# 

**WAT-SG-13 Municipal Sewage Treatment Works Guidance v6.0**

December 2024

# Update Summary

## v1.0

Draft version for internal use only.

## v1.1

Interim version – for internal use only

## v2.0

First issue for Water Use reference using approved content from the following documents:

DRAFT\_WAT-SG-13\_v10\_AH.doc

## v2.1

Two-tier Multiplier hyperlink revised.

## v2.2

Figure 1 revised.

## v3.0

Expired CMS links reviewed and updated.

## v4.0

Revise DWF definition, insert total N stds/nutrient % reduction table (per UWWTD), clarify SEPA position on aluminium stds at STWs.

## v4.1

Section 5.3: Compliance with upper tier limits clarified, links updated, Table 1 Event monitor comment revised to include remote discharges.

## v4.2

Section 5.3 upper tier limits removed, refer to WAT-RM-40 instead.

## v5.0

Sections 5.6 & 6.3.1/6.3.2 added, various clarifications.

## v6.0

S3.2.1 Infiltration text in DWF calculation amended.

S3.2.5 New section for increase in pe.

S4.2 Minor change storage calculation.

S5.4 Ref to Nitrates Directive removed.

S5.6.3 Autosampler requirements changed.

S6 Seasonal RP limits removed. RP BAT standard revised. S6.3 Chemical dosing Regular Routine/Reactive/Trials added in.

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# Key points

This document provides recommendations and information on the use of conditions in licences for Municipal Sewage Treatment Works. For the purposes of this guidance, this means STWs served by a combined sewerage system, which includes rainfall runoff and sewage. This is supplementary to the guidance document [How to Apply for a Licence to Discharge Sewage Effluent](https://www.sepa.org.uk/regulations/water/pollution-control/pollution-control-guidance/).

Particular reference is made to:

* Flow monitoring and event recorders.
* Design flows and overflow settings.
* The use of instantaneous and composite standards at STWs.

# Flow Monitoring and Event Recorders

## 2.1 Introduction

The flow of sewage arriving at a treatment works needs to be understood in order to:

* Confirm the hydraulic performance of the works.
* Trigger investment in additional capacity as growth in the catchment outstrips the existing capacity of the treatment works; and
* Provide accurate input data to sewer and quality models to determine appropriate licence conditions and to inform such investment.
* Undertake SPRI reporting for works serving >15,000 population equivalent (p.e.), and a need to confirm treatment levels under UWWTD at various p.e. trigger levels, the lowest trigger level being 2000 p.e.

Flow measurements can range from a simple understanding of the population served and water consumption figures for the area, through spot gauging at appropriate times or weather conditions, to permanently installed flow monitors and data loggers.

### 2.1.1 Formula A flows

Formula A flows are discussed in section 3.4

### 2.1.2 Treatment works flows

The various types of STW flows which SEPA requires to be monitored are discussed below.

### 2.1.3 Dry Weather Flow (DWF)

Licences for STWs on a combined sewerage system have a limit on the DWF of the influent sewage. The design of STWs is normally based on the treatment of multiples of DWF (see Section 3.2). Increases in flow, due for example to population growth or to increased trade discharges, could lead to more frequent operation of overflows and therefore the potential for an increased impact on the water environment.

### 2.1.4 Overflow settings

STW licences only allow overflows to operate when a certain flow is exceeded, e.g. >3DWF or Formula A. To ensure this is being complied with, monitoring of pass forward flows at storm overflow weirs is required.

### 2.1.5 Final effluent mean flow

Water quality modelling requires mean daily flow and standard deviation of the final effluent. Final effluent flow approximates closely to the flow to full treatment (FFT) (which will be slightly greater due to removal of sludge) and hence a dedicated final effluent flow meter is not normally required. For STWs >15,000p.e., flows are required by the operator in order to calculate SPRI submissions.

### 2.1.6 Event recorders

It is not normally appropriate to try to measure the flow of storm sewage passing over an overflow. Instead, event recorders can be used to provide a start and stop time for overflow events.

Event recorders are required for CSOs discharging to designated Bathing or Shellfish Waters in order that the number of spills can be determined. Event recorders are relatively cheap to install and can be useful in assessing increased frequency and trends of overflow events, due to increased influent flows at STW. The monitored frequency and duration of overflow events can be checked against projected data from sewer hydraulic models. An event recorder can also provide useful information when investigating an individual pollution incident in the watercourse. A limitation is that overflow events are clearly dependent on rainfall patterns, and do not necessarily reflect problems with the STW. If the actual flow of storm sewage is required, then this is best determined from flow recorders installed upstream and downstream of the overflow.

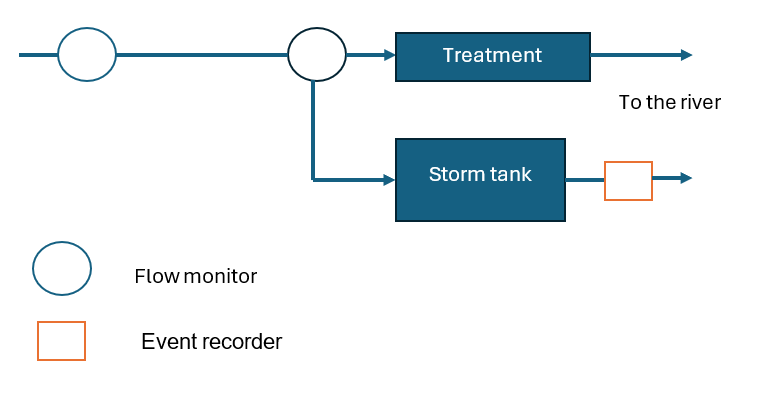
The requirement for flow measurement structures and facilities must be specified in the STW licence.

Although monitoring equipment is not expensive, the creation of a suitable flow measurement structure may be impractical at some works. N.B. A flow measurement structure is a structure which enables the operator to install flow monitors if continuous flow recording is required. Improvements should be agreed with the operator through the agreed investment process.

The configuration of monitoring points will vary according to the works, and the facilities provided according to the size of the works and the risk of impact. Figure 1 is a schematic showing typical works layout and the location of monitoring equipment (if required), although this is for illustration only.

The event recorder should be located so as to record overflows to the water environment, rather than overflows to a storm tank (if present).

Figure 1: Schematic of flow monitoring and event recording requirements



Flow monitoring / event recording requirements are summarised in Table 1.

**Table 1: Flow monitoring / event recording requirements1**

| **Population equivalent** | **Minimum flow monitoring requirement** | **Event recorders** | **Data recording** | **Period that flow/event records need to be kept** |
| --- | --- | --- | --- | --- |
| >2000 p.e | Flow measurement structures and permanent flow monitors at:   * Inlet2 * flow to full treatment (FFT) | All overflows | Instantaneous FFT.  Annual influent DWF calculation3.  Effluent mean daily flow and standard deviation calculation3.  Storm overflow events3.  Total annual volume discharged during overflow events. | 5 years |
| 500-2000 p.e | Structure at FFT only.  FFT flow monitor where dilution <10:1. | Required if CSO impacts on designated Bathing, Shellfish Waters | As above, if monitors installed. | As above, if monitors installed |
| 100-500 p.e | none | Required if CSO impacts on designated Bathing, Shellfish Waters4 | As above, if monitors installed | As above, if monitors installed |
| <100 p.e | none | none | none | none |
| CSOs in the sewer network. | Refer to WAT-RM-07. | Refer to WAT-RM-07. | Refer to WAT-RM-07. | Refer to WAT-RM-07. |

1These are minimum requirements for new STWs. Additional facilities may be required in certain situations. Improvements to existing STWs should be agreed with Scottish Water through the agreed investment process. (Refer to [CAS-G-003: Flow/Event Monitoring at Scottish Water STWs](https://www.sepa.org.uk/regulations/water/pollution-control/pollution-control-guidance/)).2 For discharges to coastal waters, inlet flow monitor is not required if STW serves 2-10,000pe, unless the discharge is to Bathing/Shellfish Waters. i.e. only required for UWWTD qualifying discharges unless to Bathing/Shellfish Waters. 3 Not required by licences for 2-15,000pe STWs.4 May not be required depending on risk assessment.

## 2.2 Facilities for STWs serving more than 2000 p.e.

Facilities for all sewage treatment works serving >2000 p.e. should include, as a minimum, flow measurement structures and flow monitors to continuously monitor:

* Inlet flows (see Table 1)
* The flow passing forward for full treatment; and
* An event recorder at all storm overflow weirs.

The FFT flows should be able to be assessed without the contribution of any return liquors, recirculates etc.

Monitoring of inlet flows can allow determination of infiltration and the total volumes of sewage spilled at the storm overflows.

There may be more than one means of determining the required flow information depending on the layout of the STW and the configuration of the flow meters. If required, flows can be derived by adding or subtracting flows from alternative flow meters.

There are physical constraints at many existing STWs that limit where flow monitors may operate effectively. In many cases a compromise may be necessary, and this should be taken into account in any compliance assessment.

Licences have conditions specifying minimum pass forward flows at overflow weirs at FFT and at any other overflows upstream e.g Formula A. In many situations compliance with this condition can be demonstrated without the need for a continuous flow monitor e.g. by using fixed hydraulics in the flow channel (such as a fixed weir plate) to ensure that minimum PFFs are being complied with. In other, possibly higher risk situations, an FFT monitor may be required to determine pass forward flows.

At each storm overflow weir or bypass channel overflow there should be, as a minimum, an event recorder to record the start and finish date/time of overflow events.

## 2.3 Facilities for STW serving less than 2000 p.e.

At works serving ≤2000 p.e. the facilities will depend on the p.e. of the STW and the risk of the discharge as detailed in Table 1. As a minimum, for STWs serving 500-2000p.e., this should include a structure to enable FFT to be measured.

The influent DWF (as specified and limited in the licence) can be derived from a FFT monitor since under dry weather conditions these 2 flows will be identical. FFT flows approximate to final effluent flows and so the mean daily flow and standard deviation can be derived from the FFT monitor.

## 2.4 Sewage pumping stations with storm/emergency overflows

Sewage pumping stations with storm/emergency overflows should be dealt with in the same way as CSO structures. However, in this case a measurement of pump capacities (e.g. by drop down tests) will provide the pass forward flow, and hours run meters will enable an estimation of volumes of sewage pass forward flow to treatment to be made. Event recorders and inlet flow measurement structures/monitors may be justified in sensitive locations.

## 2.5 Recording

Where flow monitors are permanently installed, the operator is normally required to record instantaneous flow rates to enable the following to be provided on request:

* The dry weather flow of the influent sewage (determined on an annual basis).
* The mean daily flow and standard deviation of daily flow of the effluent (determined on an annual basis).
* The rate of flow of sewage passing forward at the combined storm overflow weir and/or at the settled storm overflow weir for full treatment (FFT)
* The frequency and duration of overflow events (i.e. the start and finish date and time of each overflow event). The continuous FFT record should normally be based on 15 minute readings.
* In certain locations the volume discharged during each overflow event.
* The summary flow statistics (DWF and mean daily flow). These should be determined from the continuous FFT and daily volume records.

## 2.6 Compliance Inspections

[CAS-G-004: Flow Recording and Reporting at Sewage Treatment Works and on the Sewer Network](https://www.sepa.org.uk/regulations/water/pollution-control/pollution-control-guidance/) provides guidance on assessing recording and reporting of flows.

The licence requires keeping of flow records for 5 years which should be checked during inspections. In order to assess that the required flows are being treated during storm events, an inspection of the records of pass forward flows to full treatment should be made. In addition, where appropriate, influent DWFs, final effluent flows and event records should be inspected.

Should the inspection coincide with a storm event, the instantaneous pass forward flow to full treatment should be checked at that time. The operator should be aware of the FFT requirement.

For guidance on how to assess compliance with the licence condition requiring calibration of flow/event monitoring equipment, refer to [CAS-G-002: Calibration of monitoring and measurement equipment at Sewage Treatment Works.](https://www.sepa.org.uk/regulations/water/pollution-control/pollution-control-guidance/)

## 2.7 Reporting

Flow reporting conditions are normally only required in the licence for STWs serving ≥15,000pe (15,000pe being the threshold for SPRI reporting). In addition, certain STWs serving <15,000pe may be required to report flow data based on environmental need such as low dilution or downstream designated sites.

Rather than the operator supplying flow records on an individual basis to local SEPA teams, flow reports are submitted centrally to SEPA and made available to operational teams.

The details of flow reporting requirements vary according to the licence, but may include summary statistics such as DWF, mean daily flow, the start/stop date and time of each overflow event along with total annual volume discharged during these storm events.

More detailed flow information such as the continuous FFT flow record is kept by the discharger. Portions of the continuous FFT flow record should be made available to SEPA on request e.g. during the annual inspection.

# 3. Population equivalent, dry weather flow and design flows

## 3.1 Population equivalent

The population equivalent that a STW serves is important to determine because it helps determine the level of treatment and monitoring at a STW, the size/capacity of the STW using the DWF and the charging.

For small wastewater treatment works, serving 10 or more houses, the population equivalent can be determined using the census figures where additional information is available to support this assessment, such as flow surveys of the existing system.

For larger developments (normally Scottish Water), it is statistically highly unlikely that there would be full occupancy of every property at any one time and determining the p.e. using the Flows and Loads document would result in an over designed STW. Therefore, for these larger developments, the operator can use an appropriate census figure for occupancy (Scottish Water currently uses a figure of approximately 2.1 persons per house, depending on the locality).

## 3.2 Dry weather flow (DWF)

### 3.2.1 DWF

DWF is the flow to a STW during a period without rain. For a STW serving a combined sewer system, there is a licence condition limiting the DWF. DWF will need to be calculated.

DWF (Dry Weather Flow) = P G + IDWF + E, where

P = Population served  
G = Water consumption / head / day (typically 150 litres)  
E = Trade Effluent Flow (litres)  
I = Infiltration

The above formula can be used to calculate DWF for new or varied discharges. The values P, G and E should be based on the STW future design horizon, taking account of growth in the catchment. Infiltration, IDWF should be based on measured dry weather figures in the catchment or in nearby catchments with similar characteristics if possible.

#### Calculating future DWF for existing discharges to take account of growth[[1]](#footnote-2)

The value that is exceeded by 80% of the recorded daily flow values is known as the Q80. Q80 provides a good estimate of DWF and this correlation is used in the calculations below (see section 3.2.4).

There are 2 options to calculate future DWF.

1. Use the DWF formula above using current values of P, G and E.

Where IDWF = measured Q80 – current PG – current E.

Then, based on the STW future design horizon and taking account of growth in the catchment, increase the values of P, G and E.

Infiltration from the new population needs to be taken account of. An infiltration allowance for the increase in population of 50% of the per capita rate of infiltration in the existing sewerage system can be used. However, other factors can be taken into account such as the nature of the sewer and the type of development. For example, population increases via infill or high-rise developments may not increase sewer lengths and infiltration significantly.

1. Use the Q80 method (see section 3.2.4)

A simpler method is to use the measured data to determine the Q80 value and then extrapolate it to the future Q80 value. For example, a projected population increase of 15% will lead to a 15% increase in the mean flow, the standard deviation and the Q80 you need to apply and design for. This is a conservative but simple method of estimating DWF.

Where there is no long-term flow monitoring data e.g. where PE <2000, other approaches may be taken. For example, short term flow survey data, modelled information or for growth, default approaches. This would depend on the location, information available and whether there are changes as a result of growth.

Further background information on infiltration and DWF can be found on the [CIWEM website](https://www.ciwem.org/special-interest-groups/urban-drainage-group). eg [User Note 33 - Modelling dry weather flow](http://www.ciwem.org/knowledge-networks/groups/urban-drainage/publications/user-notes-by-topic.aspx).

### 3.2.2 Background

Some STW licences may still define DWF in the licence Interpretation of Terms as:

‘the average daily flow to or from the STW during a week without rain (excluding a week which includes public or local holidays), following a week during which the rainfall did not exceed 0.25mm on any one day. For sewage with a large industrial component, dry weather flow should be based on the flows during five working days if production is limited to that period’.

There are various problems with this traditional definition such as the infrequency of qualifying periods of DWF, large variability and difficulties in obtaining local reliable rainfall data.

A 2006 research project sponsored by UK Water Industry Research recommended using the Q80 DWF definition given below, rather than the traditional rainfall related definition. The Q80 definition closely matched the rainfall related definition and does not suffer from the problems outlined above.

This approach also means that Scotland is consistent with that taken by the Environment Agency.

### 3.2.3 Licence compliance with DWF

If the licensed DWF is being exceeded then water quality impacts may occur, due to for example, more frequent operation of sewer overflows.

It has been determined that the 80%ile exceeded flow (or Q80) closely matches the DWF figure derived from the design equation in section 3.2.1. It is this 80%ile flow which should be used as a straightforward measure of DWF.

SEPA is moving to a position where DWF is defined in the licence as:

‘the total daily flow value that is exceeded by 80% of the total daily flow values in a period of twelve months”.

For those STWs required to provide flow data returns (generally >15kpe STWs), this definition was changed by a licence variation undertaken centrally and came into force in December 2012.

For those STWs where no flow reporting is required, SEPA is intending to vary centrally the DWF definition to the 80%ile flow definition. In the meantime, SEPA will accept DWF figures provided using the 80%ile definition.

### 3.2.4 DWF compliance and reporting

Compliance is assessed by comparing the 80%ile exceeded flow limit against the measured 90% exceeded flow.

This is done by calculating the total daily flow value that is exceeded by 90% of the measured total daily flows in any period of 12 months and matching this value against the permitted daily DWF limit.

The measured Q90 will always be less than the measured Q80. By assessing using the measured Q90 rather than the Q80, an allowance is made for year-on-year variability in the flow rates and also for uncertainty in the measurement of the daily flows. An assessment is made against the (lower) measured Q90 so that the discharger is not held responsible for factors out with their control such as higher flows in particularly wet years.

The UK Water Industry Research project referred to in section 3.2.2 showed that if this measured Q90 is above the discharge licence limit, we can be 95% confident that the discharge has truly exceeded the licence DWF limit.

Refer to [CAS-G-004: Flow Recording and Reporting at Sewage Treatment Works and on the Sewer Network](https://www.sepa.org.uk/regulations/water/pollution-control/pollution-control-guidance/) for more detailed guidance on assessing DWF compliance.

### 3.2.5 Proposals to amend population equivalent (pe) at STWs

STW licences issued post December 2020 refer to pe in the Notice and in the Authorised Activities condition. For these licences, pe is used to limit the scale of the discharge and therefore amendments to this pe need to be assessed as a licence variation.

Pre 24 December 2020 STW licences have the following reference to pe in the Explanatory Notes at the back of the licence. This is not part of the licence.

'The discharge quality and flow conditions attached to this licence are based on a design PE of <<INSERT design PE>> as stated in the licence application'

Pe is used to calculate charging and it is therefore important that this figure is correct. If the operator believes that this pe number is to be exceeded (say due to population growth in catchment), then they should contact SEPA and supply the following information.

N.B. This is not an application to vary the licence since the Explanatory Notes do not form part of the licence.

The Responsible Person should provide the future/projected pe.

The operator should calculate if the future pe means that licence limits DWF, Flow to Full Treatment or storm tank size would be exceeded. This calculation should use current best practice methods and figures (eg up-to-date l/head/day and infiltration calculations).

If these licence limits are not exceeded, then it can be assumed that the STW will not be overloaded by the future pe.

SEPA will check these calculations and reissue the Explanatory Notes as follows.

The existing reference to pe in the licence will have wording similar to this -

The discharge quality and flow conditions attached to this licence are based on a current PE of <<INSERT current PE>> and OR a design PE of <<INSERT design PE>>

This should be amended to -

The discharge quality and flow conditions (namely Dry Weather Flow, Flow to Full Treatment AND/OR storm tank size) attached to this licence were based on a design PE of <<INSERT design PE>> at the date of issue of this licence <<DD/MM/YYYY>>, but are also sufficient to account for the organic biodegradable load from a design PE of <<INSERT design PE>>, as calculated on <<DD/MM/YYYY>>

Charging need to be informed.

If these licence limits are calculated to be exceeded then there is an indication that the STW may be overloaded by the future pe. It then needs to be determined whether this is environmentally acceptable.

## 3.3 Design FFT

The industry design standard FFT is 3PG + Imax + 3E, also referred to as 3DWF.

Imax, the maximum possible infiltration rate should be used. This is because the flow to full treatment (FFT) needs to be appropriate throughout the year. Imax should be calculated usingthe maximum minimum night flow on each dry day.

To find Imax, calculate infiltration for every dry day as:

Idry day = measured Total Daily Volume − PG – E.

A dry day is defined as a day when rainfall does not exceed 0.25mm.

However, the first day after it has rained should be removed from the calculation. Where it can be demonstrated that it takes more than one day for rainfall to reach the STW, this second day can be discounted also. Also discount days when there has been significant snow melt and the day after as the flows measured may contain significant runoff or snow melt from the previous day. Infiltration for all the remaining days should be calculated.

The analysis must normally use data from at least 12 consecutive months, with ideally flow data over several years being used.

Where there is no long-term flow monitoring data e.g. where PE <2000, other approaches may be taken. For example, short term flow survey data, modelled information or for growth, default approaches. This would depend on the location, information available and whether there are changes as a result of growth.

The infiltration rate required Imax is the maximum calculated value.

Infiltration from the new population needs to be taken account of. An infiltration allowance for the increase in population of 50% of the per capita rate of infiltration in the existing sewerage system can be used. However, other factors can be taken into account such as the nature of the sewer and the type of development. For example, population increases via infill or high-rise developments may not increase sewer lengths and infiltration significantly.

Where there is growth in the catchment, the Imax used should be for the whole sewer system (existing and new), and not just for the new section of sewer.

## 3.4 Formula A

Normally all sewage up to the Formula A flow needs to undergo settlement (either primary treatment or a storm tank) and all sewage up to the 3DWF flow needs to undergo full treatment.

Formula A = DWF + 1360P + 2E

Where there is a significant proportion of the catchment drained on a separate system, a modified Formula A should be used. This is discussed in [WAT-RM-07: Regulation of Sewer Overflows.](https://www.sepa.org.uk/regulations/water/pollution-control/pollution-control-guidance/)

# 4. Overflows

Guidance on sewer overflows is available in [WAT-RM-07: Regulation of Sewer Overflows](https://www.sepa.org.uk/regulations/water/pollution-control/pollution-control-guidance/). This includes storm tank location and sizing, overflow settings and screening requirements.

Improvements should be agreed with Scottish Water through the agreed investment process.

There are a number of different ways to configure and operate storm tanks and conditions should reflect the individual circumstances following the guidance in WAT-RM-07.

## 4.1 Combined sewer overflows (CSOs)

Where an existing CSO is satisfactory, the licence should reflect existing provisions without driving further costs. An unsatisfactory CSO (see paragraph 4, Annex H of the Urban Wastewater Treatment Regulations Guidance Note) should be licensed as it is. If investment is required, the CSO should be identified in the agreed investment programme. Where a CSO fails only one of the unsatisfactory criteria, improvements should be made to a satisfactory standard for that criterion. If the unsatisfactory CSO is failing two or more criteria, improvements to achieve the full UWWTR requirements are required. Similarly, any newly constructed CSO should be designed, constructed and licensed to achieve all UWWTR requirements. See WAT-RM-07.

The default overflow setting is Formula A (DWF+1360P+2E) expressed as litres/second. For existing satisfactory discharges, Formula A may be overly conservative in some cases and variations may be acceptable following detailed sewer modelling and impact assessment or where there are very large/small sewerage systems which warrant lower/higher settings respectively.

Where dilution is limited (for example less than 8:1), higher pass forward flows or additional storm tanks may be required to protect the receiving water. See WAT-RM-07.

## 4.2 Settled storm sewage overflows

Where an existing settled storm tank discharge is satisfactory the licence should reflect the existing conditions/provisions. Where a storm tank discharge is unsatisfactory (see paragraph 4, Annex H of the [UWWTR Guidance Note](http://www.sepa.org.uk/water/water_publications.aspx#docs)), due to only one of the criteria, the new licence should only tighten performance of the failing criterion. If the unsatisfactory storm tank discharge is failing two or three criteria the licence should take account of all requirements.

For existing satisfactory discharges, the settlement storage capacity currently provided should be stated. The normal requirement is for flows up to 3DWF (3PG + Imax + 3E) to receive full treatment and flows in excess, up to Formula A (DWF + 1360P + 2E) to receive 68 litres per head or 2 hours storage at 3DWF prior to discharge or 2 hours storage at Formula ‘A’- FFT. Generally, 2 hours at Formula ‘A’ – FFT is used to calculate storage requirements in cases where FFT is greater than or less than the standard 3DWF. The storage capacity should be stipulated in accordance with the above standard design criteria for new or unsatisfactory storm tank discharges. Variations may be permitted following detailed sewer modelling and impact assessment or where there are very large/small sewerage systems which warrant lower/higher settings respectively. In addition to the above storm tanks, further storage capacity may have to be provided at the STW for CSOs on the inlet sewer depending on the available dilution. Refer to WAT-RM-07 for further details.

## 4.3 Emergency overflows (EOs)

EOs should only be authorised for pumping stations on the sewer network or at STWs. The emphasis of the schedule of conditions relating to EOs is to ensure that there are adequate arrangements for a quick response to an event in order to minimise pollution. What is adequate will depend on local circumstances, with telemetry being normally considered essential. The means of minimising pollution, agreed with the operator, may include standby power, storage or access for tankers.

### 4.3.1 Screening

12-18mm bar screening is acceptable, however the discharger may choose to put in 10mm bar screening.

### 4.3.2 Storage

Storage is provided to allow the operator time to take preventative measures in the event of station failure, and thereby minimise the risk of a discharge occurring. A minimum of 2 hours storage at 3DWF (3PG + I + 3E) should be provided at new pumping stations. This may be reduced to 1 hour for stations which the operator or their agents can attend quickly and which have other mitigation measures in place to minimise the risk of the overflow operating, i.e. automatic standby pumps, dual power supply etc.

Where operation of the EO would result in partially treated, secondary or tertiary treated effluent being discharged, precautions such as storage tanks may not be justified.

For existing pumping stations which are problematic, the licence should be modified to include enhancements required to provide adequate protection within a specified time-scale agreed with Scottish Water through the agreed investment process.

### 4.3.3 Telemetry

There are two types of telemetry alarm. One to advise of pump failure (e.g. due to loss of power or mechanical failure) and the other to advise of high level in the wet well and/or operation of the overflow. Typically, the requirement is for notification of pumping station failure only. Notification of operation of the overflow should only be required in high risk locations, e.g. risk of impact on shellfish or bathing waters. Requirements and installation dates should be agreed with the operator.

### 4.3.4 Response time

There are a range of licence condition options relating to response time. The choice of condition should be agreed between SEPA and the operator having regard to storage capacity, remoteness of site, risk to downstream users etc. The quality of the effluent should be considered since some EOs consist of treated or partially treated effluent.

### 4.3.5 Power

The selection of the most appropriate alternative power supply is dependent upon the vulnerability of the receiving waters. Provision of facilities to allow a mobile generator to be installed is the least onerous requirement. A permanent stand-by generator or duplicate electricity supply (fed from two separate sub-stations) should only be required for high risk sites.

### 4.3.6 Pumps

Standby pumps should be provided in case of failure of the duty pump(s). The standby pump(s) capacity must normally be equivalent to the duty pump(s) capacity. However, in larger pumping stations, where multiple duty pumps are provided, there is less justification for equivalent standby pumps since it is unlikely that more than one duty pump would fail at any one time. Should the duty pump(s) fail, the standby pump(s) should activate automatically. The option for activation “as soon as practicable” should only be used for existing sites, and in this case, modification of the set up to automatic activation should be considered. Pumps at new pumping stations should reactivate immediately after power is restored.

# 5. Discharge standards and UWWT (Scotland) Regulations 1994

Licences for Urban Waste Water Treatment (Scotland) Regulations 1994 (UWWTR) qualifying discharges (i.e. greater than 2000 p.e. to inland waters and estuaries and greater than 10,000 p.e. to coastal waters) require:

* a UWWTR schedule which contains UWWTR required standards and
* a CAR schedule (treated sewage effluent schedule) which contains standards required to protect the receiving water.

Licences for non-qualifying discharges (i.e. <2000 p.e. to inland waters and estuaries and <10000 p.e. to coastal waters) requiring ‘appropriate treatment’ under UWWTR have a CAR schedule only which contains standards required to protect the receiving water.

Section 5.5 provides for an explanation of how to apply discharge quality conditions under different scenarios.

## 5.1 Appropriate treatment

Appropriate treatment means treatment of urban waste water by any process and/or disposal system which, after discharge, allows the receiving waters to meet the relevant quality objectives and the relevant provisions of the EC UWWTD and other Community Directives. The precise form of appropriate treatment for discharges to freshwaters will depend upon the size of the discharge relative to the receiving water and uses identified downstream.

For discharges to estuarine and coastal waters, given the dilution and dispersal characteristics, a minimum requirement will normally be screening or equivalent to retain aesthetically objectionable solids.

## 5.2 Primary treatment

Primary treatment means treatment of urban waste water by a physical and/or chemical process involving settlement of suspended solids, or other processes in which the BOD of the incoming waste water is reduced by at least 20% and the total suspended solids is reduced by at least 50% before discharge.

## 5.3 Secondary treatment

Secondary treatment means treatment of urban waste water by a process generally involving biological treatment either with secondary settlement or another process in which the requirements in Table 1 of the UWWTR are met. This is reproduced in Table 2.

Compliance with either the concentration or the % reduction requirements in Table 2 would mean the discharge is compliant with UWWTR. Refer to [WAT-RM-40: Assessment of Numeric Discharge Quality Conditions.](https://www.sepa.org.uk/regulations/water/pollution-control/pollution-control-guidance/)

**Table 2: Minimum Concentration Value or % Reduction**

| **Parameter** | **Concentration** | **Minimum % reduction** |
| --- | --- | --- |
| BOD | 25mg/l | 70% |
| COD | 125 mg/l | 75% |

Further detail is provided in [The Urban Waste Water Treatment (Scotland) Regulations 1994](http://www.legislation.gov.uk/uksi/1994/2842/contents/made) and UWWTR Guidance Note.

In addition, analysis of discharges from lagoons shall be carried out on filtered samples, and the concentration of total suspended solids in unfiltered water samples shall not exceed 150mg/l.

## 5.4 Nutrient limitation conditions

Nutrient limitation conditions should be used where the receiving waters are designated as “sensitive” under the UWWTD or where this is required to meet environmental standards and nutrient stripping has been identified as an investment driver for the works in question (Refer to section 6).

## 5.5 Discharge quality standard conditions

If secondary treatment is required for a sampled discharge with reasonable watercourse dilution, modelling may produce a relaxed BOD lower tier standard such as 90mg/l. However, a two tier BOD standard no more relaxed than 40/80mg/l should be used in the licence.

If secondary treatment is required and modelling requires a lower tier ammonia limit of more than 50mg/l then there is no need to insert an ammonia limit in the authorisation.

If secondary treatment is required and modelling requires a lower tier reactive phosphorus (RP) limit of more than 10mg/l then there is no need to insert an RP limit in the authorisation.

### 5.5.1 Use of instantaneous (spot) and composite conditions

Instantaneous or composite conditions must be included in the licence schedules as appropriate, e.g. spot standards for protecting an EQS, composite for implementing the UWWT Regulations and/or composite standards where the concern is discharge loadings, e.g. to an estuary or freshwater loch, rather than peak concentrations. Where composite conditions are used, an instantaneous upper-tier for BOD and suspended solids should be included in the licence to enable immediate enforcement of serious breaches of the licence. Where other parameters (e.g. ammonia, metals) are limited by composite conditions, an instantaneous limit set at 1.5 times the composite upper tier should be used.

The UWWTR requires composite sampling for monitoring compliance with the Directive’s standards.

Composite sampling for UWWTR compliance applies for discharges to coastal waters >10,000 p.e and discharges to freshwaters and estuaries which are >2,000 p.e.

The UWWTR allows for compliance with either the concentration standards or the % reduction requirements. Concentration standards should be included in all UWWTR licences but it is at the discretion of the operator to determine if they require % reduction standards to be included. The requirements should be specified in the licence.

Guidance on the type of sampling required is provided in below, with a summary provided in Table 3.

#### Discharges to coastal waters and estuaries >10,000 p.e. and discharges to freshwater lochs >2,000 p.e.

Composite samples are required by UWWTR and composite samples should be included in the UWWTR schedule. Composite standards are also required for CAR as discharge loading is the main concern. However, composite standards for BOD, COD (or nutrients where required by UWWTR) should not be included in the CAR schedule unless the lower-tier standard is more stringent than that required by UWWTR (e.g. CAR BOD lower tier <25 mg/l). The upper tier standards in the CAR schedule should not be more relaxed than the UWWTR requirements (e.g. BOD upper tier should be a maximum of 50 mg/l).

Instantaneous upper-tier standards for TSS and BOD should be included for enforcement purposes, but not routinely monitored.

Routine monitoring by taking composite samples for BOD, COD, nutrients (if required), any other required determinands set to protect receiving water and UWWTR percentage reduction is required.

For enforcement purposes SEPA may take instantaneous samples for BOD and TSS.

**Discharges to rivers >10,000 p.e.**

Composite samples are required by UWWTR and composite samples should be included in the UWWTR schedule. However, instantaneous standards are required for CAR as peak concentration and compliance with the EQS is the main concern for rivers.

Instantaneous two-tier standards should be calculated to protect receiving water and should be included in the CAR schedule. This will include instantaneous BOD standards as those specified in the UWWTR schedule will be for composite samples.

Instantaneous upper-tier 100 mg/l TSS should be included within the CAR schedule and included within routine monitoring and compliance assessment.

Routine monitoring by taking composite samples for COD, BOD and nutrients (if required) and UWWTR percentage reduction (optional) is required.

Routine monitoring by taking instantaneous samples for BOD, TSS and any other required determinands set to protect receiving water is required.

#### Discharges to rivers and estuaries between 2,000 and 10,000 p.e.

The UWWTD requires composite sampling for monitoring compliance with the Directive’s standards.

Instantaneous standards will be required for CAR. Instantaneous two-tier standards should be calculated to protect receiving water as peak concentration and compliance with the EQS is the main concern for discharges of this size to rivers and estuaries. These standards should be included in the CAR schedule, including:

* Instantaneous BOD standards, as those specified in the UWWTR schedule will be for composite samples.
* Instantaneous upper-tier 100 mg/l TSS. This should be included within routine monitoring and compliance assessment.
* Routine monitoring of composite samples for COD and BOD and UWWTR percentage reduction (optional).
* A requirement for routine monitoring of instantaneous samples for BOD, TSS and any other required determinands required to protect the receiving water.

#### Discharges to rivers and estuaries <2,000 p.e. and discharges to coastal waters <10,000 p.e.

The UWWTR does not specify the treatment standards for discharges of this size. Such discharges require appropriate treatment, therefore a UWWTR schedule in the licence is not required.

The CAR schedule should include instantaneous two-tier standards, set to protect the receiving water (e.g. BOD and ammonia).

Instantaneous upper-tier 100 mg/l TSS standard should be included in the CAR schedule for discharges subject to secondary / tertiary treatment.

Two-tier instantaneous TSS conditions only (usually 100/250mg/l) should be included for sampled primary or septic tank effluent.

Routine monitoring by taking instantaneous samples for any required determinands set to protect the receiving water (eg BOD, Ammonia and TSS) will be required.

**Table 3: Summary of discharge quality standard conditions**

| **Size of discharge / UWWTR qualifying discharge** | **Treatment** | **Treated sewage effluent (CAR) schedule** | **UWWTR schedule** |
| --- | --- | --- | --- |
| > 10,000 pe to coastal waters and estuaries > 2,000 pe to freshwater lochs/ Yes | Secondary | 1. No two-tier standards for BOD, COD, or nutrients should be included unless the lower-tier standard is more stringent than that required by UWWTR. 2. Composite 95%ile and upper-tier1 for other standards (eg Ammonia) should be set where required to protect receiving water. 3. Instantaneous upper-tier of 100 mg/l TSS for enforcement purposes. 4. Instantaneous upper-tier 75 mg/l BOD for enforcement purposes. | UWWT conditions for secondary treatment2:   1. Composite two-tier standards for BOD and COD. 2. Composite condition for percentage reduction (optional) 3. Composite nutrient standards including percentage reduction should be included where required by UWWTR |
| >10,000 pe to rivers | Secondary | 1. Instantaneous 95%ile and upper-tier 1 set where required to protect receiving water (BOD conditions should be included as UWWTR conditions are composite). 2. Instantaneous upper-tier 100 mg/l TSS | UWWT conditions for secondary treatment2:   1. Composite two-tier standards for BOD and COD 2. Composite - condition for percentage reduction (optional) 3. Composite nutrient standards including percentage reduction should be included where required by UWWTR. |
| 2,000 – 10,000 pe to rivers and estuaries/Yes | Secondary | 1. Instantaneous 95%ile and upper-tier1 set where required to protect receiving water (BOD conditions should be included as UWWTR conditions are composite). 2. Instantaneous upper-tier 100 mg/l TSS. | UWWT conditions for secondary treatment2:   1. Composite two-tier standards for BOD and COD. 2. Composite condition for percentage reduction (optional). |
| <2,000 pe to rivers and estuaries <10,000 pe to coastal waters/ No | Secondary | 1. Instantaneous 95%ile and upper-tier1 set to protect receiving water - for example BOD & ammonia standards. 2. Instantaneous upper-tier 100 mg/l TSS for secondary/tertiary works. | None |
| 2,000 pe to rivers and estuaries <10,000 pe to coastal waters/No | Primary | 1. If sampled, instantaneous 95%ile and upper-tier TSS standards set to protect receiving water (usually 100/250mg/l). | None |

1 Upper-tier: 95 percentile multipliers vary according to value of lower tier.

2 UWWT secondary treatment condition and nutrient conditions specified in UWWTR & licence template.

## 5.6 Composite samples

### 5.6.1 Types of composite samples

Composite samples are described as two or more samples or sub-samples, mixed together in appropriate known proportions (either discretely or continuously), from which the average result of a desired requirement may be obtained.

The proportions are usually based on time or flow measurements.

Time based composite sampling is suitable for regular flow where there are minimal fluctuations in flow. This is the default sampling method used by Scottish Water and expected by SEPA.

CAR Licences specify the start and end times of 24 hour composite samples (normally 10:00 and 09:00 respectively). These times refer to GMT (all year round) with no adjustment of autosamplers being required to take account of BST.

Flow proportional composite sampling is suitable for situations where irregular or erratic flows are experienced, i.e. batch processes or pumped inlets.

There are 3 types of composite sampling:

* **Constant Time Constant Volume Sampling** (C.T.C.V.). Equal volumes of sample or sub-sample are collected at equal increments of time.
* **Constant Volume Variable Time Sampling** (C.V.V.T.). Flow proportional sampling is based on collecting equal volumes of sample at frequencies proportional to flow.
* **Constant Time Variable Volume Sampling** (C.T.V.V.). Flow proportional sampling is based on collecting samples at fixed time intervals but the volume of sample is varied in proportion to the flow.

The most appropriate composite sampling method should be used to assess the quality of the influent and final effluent, e.g. if flow proportional sampling provides a more representative sample than time-based sampling then flow proportional sampling should be used.

There may be situations where a combination of flow-proportional and time-based sampling are utilised on the same site.

The operator will need to satisfy SEPA that their proposals will ensure that representative samples are obtained.

### 5.6.2 Minimum sample volume

For automatic sampling equipment installed prior to 2016 there is no minimum sample volume requirement for UWWTR.

For new or replacement automatic sampling equipment a minimum sample volume of 3 litres is required for UWWTR purposes.

### 5.6.3 Temperature requirements

Automatic sampling equipment installed prior to 2016 should maintain a sample at a temperature above freezing but below 4oC.

New or replacement automatic sampling equipment should be designed and guaranteed to maintain a sample between 0 and 5°C prior to transportation[[2]](#footnote-3), as required by the British Standard BS EN 16749. Where the composite sample is removed from the automatic sampling equipment it should be stored in compliance with BS EN 16749 prior to collection.

# 6. Chemical dosing and nutrient standards

## 6.1 Chemical dosing

Any application for chemical dosing must justify its use over non-chemical alternatives. The application to use any chemical must be accompanied by a proportionate risk assessment to show that environmental standards will be met and that there will be no impact on other water users. Potential by-products generated by the use of the chemical must be considered.

### 6.1.1 Chemical types

The operator can use chemical dosing at STWs for a variety of reasons including meeting BOD, suspended solids and phosphorus licence limits, pH correction, septicity/odour control, sludge thickening and dewatering.

Chemicals can be:

* Iron based.
* Aluminium based; or
* Other products such as tannins, caustic, sodium hypochlorite, polymers etc.

### 6.1.2 Chemical use

#### Regular routine

This is defined as chemical use lasting greater than 4 months in a rolling year. Chemical use should be licensed in accordance with the guidance below.

#### Regular intermittent

This is for foreseen, short term intermittent use such as addressing seasonal changes e.g. spring sloughing. This is defined as chemical use lasting less than 4 months in a rolling year. Chemical use should be licensed in accordance with the guidance below, with the exception that an Annual Average condition should not be used, since this is not appropriate for a discharge only lasting for part of the year. 2 tier limits should be used.

#### Reactive

This is to cover unforeseen, one off, short term temporary dosing e.g. in response to an incident. If reactive dosing continues for a prolonged period, then licensing should be considered. SEPA must be informed prior to dosing and a risk assessment to show that environmental standards will be met provided. A method statement should be provided setting out why chemical dosing is necessary, how the chemical and dose rate has been determined and measures to prevent overdosing. There may be a requirement to sample the discharge to demonstrate that no overdosing is happening.

#### Trials

This is to test the efficacy of a chemical over a short, agreed period with a view to making the use of this chemical permanent if successful. Normally if the trial will last more than one month, then a licence variation to allow this would need to be made. This period can be modified depending on the environmental risk. As above, if a licence variation is not required, justification of why the chemical dosing is necessary and a risk assessment will be required.

### 6.1.3 Ferric dosing

An operator is likely to use ferric dosing to meet phosphorus standards. Where this is the case, a standard condition of 2mg/l annual mean, total Fe measured on the instantaneous sample should normally be included in the CAR licence schedule.

The approach below doesn’t apply for discharges to tidal waters. You should follow the guidance in WAT-SG-11 Modelling Coastal and Transitional Discharges and consult Ocean Modelling as required.

Where the operator is struggling to meet 2mg/l, the Fe limit can be changed to 2 tier standards with the 95%ile limit based on site specific modelling. The procedure for doing this is described below.

The discharge iron limit should be calculated to ensure the dissolved Fe EQS of 1mg/l annual average is not exceeded, though this iron limit should be specified as total iron, not dissolved iron.

Normally the modelling would be expected to result in a dissolved iron discharge limit in order to match the EQS. The reason for specifying the discharge limit as total iron is that setting a dissolved Fe discharge limit may in theory allow the river dissolved Fe EQS to be exceeded. This is because discharge total Fe would not be limited and some of this Fe may change state into the dissolved form once it is in the river (due to for example a reduced pH).

However, in order to prevent overly high 95%ile limits being set (in cases of high dilution), a backstop maximum 95%ile limit of 4mg/l total Fe should be set.

A limit no tighter than 1mg/l total Fe as a 95%ile should be set. An upper tier spot sample limit should be 8mg/l.

### 6.1.4 Aluminium dosing

SEPA discourages the use of aluminium dosing due to its toxicity. Aluminium dosing at STWs should only be used in situations where ferric dosing is impracticable. The operator needs to provide full justification for the use of aluminium.

If aluminium is proposed, the EQS standards to be followed are those set out in [WAT-RM-12](https://www.sepa.org.uk/regulations/water/pollution-control/pollution-control-guidance/) which will determine discharge limits. However, to limit discharge levels in high dilution situations, a backstop discharge limit of 10mg/l dissolved aluminium may need to be used. If the discharge is to be sampled, 2 tier standards should be used.

## 6.2 Reactive phosphorus (RP)

Where phosphorous standards are required, modelling should be undertaken which will give mean and 95%ile RP standards for licensing purposes.

The 95%ile RP value derived from the modelling (corresponding to the annual average) should be used as the lower tier licence limit.

The TP annual average (AA) BAT standard is 0.25mg/l. However, we need to convert this to an RP BAT based on the RP/TP ratio of the individual STW. This is because the RP/TP ratio varies significantly depending on the individual STW. If the RP/TP ratio is unknown, the RP should be assumed to be 40% of the TP. i.e. the RP BAT would be 0.10mg/l AA. In this case the modelled RP should not be lower than 0.10mg/l AA, and the corresponding modelled 95% limit should be used as the licence lower tier limit.

We will not require standards tighter than the RP BAT standard for a particular STW.

Lower tier compliance will be assessed using the exceedance look up table. No upper tier will be used.

## 6.3 Total phosphorus (TP)

STWs serving >10,000pe discharging to freshwater river or lochs designated as Sensitive Areas subject to eutrophication under UWWTD require Total Phosphorus standards.

UWWTD phosphorus standards are fixed at 1 or 2 mg/l annual mean TP depending on the p.e. of the works. A Total Phosphorus (TP) standard of 2mg/l is applied for works < 100,000 p.e., with a TP of 1mg/l only applying to STW > 100,000 p.e.

It is the annual mean UWWTD standards which must be used in licence conditions. These TP standards should be inserted in the UWWTD schedule in the STW licence and will therefore be based upon composite sampling.

This is reproduced below in Table 4. Compliance with either the concentration or the % reduction requirements in Table 4 would mean the discharge is compliant with UWWTR.

**Table 4: Total phosphorous concentration value or % reduction**

| **Population equivalent** | **Annual mean concentration** | **Minimum % reduction** |
| --- | --- | --- |
| 10,000-100,000 | 2mg/l | 80 |
| >100,000 | 1mg/l | 80 |

For STW discharging to or impacting upon a freshwater loch, TP rather than RP standards should be used, e.g. Loch Lomond Catchment. [Refer to WAT-RM-37: Regulation of Phosphorus Discharges to Freshwater Lochs.](https://www.sepa.org.uk/regulations/water/pollution-control/pollution-control-guidance/)

## 6.4 Summary of phosphorus licence conditions

**Table 5: Phosphorus licence conditions**

| **Regulatory regime** | **Form of phosphorus** | **Statistic** | **Sample type** | **Upper tier** |
| --- | --- | --- | --- | --- |
| UWWTD | Total P | Mean | Composite (>10,000 p.e) | None |
| CAR | Rivers RP, Loch TP | 95 percentile | Spot | None |

## 6.5 Total Nitrogen (TN)

STWs serving >10,000pe discharging to tidal waters designated as Sensitive Areas subject to eutrophication under UWWTD require Total Nitrogen standards.

UWWTD nitrogen standards are fixed at 10 or 15 mg/l annual mean TN depend on the p.e. of the works. A Total Nitrogen (TN) standard of 15mg/l is applied for works < 100,000 p.e., with a TN of 10mg/l only applying to STW > 100,000 p.e.

It is the annual mean UWWTD standards which must be used in licence conditions. These TN standards should be inserted in the UWWTD schedule in the STW licence and will therefore be based upon composite sampling.

This is reproduced below in Table 6. Compliance with either the concentration or the % reduction requirements in Table 6 would mean the discharge is compliant with UWWTR.

**Table 6: Total Nitrogen concentration value or % reduction**

| **Population equivalent** | **Annual mean concentration** | **Minimum % reduction** |
| --- | --- | --- |
| 10,000-100,000 | 15mg/l | 70 |
| >100,000 | 10mg/l | 70 |

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1. Based on information taken from [Calculating dry weather flow (DWF) at waste water treatment works - GOV.UK (www.gov.uk)](https://www.gov.uk/government/publications/calculating-dry-weather-flow-dwf-at-waste-water-treatment-works/calculating-dry-weather-flow-dwf-at-waste-water-treatment-works), [↑](#footnote-ref-2)
2. The autosampler can be defined as having taken a sample and is subsequently storing it for transportation. [↑](#footnote-ref-3)