values.

Regarding the energy consumption value of 0.5 kWh/m³ it must be clear that in Table 6 this is described as context information, which depends e.g., on the type of water resources, geography, required water treatment processes, or the average pumping requirement. Only a certain amount of the energy consumption can be influenced by proper management, while the large remainder depends mainly on Utility and site-specific conditions, e.g., in drought-stricken Member States where desalination is a much-needed source of potable water. For example, a water utility using resources in alpine regions with low treatment needs and gravity supply will have a much lower specific energy consumption than a water utility using desalinated sea water which subsequently needs to be pumped into higher elevated distribution systems.

Parameter	Units of measurement	System Size Descriptions					This System	
		Very Small	Small	Medium	Large	Very Large		
Service connections:	Number	< 3k	3k to < 30k	30k to < 300	300k to < 3 million	3 mi or more	29k	Small
Service connection Density	Number per km of mains	< 20	20 to <30	30 to < 50	50 to < 70	70 or more	52	Large
Average length Main to Meter	Metres per Connection	< 4	4 to < 8	8 to < 12	12 to <16	16 or more	8	Medium

Parameter or Context Information	Units of measurement	Performance Indicator and Context Information Descriptions					This System	
		Very Low	Low	Moderate	High	Very High		
Infrastructure Leakage Index ILI		< 1,5	1,5 to < 2,0	2,0 to < 4,0*	4,0* to < 8,0*	8* or more	2,5	Moderate
Average System Pressure	Metres	< 30	30 to < 40	40 to < 50	50 to < 60	60 or more	40	Moderate
Mains repairs	per 100 km/year	< 7	7 to < 10	10 to < 15	15 to < 20	20 or more	21	Very High
Mains - average time to repair	Days	< 1	1 to < 2	2 to < 4	4 to < 8	8 or more	1	Low
Service Connection repairs	per 1000 services/year	< 3	3 to < 4	4 to < 7	7 to < 10	10 or more	22	Very High
Services - average time to repair	Days	< 2	2 to < 4	4 to < 8	8 to < 16	16 or more	1	Low
Active Leakage Control	% checked annually	< 10%	10% to < 30%	30% to < 70%	70% to < 90%	90% or more	50%	Moderate
Rate of Rise of Unreported Leakage	litres/service conn/day, in a year	< 20	20 to < 40	40 to < 80	80 to < 160	160 or more	?	?
Assessed Value of leakage	Euro/m³	< 0,10*	0,10 to < 0,25*	0,25 to < 0,50*	0,50 to < 1,00*	1,0* or more	0,65	High
Use of Energy	kWhr/m³	< 0,25*	0,25 to < 0,50*	0,50 to < 1,0*	1,0 to < 2,0*	2,0* or more	4,5	Very High

* Limits for these parameters are provisional and subject to further checking and/or review

Table 6 – Additional PIs and context indicators (Lambert et al, 2014).

Based on EU Reference Document ‘Good Practices on Leakage Management’ 2015

Context

It is not clear how Section 5.1 of ANNEX 1, EU Taxonomy, should be applied. It appears to be aimed at new networks and extensions to existing networks, though it is not clear under what circumstances a distribution network to serve a new development would be classed as a new network or an extension to an existing network. Section 5.1 also refers to the “operation” of those networks. If the aim is to benchmark the construction and operation of new networks and major extensions to existing networks, designed to serve new customer demand, against an ILI of 1.5 then it is reasonable. The WLSG supports that leakage from existing systems are not benchmarked in an equivalent manner to new pipe networks.

However, if the intention in Section 5.1 is indeed to benchmark existing networks against an ILI of 1.5, the WLSG considers this to be inappropriate.

It could also be interpreted to cover a new treatment works that supplies customers through an existing network of pipes. Clarification is needed to avoid confusion and misinterpretations.

Section 5.2 of ANNEX 1, EU Taxonomy, relates to the renewal or rehabilitation of systems, but here there is no mention of operation. It states that "*It implies no material changes to the volume of flow collected, treated or supplied*". However, it goes on to propose "*closing the gap by at least 20% either between the current leakage level … and an ILI of 1.5*". Closing the gap, implies a reduction in leakage and therefore a material change to the volume of flow.

For both Sections, the WLSG is concerned that they could be interpreted as setting targets to reduce leakage in existing pipe networks without taking account of other relevant factors.

Alternatives to ILI

Section 5 refers to the use of ILI "*or calculated using another appropriate method and the threshold value is established in accordance with Article 4 of Directive (EU) 2020/2184 of the European Parliament and of the Council*". The WLSG understands that there may be circumstances where an alternative ILI is required e.g., where pressure reduction makes a major contribution to water loss reduction. However, the EU Taxonomy ANNEX 1 provides no guidance on suitable measures or the benchmark levels associated with them.

Scope and application

Sections 5.1 and 5.2 state "*That calculation is to be applied across the extent of water supply (distribution) network where the works are carried out, i.e., at water supply zone level, district metered area(s) (DMAs), or pressure managed area(s) (PMAs).*"

Clarity is needed on how this is to be applied. For example,

- if a section of water main is being renewed, does that mean that the whole DMA in which it lies is then benchmarked against an ILI of 1.5 or a 20% reduction towards 1.5?
- if a water treatment works is being renewed, does that mean the whole network it supplies is then benchmarked against an ILI of 1.5 or a 20% reduction towards 1.5?

Benchmarks vs Targets

The current wording of the EU Taxonomy ANNEX 1 does not make it clear whether an ILI of 1.5 is seen as a benchmark against which current performance should be compared, or whether it is seen as a target to aim for when undertaking works to extend or rehabilitate water distribution networks.

The WLSG considers that the use of an ILI of 1.5 as a target to aim for is inappropriate, as it does not take account of other relevant economic, social and environmental factors that vary considerably from zone to zone, system to system, country to country. Neither does it take account of system size, the system structure (e.g., topology, network structure in terms of zoning / DMAs, urbanity, network age, materials used etc.), or the inherent condition of the network prior to the work being undertaken.

If it is proposed as a benchmark, it should be noted that the ILI itself is a benchmark of current leakage (CARL) against an unavoidable level of leakage (UARL).

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Appendix 1

EU Reference document Good Practices on Leakage Management WFD CIS WG PoM (ISBN 978-92-79-45069-3 © European Union, 2015)

Set out below is some of the relevant text from the EU Reference document, produced in 2015 with contributions from members of the WLSG.

Recommendation G: As the current pressure regime may not be optimal, ILI should always be interpreted with some measure of pressure, and only used for tracking progress if all justifiable pressure management has already been completed.

Section 5.3, summarises in two groups the performance indicators from most of the European Case Study accounts:

- KPIs for targets and tracking progress in individual systems: Volume/year, m^3/km of mains/day, litres/connection/day, and litres/property/day.
- KPIs for internal/external leakage comparisons between different systems: UARL, ILI, average pressure, value of leakage Euro/m^3 and repair frequencies.

Note that ILI is not used for target setting.

Section 6.2.2 Making comparisons of technical leakage performance:
The Infrastructure Leakage Index (ILI) was designed by an IWA Task Force in 1999 specifically for comparisons of leakage management performance between different systems with different infrastructure characteristics (connection density, length of service connections, average pressure).

ILI = CARL/UARL.
CARL is Current Annual Real Losses volume in m^3/year.
UARL is Unavoidable Annual Real Losses (UARL) in m^3/year where:

UARL (m3 /year) = (6,57 × Lm + 0,256 × Nc + 9,13 × Lt) × Pc.
Lm = underground mains length (km).
Nc = number of underground service connections.
Lt = total length (km) of underground service connections (main to meter).
Pc = current average operating pressure (metres).

The important performance indicator of average pressure is required for the calculation of UARL. Where a utility is undertaking a Pressure Management programme to reduce leakage, ILI should be used in conjunction with some measure of average system pressure.

Recommended actions for each ILI description	Low ILI < 2	Moderate 2 < ILI < 4	High 4 < ILI < 8	Very High ILI ≥ 8
Investigate pressure management options	Yes	Yes	Yes	
Investigate speed and quality of repairs	Yes	Yes	Yes	
Check ALC economic intervention frequency	Yes	Yes		
Introduce/improve active leakage control	Yes	Yes	Yes	
Identify options for improved maintenance		Yes	Yes	
Assess Economic Leakage Level	Yes	Yes		
Review burst frequencies		Yes	Yes	
5-year plan to achieve next lowest band			Yes	Yes
Fundamental peer review of all activities				Yes

Table 5 – Likely priorities for action based on ILI (after R. Liemberger, 2005).

Based on EU Reference document 'Good Practices on Leakage Management WFD CIS WG PoM' 2015

Table 5 was developed by WLSG members in 2005 for initial estimates of likely priorities for action based on different ranges of ILI. Investigation of pressure management options is always a clear priority unless initial ILI is very high.

Setting targets in volumetric parameters (Ml/day or Mm^3/year):
This section emphasised the need to take several factors into account when setting targets for water loss.

The ideal target will effectively be a compromise between several competing factors, though it is likely that one or two factors will predominate. The ideal target should be:

- Based on economic principles to ensure efficient operations. The cost of leaking water must be balanced against the ongoing cost of leakage control and investment in infrastructure.
- Practical to apply, in terms of data and analytical needs.
- Sustainable in the long term and flexible in the short term. Any target should reflect the ability of the organisation to maintain water loss at a reduced level over say a 20 to 30-year time horizon. In the short term, it is likely that new information will become available as water loss reduction projects are carried out. So, it is important that there is some degree of flexibility in the target until specific experience is gained or more data collected.
- Consistent with the water resources plan, and the demand forecast to safeguard future water supplies. There will be more incentive to reduce water loss when there is insufficient 'headroom' between demand and the available supply capacity of the system.
- Understandable, transparent, simple and consistent in order to demonstrate continual improvements to customers, in order to improve public perception.
- Founded on a sound understanding of leakage and water loss mechanics, taking a component-based approach.
- Sensitive to political considerations. Any target will have to recognise the influence of non-technical people from outside the industry. Leakage often becomes a political issue, linked to other newsworthy issues such as drought and water shortage.
- To meet regulatory requirements. In some countries, government agencies collect data on water loss and use this to set mandatory targets.
- Able to allow for fair technical comparisons between organisations. It is inevitable that an organisation will compare its level of loss with that of other water supply organisations. It is important that the target also allows for two significant factors, which differ from one area to another:
    - Topography, which affects the economics of pressure management.
    - Inherited infrastructure condition, which affects the economics of active leakage control and the need for investment in network asset management.

Appendix B.2 explains, with clear examples, why leakage as a % of System Input Volume is not appropriate for performance comparisons, setting targets or tracking leakage performance.