TREATING DISCHARGES FROM OVERFLOWS

What is meant by treating overflow discharges?

Why we need it?

What methods are out there?

Where is it currently implemented?

Can it be utilised here in the UK?

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Overview

Why its needed?

- Pollutants caused by stormwater can be **harmful to local biodiversity** as well as **human health.**
- Currently, most schemes and solutions to mitigate pollution involves **reducing the number of spills** and the volume of discharge entering a water body.

Legislation – SODRP 2023

- The most recent legislation states that:
  - '*Water Companies need to **significantly reduce their untreated sewage discharges** from storm overflows. In some cases, it may be **better to treat discharges**, rather than reduce their frequency'.*
- To also protect public health in designated bathing waters:
  - '*Water companies must significantly reduce harmful pathogens from storm overflows discharging near designated bathing waters, by **either: applying disinfection** or **reducing the frequency** of discharges to meet EA spill standards by 2035.*

Legislation around the world

- The US have a framework in place to compensate more spills to occur when the discharge is being treated.

The Storm Overflow Discharge Reduction Plan

Headline Target: *Storm overflows will not be permitted to discharge above an average of 10 rainfall events per year by 2050.*

In 2021, **90% of storm overflows discharged** and 5% of this proportion discharged more than 100 times across the year.

Some of these discharges were in or close to a **'high priority'** nature site such as Sites of Special Scientific Interest.

Bathers and other recreational **water users** are **impacted by 8%** of storm overflows that discharge near a designated bathing water.

There are **2 main harms** that are presented following sewer discharge:

Public Health – Raw Sewage contain high levels of **harmful pathogens** such as **viruses** and **bacteria**.

Environment – Overflows can lead to **ecological harm** due to their impact on **water chemistry.**

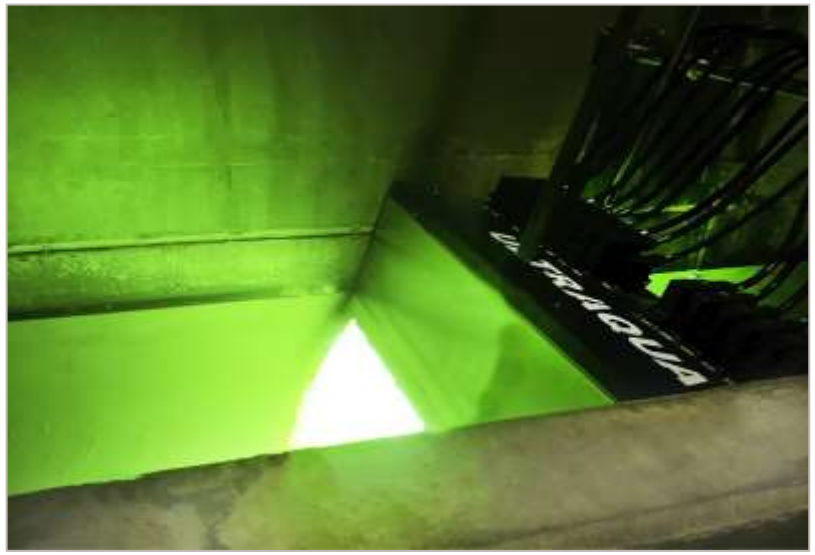
Treatment Technology - Summary

Primary:

- Screening
- Storing and Settling

Secondary:

- Disinfectants:
  - ➢ Chlorine Dioxide
  - ➢ Peracetic Acid
  - ➢ Ozonation (used by UK water companies)
- Ultraviolet (UV) Radiation
- Membranes & Constructed Wetlands



https://ultraaqua.com/application/uv-disinfection-stormwater-overflow-cso/

https://www.lochgroup.com/projects/constructed-wetlands-for-cso-treatment

The Decision Tree

Pollutant Type	Treatment Component
Visual Solids	Screening
Bacteria – Primary **Bacteria** - Secondary	UV/Disinfection Membranes
Settleable Solids	Settling
Oxygen Demanding	Reduction in discharge

Bacteria e.g

Bacteria Treatment Option:
1. UV radiation
2. Disinfection
3. Membranes

UV

Cost effective?

Yes

Is prolonged contact time required?

Yes

Is sufficient space available?

Yes

Support systems available?

Yes

Other treatment methods required?

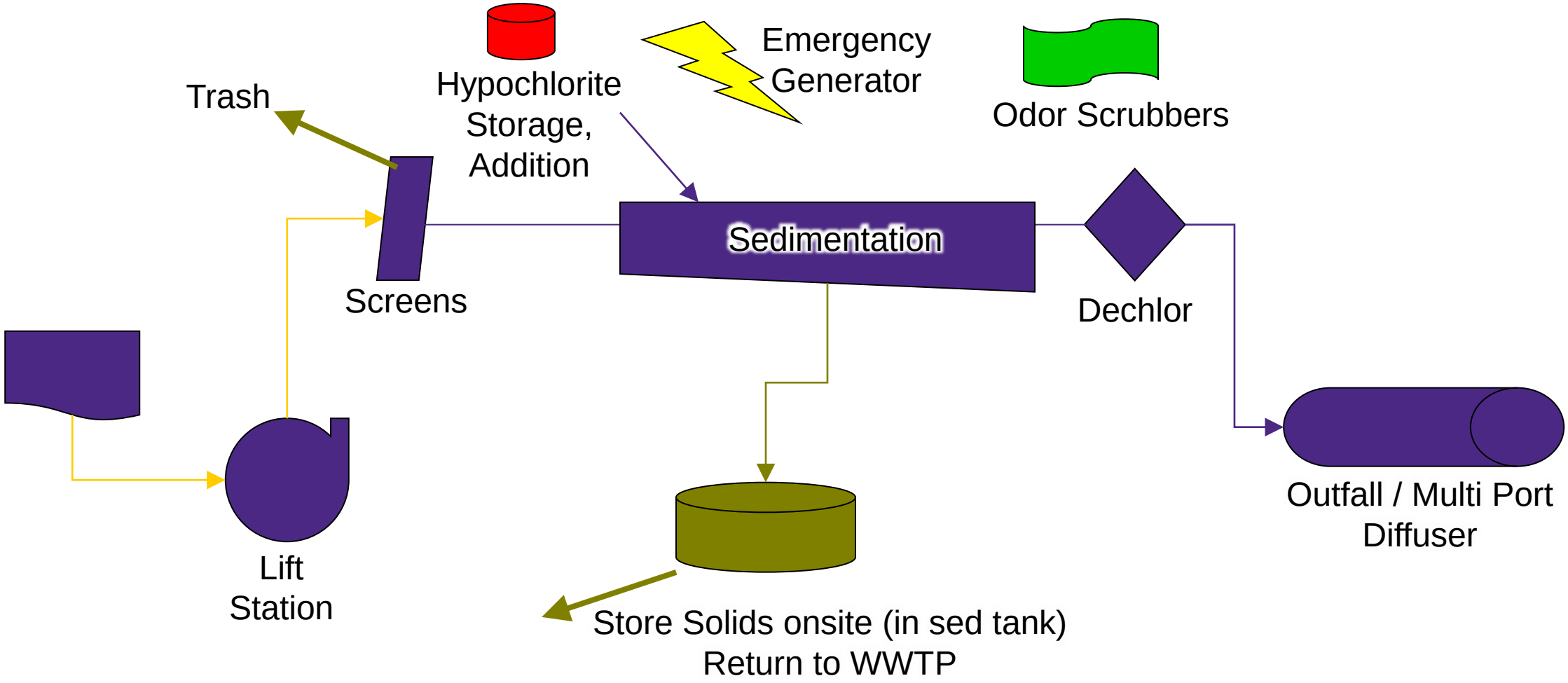
Retrofitting?

No

No

Yes

Example Treatment Train



Disinfection

Chlorine Dioxide

- **Effective wastewater disinfectant.**
- Applied as a gas during treatment.

Peracetic Acid

- Very strong oxidant and an effective disinfectant.

Peracetic Acid Wastewater Disinfection - Enviro Tech Chemical Services, Inc.

Ozonation

- Ozone is a strong oxidizer and is also applied to wastewater as a gas. Considered **equal or superior to Chlorine Dioxide** in terms of disinfection.

Pros	Cons
• *Chlorine Dioxide* is relatively easy and economical to produce • ***Ozone* more powerful disinfectant** than most chlorine compounds • *Ozone* requires **short contact time**	• All are unstable and either hazardous to **transport** or must be **generated on site**. • Ozone - Forms nitric oxides and nitric acid which can lead to **corrosion.** • Peracetic Acid – Concerns over **health and safety** in production and use.

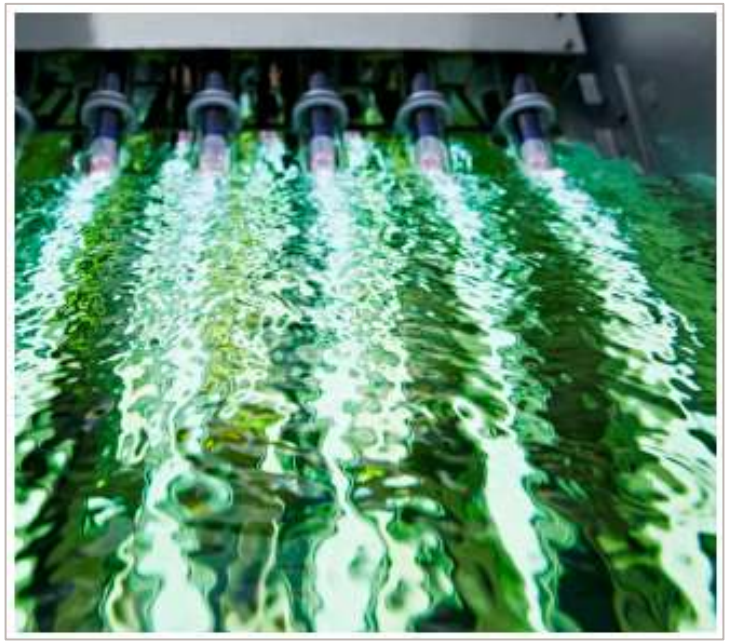
DISINFECTION – TETRA TECH

- Requires multiple **support systems** (Facility Cleaning, Dewatering).
- Facilities are **needed to store chemicals** and deliver at a wide range of rates
- Chemical mixers may be needed.
- **15-30 minutes of hydraulic residence time** should be provided after chemical delivery and mixing.

Potential in UK?

- Opportunity to **retrofit** current infrastructure (storm tanks)?
- **Ozonation** already used by UK water companies and does not require the contact time.
  - ➢Frankton, Itchen Bank & Ludlow WwTW.
  - ➢Equipment to be installed late 2023.

Ultraviolet (UV) Radiation



- One example of electromagnetic radiation used for disinfection.
- The primary method for utilizing UV disinfection is to **expose wastewater to a UV lamp.**
- Requires **short contact time** and is notoriously effective against all known **bacteria** and **viruses.**

Pros	Cons
• **No hazardous chemicals are produced or released** while treating CSOs with UV - because UV is not a chemical disinfection method, it disinfects without altering the physical or chemical properties of water.	• UV disinfection is **not effective in wastewaters with a high amounts of suspended solids** – scatter and absorption of light.

UV STORMWATER TREATMENT FACILITY TORONTO, ONTARIO

The Treatment facility was constructed in the Sherbourne Common waterfront Park in Toronto in 2011.

- During heavy rainfall, the area is prone to CSO discharge resulting in microbial contamination of water supplied to the park.

- Ultraviolet (UV) water disinfection was chosen to treat the runoff water to make it suitable for human contact in Lake Ontario.

Process:

- Overflow discharge runoff is collected in storage tanks for initial treatment.
- Flows then enter another large tank which acts as an artificial wetland. The platform has three holes for penetration of UV rays for treatment.
- Treated water is then conveyed through 240m long artificial channel which is accessible to the public.

Sherbourne Common Stormwater Treatment Facility, Toronto, Ontario - Water Technology (water-technology.net)

Potential in UK?

- UV technology is **already used** to treat drinking water. Potential to **retrofit** into storm water treatment.
- Water Quality standards would be met, **no hazardous chemicals** being released into the environment.

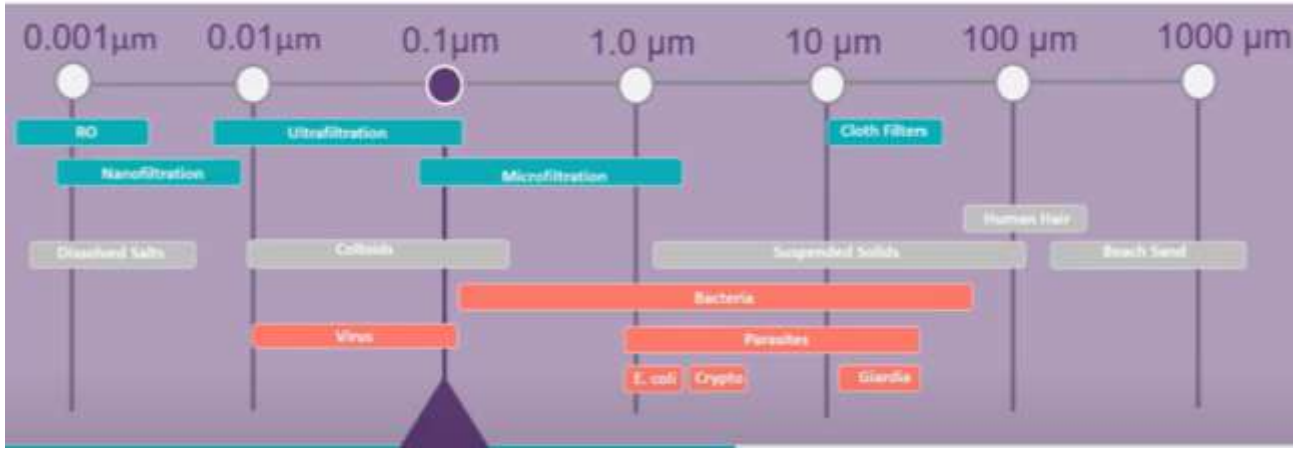
rpsgroup.com

MAKING COMPLEX EASY

A TETRA TECH COMPANY

Membranes

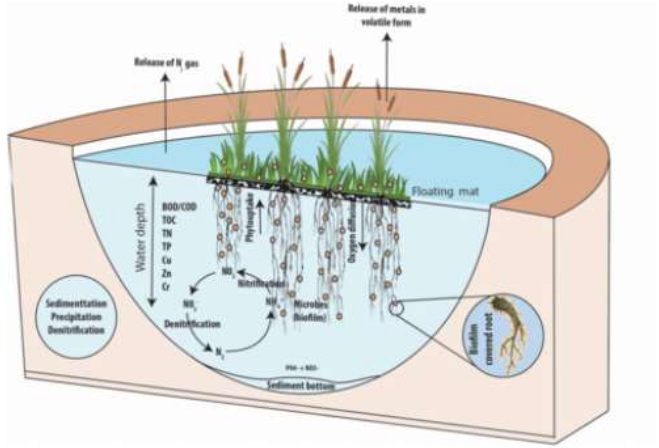
- **Physical barrier** with light vacuum applied, pulling water through.
- **Pore sizes are smaller than bacteria and particulate matter etc**.
- Different pore sizes for removal of different pollutants – **Micro/Ultra/Nano**



- **Mycofiltration** – This treatment uses web-like tissue of mushroom-forming fungi like **Mycelium** to degrade environmental pollutants.

Pros	Cons
• **Rapid treatment capability (2 minutes)** • **Versatility to handle flow and load variation** • Can be a relatively small footprint • No negative residuals	• Can be expensive • **Damage of membrane material over time** • **Ineffective in extreme conditions.**

Wetlands



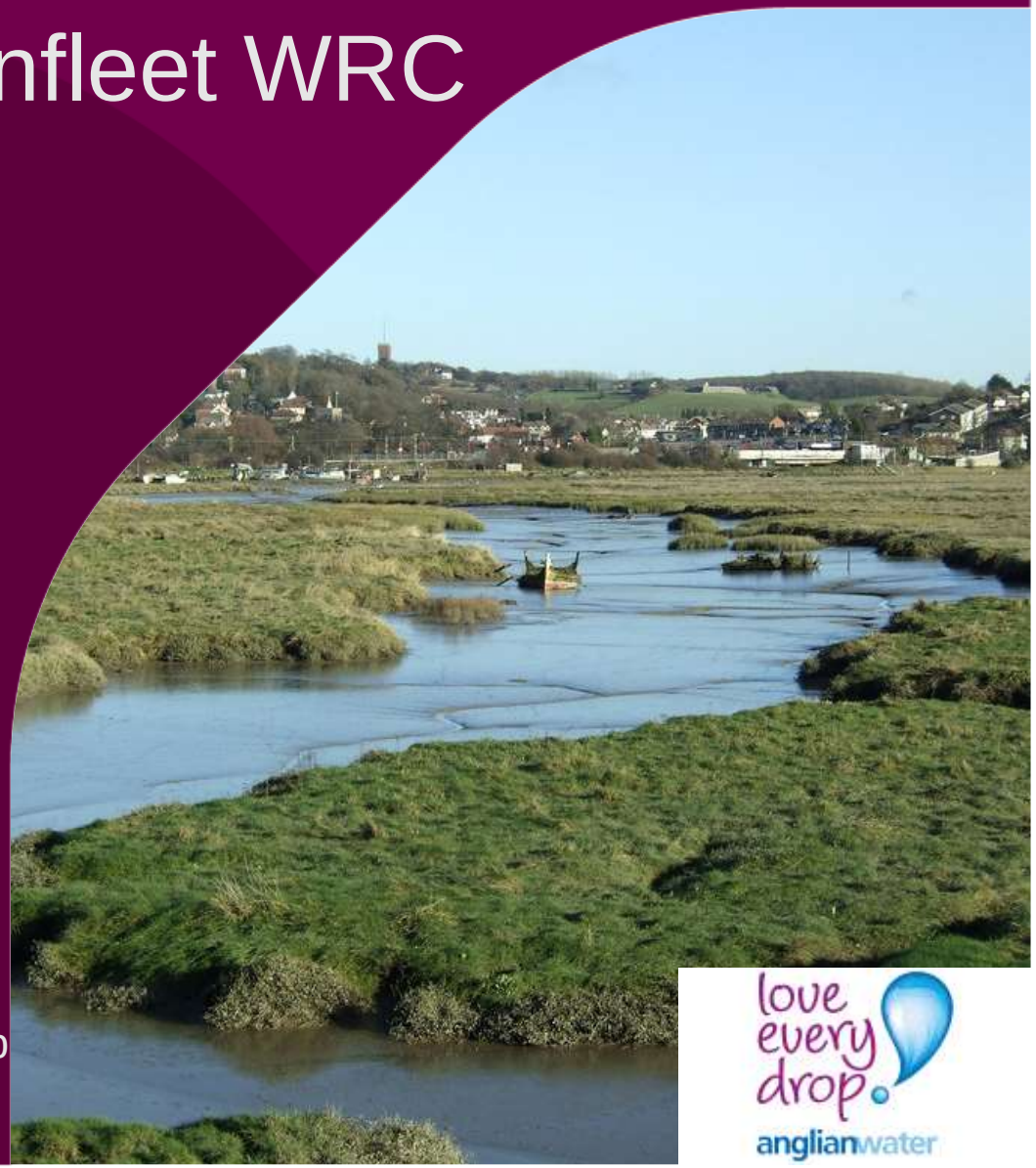
- Engineered wetland systems are designed and constructed to **replicate the natural processes** and combination of wetland vegetation, soils and associated microbial life to reduce contaminants and improve water quality.
- **Surface and sub-surface horizontal and vertical flows.**
- **Floating wetlands** also applicable - plants are vegetated on a floating mat while their roots are extended down to the contaminated water acting as biological filters.

Mycofiltration for Urban Storm Water Treatment Receives EPA Research a (fungi.com)

Pros	Cons
• Relatively **low capital and O&M costs** compared to other technology. • **Wider ranging.**	• Not effective in certain conditions such as during frozen landscape. • **Large plan area.** • Flows may need pre-treatment, e.g. screening. • **Often require continual (not intermittent) flows to be effective**.

Innovation of Wetlands at Benfleet WRC to treat storm discharge

- The upcoming project will treat settled storm effluent using **Mycelium.**
- The flow being treated would be coming into Benfleet WRC which gets immediately directed to the storm tanks.
- Within the Benfleet Creek, there is a **SSSI salt marsh** which borders the site. Currently the **algae bloom is eating away** at the marsh due to the build-up of pollutants.
- The innovation following the **Mycelium treatment** will allow Anglian Water to closely monitor the quality coming off the new wetland.
- During this study, AW are also trying to acquire a very **innovative style of sand** that was analysed in Holland which claims to absorb and remove organic matter.



love every drop. anglianwater

CONSIDERATIONS & RECOMMENDATIONS

- Clearer legislation – Could water companies be given clearer instructions with regards to disinfection in bathing waters?
- SODRP – ‘treatment’ not defined. Suggest this needs more clarification ie. Is screening treatment?
- Decision tree – what type of treatment is applicable/suitable for a specific site based on known constraints. Could there be an initial screening (not physical) process to rule in or out treatment?
- Learning from around the world – Can we adapt/integrate current facilities in the US within the UK environment?
- PFAs – These treatment techniques are not able to remove forever chemicals from wastewater.