


# Our Drainage and Wastewater Management Plan 2030-2055

## Delivering for customers, communities and the environment

## Performance Indicator Methodology – Internal Flooding

March 2026

Thames Water

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This methodology document is a working draft based on the requirements of the published DWMP guidance and informed by agreements made through the Water Industry Task and Finish Groups for each Performance Indicator (PI). As the DWMP stages for each PI progress, this methodology will be refined to reflect the practicalities of deployment and feedback from stakeholders. A final published methodology document will describe the detailed approach followed.

# 1. Introduction

1.1. This document provides a detailed description of the **Internal Flooding Performance Indicator** and its purpose and contribution to forming our Drainage and Wastewater Management Plan (DWMP).

## Purpose of this document

1.2. The purpose of this document is to outline the methodology that will be used to establish the base year and future baseline forecasts for the **Internal Flooding Performance Indicator**, as part of our DWMP for the 2030-2055 planning period. The base year is 2030 and it is our best estimate of expected performance for this indicator at the end of the current investment period (2025-2030) and reflects the outcome of schemes and maintenance activities planned for this period. We then forecast what is expected to happen to the indicator at baseline points in the future if no change in investment is made. These future points are set in the short term (2035), the medium term (2045) and the long term (2055).

1.3. In addition, it sets out threshold values that will be used to summarise the level of risk and guide the development of options for the 2030-2055 planning period.

1.4. The requirements for Performance Indicators are set out in Government guidance for DWMPs[1] and subsequent clarifications by the Environment Agency (EA)[2]. To understand the general approach to our DWMP please also refer to our Strategic Context document on our website[3].

1.5. Assessment of the base year and future risks for each of our Performance Indicators is a crucial step in the development of our DWMP. It informs our understanding of how the drainage and wastewater system is able to meet legal obligations and meet the needs of customers and the environment. The DWMP approach requires completion of a risk assessment for the following Performance Indicators for each future planning horizon:

- **Internal flooding**
- External (curtilage) flooding
- Storm overflow performance (England)[$]
- Treatment works compliance (numeric)[$]
- Treatment works compliance (descriptive at numeric sites)[$]
- Treatment works compliance (Dry Weather Flow (DWF))
- Treatment works compliance (Flow to Full Treatment (FFT))
- Good Ecological and/or Chemical status: Public sewerage

[1] Guidelines for Statutory Drainage and Wastewater Management Plans (DWMPs) - GOV.UK
[2] EA letters to water companies with feedback on performance indicators (02/10/2025), (23/03/2026) and reporting thresholds (17/10/2025).
[3] DWMP28 | Drainage and wastewater | Thames Water

- Pollution incidents: serious[$]
- Pollution incidents: total
- Bathing water quality
- Shellfish water quality
- Surface water flooding (Shared responsibility)[β]
- Good Ecological and/or Chemical Status: Urban and transport (Shared responsibility)[β]
- Emergency overflow performance[$β]
- Treatment Works Compliance (descriptive)[β]
- Groundwater pollution[β]
- Groundwater infiltration[β]

1.6. Performance Indicators marked $ will use a nationally consistent suite of thresholds to describe the general level of risk[1,2]. Performance Indicators marked β are considered more experimental in nature and are recognised as inherently difficult to forecast and will hence be trialled in DWMP28 as emerging Performance Indicators and then possibly refined for subsequent DWMPs[1].

## Key definitions

1.7. **Internal Flooding Performance Indicator:** The Government DWMP guidelines provide the following definition:

Table 1. Extract from Table 2 of the Government DWMP guidelines

| Category | Metric | Details |
|---|---|---|
| Flooding | Internal Flooding | Annual number of internal sewer flooding incidents normalised per 10,000 sewer connections, in line with the latest Ofwat Performance Commitment[4] definition. The annualised figure is to be used based on reported and forecast incidents based on 1/10, 1/20, 1/30 and 1/50 return periods. |

1.8. The following clarifications are provided for key terminology within Table 1:

1.8.1. **Return periods:** This refers to rainfall return periods and not 'flood' return periods; we will use the latest Flood Estimation Handbook methodology to create the synthetic design rainfall that is subsequently used in conjunction with our system hydraulic models to forecast internal flood risk.

1.8.2. **Normalisation:** We will 'normalise' our internal sewer flooding incidents by assessing the incidents per 10,000 sewer connections, in accordance with the approach used to derive the Ofwat Performance Commitment values.

[4] PR24 final determinations performance commitment definitions - Ofwat

# 2. Key assumptions

2.1. This section contains a description of the assumptions we will make in reporting the Performance Indicator and provides a commentary on alignment with the DWMP guidelines.

## Assumptions

2.2. Where properties experience both internal and external flooding, this will be counted against the internal sewer flooding Performance Indicator. This aligns with the Ofwat Performance Commitment definition where only the severest impact, i.e. internal flooding, is counted. We will also take this approach when forecasting flood risk.

2.3. Sewer flooding not impacting internal to a qualifying property and/or the external curtilage of a property is referred to as 'non-property' flooding; this category of sewer flooding is not captured in either the internal or external sewer flooding Performance Indicator. This is in line with the Ofwat Performance Commitment on Internal and external sewer flooding, as per Table 1 DWMP definition.

2.4. This metric covers both hydraulic overload and 'other cause' flooding incidents (i.e. those caused by sewer blockage, sewer collapse or equipment failure). An individual property might experience multiple flooding incidents in a single year. We will take account of this when counting incidents due to 'other causes' but will not apply the same to incidents caused by hydraulic overload. In establishing the current risk position, the assumption is that this can be accounted for by comparing actual reported sewer flooding data available at the time of the assessment, with the total number of properties at risk.

2.5. Basement flooding will be captured in historic reported figures and yearly performance updates on this measure. However, basement flooding caused by sewer surcharge is excluded from forecasts for this indicator. Accurate data relating to the number of properties with basement 'piped' connections to the sewer system does not exist to aid with forecasting; no data is available to assess how many basement connections at a company level have flood protection such as flap valves, which typically could be a private measure.

2.6. Our system modelling will reflect the observed current levels of performance being achieved by our assets, amended where it is possible and appropriate to account for investments and operational changes up to the base year of our DWMP.

2.7. Consistent with the Ofwat Performance Commitment, failure of third-party assets impacting upon sewer capacity (such as river or land drainage flooding) will be excluded. For our DWMP this will also include incidents caused by burst water mains.

2.8. Other significant assets outside of Thames Water's control could have an impact on performance. For flooding, these could include property development and other infrastructure (e.g. New Appointments and Variations (NAVs), utilities and transport assets

e.g. Heathrow expansion) that could impact hydraulic load on a system or be the source of 'other cause' flooding from customer behaviour. It is not possible to account for the impact of non-Thames Water new assets on performance; however, we will flag descriptively where these issues may be expected in any commentary/plans.

## Alignment with Government DWMP guidelines

2.9. Our assessment methods, risk thresholds and our approach to reporting performance aligns with Government DWMP guidelines.

# 3. Data sources

3.1. This section includes a brief description of the key datasets required to report on this Performance Indicator. We also outline the process of assuring the data to maintain accuracy in our understanding of catchment performance.

Table 2. Data sources and assurance

| Dataset | Source | Assurance |
|---|---|---|
| Internal sewer flooding incident records (hydraulic overload and other causes) | Sewer Flooding History Database (Thames Water system) and datasets provided in the Annual Performance Report (APR) to Ofwat | Thames Water Asset Performance Insight Team and Sewer Flooding Team. The number of internal sewer flooding incidents is also subject to annual third line external assurance as part of the APR |
| Forecast sewer flooding due to hydraulic overloading | Applied to traditional computed based system models (used in the main for analysis of hydraulic performance/capacity assessment - hydraulic system, process, river & groundwater models)[5] | Modelling outputs are ISO9001 accredited. The methods applied are assured by an independent DWMP assurance process |
| Synthetic rainfall | Generated in accordance with Government DWMP guidelines. Applied to hydraulic system models to facilitate forecasting of future hydraulic flooding performance | Data provided by a third party will be assured at source. Design rainfall generated by TW modelling is ISO9001 accredited |
| Property data | APR data and Water Resources Management Plan / DWMP agreed data. Used in normalisation of flooding performance and as an input to hydraulic system models | Data provided by a third party will be assured at source. Connected property numbers is also subject to annual third line external assurance as part of the APR |

[5] These are referred to as 'hydraulic system models' in subsequent sections.

# 4. Reporting thresholds and outputs

4.1. This section includes a detailed description of:

- The reporting thresholds used to categorise the base year and baseline performance risk across our short, medium and long term time planning horizons, and
- The outputs that will be reported.

4.2. Reporting of internal flooding incidents will be undertaken in accordance with the Ofwat Performance Commitment for sewer flooding, using a normalised approach of incidents per 10,000 connections. This allows for a clear comparison between regions/sub-regions as well as between water companies.

4.3. For assessment/quantification of internal flooding at a wastewater catchment level we will prepare both normalised and absolute numbers. This is necessary as many of our catchments are very small and applying the standard approach to normalisation will result in very small fractional numbers (just 1% of the total population is served by over half of our catchments).

## Reporting thresholds and planning horizons

### 4.4. Spatial (mapping) Scales

- Level 1 Company level
- Level 2 River catchment or Local authority level
- Level 3 Sewerage catchment(s) level
- Level 4 local level (London catchments only)

### 4.5. Thresholds

4.6. To assist with prioritisation of needs, we will review all data across our L2/3 areas in our region and support ranking them in order of impact e.g. number of normalised flooding incidents. Data will then be banded into three thresholds, based on quartiles[6] with the following breakdown:

0. Green Low risk - Bottom Quartile (effectively low flood risk).
1. Amber Moderate risk – Middle Quartiles (Upper Lower & Lower Upper Quartile) - sites to be addressed as medium priority.
2. Red High risk - Upper Quartile - sites with greatest risk and to be addressed as a priority.

[6] Quartiles will be determined for Thames Water as whole i.e. Level 1, this will regional and local areas to be interpreted against Thames Water's performance overall. Upper quartile defines properties at greatest risk from flooding, with lower quartile depicting those areas at lowest risk.

4.7. Where a Level 3 catchment falls within threshold '0', we will still explore investment need as part of our asset management planning to ensure individual risk or worst served customers, e.g. individual property at sewer flood risk is accounted for.

4.8. Thresholds for bands to be developed based on results of data generated[7] to achieve the most equitable distribution of risk across the bands.

## Reporting outputs

### 4.9. Tables

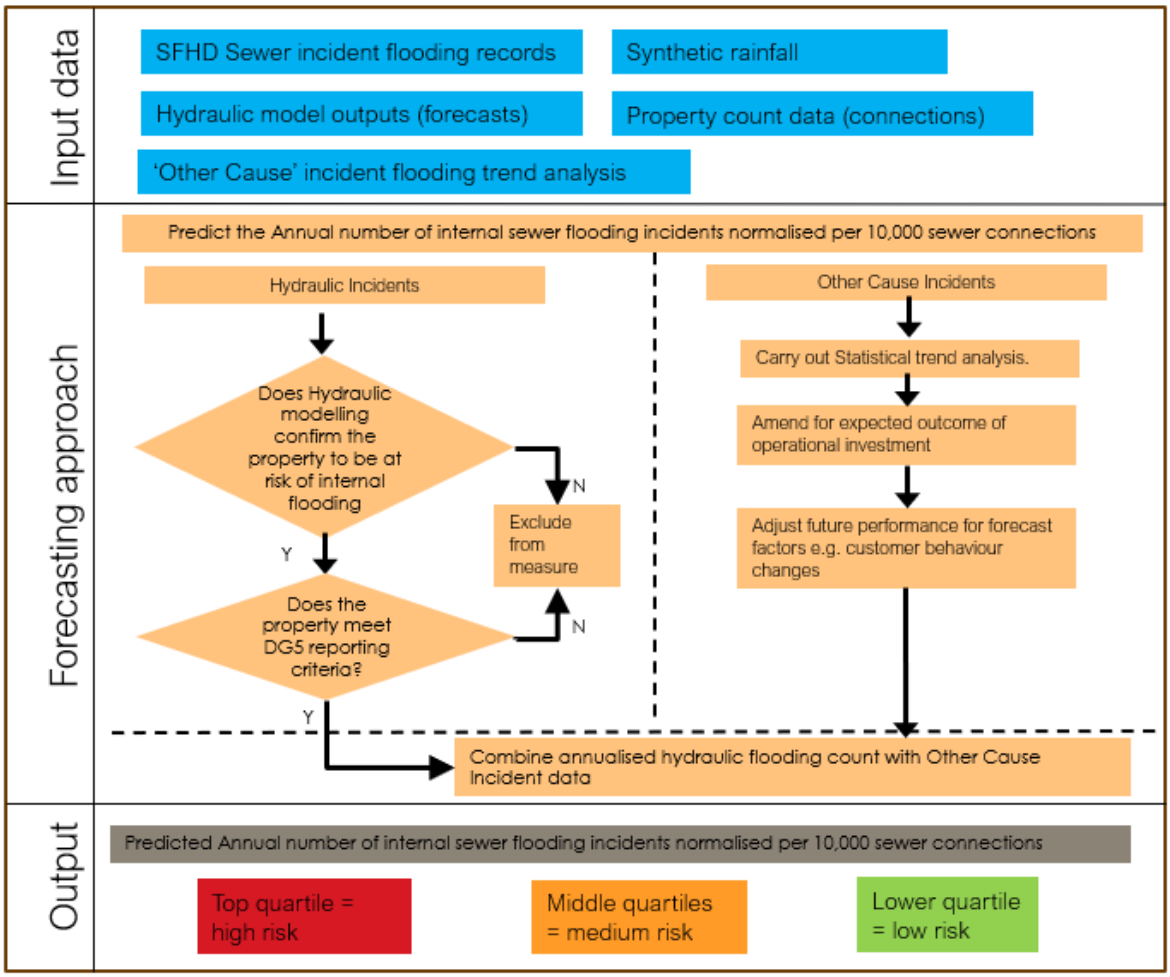
- To be produced for all DWMP spatial scales: L1, L2, L3 & L4 (London only) and include only 0, 1 & 2 banding.
- Modelled hydraulic forecasts will be produced for 2030, 2035, 2045 & 2055. Where the data tables require yearly forecasts (e.g. 2030 – 2040) these will be interpolated from the modelled results.

[7] Generation of data planned to be available early 2026.

# 5. Performance Indicator methodology

5.1. The following methodology will be applied to assess current and forecast future internal flooding risk.

Figure 1. Performance Indicator methodology




## Conversion of modelled output risk data to annualised values

5.2. Simulation of hydraulic models produced a view of absolute risk of flooding for a defined rainfall return period e.g. a simulated 1 in 10-year rainfall event will identify all properties at risk of flooding from an event of this magnitude. A requirement of the DWMP approach is to convert these results into an annualised risk, below is an example of how this conversion is performed.

5.3. In this example a model has been simulated for a 1 in 10-year rainfall event and the results have identified that 2,000 properties are predicted to experience flooding for this rainfall event. The core assumption is that over a ten-year period 2,000 properties will experience flooding, to reduce to an annualised figure the 2,000 is divided by the 10 years, to determine an annual risk.

5.4. Where the analysis is a summation of multiple events then these will be corrected to remove duplicates as per below – note in the example below 3 events have been used, the same approach would apply to less or more rainfall events. Duplicate properties would be identified through GIS analysis of the modelling results.

Table 3. Annualisation of multiple events

| Rainfall Return period | Total property risk count | Duplicate properties | Discounted risk* | Annualised risk |
|---|---|---|---|---|
| 1 in 5 year | 100 | 0 | 100 | 100 / 5 = 20 |
| 1 in 10 year | 500 | 100 | 400 | 400 / 10 = 40 |
| 1 in 20 year | 1000 | 200 | 800 | 800 / 20 = 40 |
| | | | | 20+40+40=100 |

* Removes duplicate properties from property count.

## Base year performance – 2030 (hydraulic overload)

5.5. To determine base year performance, hydraulic network models are used to generate the performance for each of the catchments under scenarios of rainfall severity as prescribed by the Government DWMP guidelines. Modelled escapes of sewage are then routed through 2D surface models to assess the number of properties impacted by sewer flooding, generating the required output. Where models do not exist for the L3 system being analysed, such as in the case of small systems with low population served, e.g. 50-100 population and the ability to model with sufficient confidence is not possible, recourse to historic flooding data will be undertaken.

## Base year performance – 2030 (other causes)

5.6. Base year performance will be forecast from a statistical trend analysis of historical data (minimum of five years), amended by the expected outcomes of planned investments and operational improvements where possible and appropriate (up to the base year for our DWMP). Consideration will be given to augmentation of data to account for likelihood of incidents in locations with no historical incidents.

5.7. **Sewer blockage:** Based on previous experience, we will evaluate how the number of blockages will change depending on our level of activity in proactive maintenance, monitoring and response. Therefore, we aim to forecast future levels of blockage from the historical statistical trend, modified to account for anticipated levels of activity up to the base year. We currently have limited data on blockages on our public surface water systems, such as those caused by siltation and tree root ingress. Our understanding of these systems will mature over DWMP28 and further evolve in DMWP33.

5.8. **Sewer collapse and equipment failure:** By assessing historical asset failures, we will evaluate the rate at which our assets are ageing and deteriorating and how this affects the likelihood of sewer structural failure or equipment failure. We will evaluate this separately

for each type of asset. For example, pressurised pipes (rising mains) deteriorate at a different rate when compared to sewers that convey wastewater by gravity. We will forecast future levels of sewer collapse and equipment failure from the historical statistical trends for each type of asset, modified to account for anticipated levels of activity up to the base year.

5.9. We will assess historical data to determine the proportion of sewer blockages, sewer collapses or equipment failures that are likely to result in an internal flooding incident.

5.10. Inclusion of flooding incidents due to causes other than hydraulic overload is new for DWMP28. Therefore, we expect this area of analysis will mature over DWMP28 and further evolve in DMWP33. We will work in collaboration with other water companies on the development of approaches with the aim of seeking alignment where possible.

5.11. For example, a challenge we face when forecasting flooding incidents due to causes other than hydraulic overload is the application of spatial equality across our region, i.e. how we account for future incidents of other cause flooding in locations where no incidents have occurred to date but could in the future.

## Future baseline performance – 2035-2055 (hydraulic overload)

5.12. Future baseline values for each planning horizon will be assessed as described for the base year. Data will be revised, where applicable, to account for forecast changes in factors affecting performance (for example, synthetic rainfall will be generated to account for anticipated climate change, population growth will be accounted for within hydraulic system models).

5.13. No account will be made for 'as yet' to be built new properties in the number of properties at risk due to uncertainty of exact locations where they will be built and what measures will be taken at the time of construction to protect against flooding. However, the additional flow generated by these 'new' properties will be accounted for in the modelling.

## Future baseline performance – 2035-2055 (other causes)

5.14. Future baseline values for each planning horizon will be assessed as described for the base year (2030). As for hydraulic overload, data will be revised, where applicable, to account for forecast changes in factors affecting performance. For example:

5.14.1. Consideration of future rainfall scenarios which may result in longer dry periods, leading to increased likelihood of blockages impacting internal flooding performance.

5.14.2. Changes in customer behaviour around non-flushable products (due to the impact of current activities that we continue into the future), leading to decreased likelihood of blockages impacting internal flooding performance.

5.14.3. We will analyse historic trends and data in relation to historical other cause flooding as this is likely to be an appropriate indicator for future performance. Expert judgement will be applied to this data to facilitate forecasting over the DWMP 25-year period. This will include a judgement of the likelihood of future other causes incidents where there have been no historical incidents.

5.15. When reporting current and forecast performance, the number of internal flooding incidents will be normalised using the number of connections (residential properties) in the system being assessed. When forecasting future connections to our network, we will use residential property / population forecasts aligned to the expected levels as defined in our Water Resources Management Plan.

### Assessing the value of performance

5.16. Alongside publication of this Performance Indicator methodology, there is a requirement to value performance outcomes using our Value Framework. This step will be completed during the Options Development and Appraisal (ODA) stage, once the framework has been fully defined and agreed following consultation with stakeholders.

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## 6. Next steps

### Receipt and adoption of any changes/adjustments as required by Ofwat

6.1. Data will be collected/generated in support of this Performance Indicator. The data will be processed and reviewed to determine the most suitable threshold bands as indicated in this document and in line with the DWMP stages and overall timeline.

We welcome your views on this technical methodology. Please share them with us by emailing DWMP@thameswater.co.uk.

Our Drainage and Wastewater Management Plan 2030–2055 will include a number of technical methodologies, like this one. They will all provide detailed information on specific topics featured in our draft Plan such as climate change and sustainable approaches to drainage. You will be able to access all of the technical methodologies on our DWMP webpage.

For more DWMP28 information please visit our DWMP webpage and portals on our website.

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