



Sewage Treatment Plant Installation for Red Barn, Turves

BACKGROUND:

EWwS was commissioned to design and propose a wastewater treatment solution for Red Barn – Turves. The scheme required a compliant, compact, and robust treatment system designed in accordance with the **British Water Code of Practice – Flows & Loads 4**, with additional allowances for infiltration as required by Anglian Water Authority (AWA).

The plant was designed to achieve stringent final effluent standards on a 95%ile basis while ensuring operational resilience, odour control, and effective nitrification.

DESIGN BASICS

The plant sizing incorporated infiltration to increase per capita flow to 156.25 l/PE.d, as required by AWA.

Design Parameters:

Parameter	Value
Wastewater Temperature	12°C – 20°C (assumed)
Dry Weather Flow (DWF)	27.5 m ³ /day
Peak Flow Rate	3.45 m ³ /hr
BOD ₅ Load	10.56 kg/day (400 mg/l)
NH ₄ -N Load	1.41 kg/day (53.3 mg/l)
TKN Load	1.94 kg/day (70.4 mg/l)
Inlet pH	6–9 (assumed)

Alkalinity Considerations:

The design assumes adequate influent alkalinity (300 mg/l as CaCO₃) to support full nitrification. The proposed system incorporates internal recycle to recover alkalinity

and support biological stability; however, sufficient influent alkalinity remains critical to maintaining complete nitrification performance.

Final Effluent Discharge Standard (95%ile Basis):

Parameter	Consent Standard
BOD	≤ 20 mg/l
TSS	≤ 30 mg/l
NH ₄ -N	≤ 10 mg/l

Process Solution:

The proposed treatment system consists of:

- Two-stage Primary Settlement Tank (PST)
- 3m diameter, 3-bank NIFAS® RBC
- Integral flow management and balancing chamber
- Internal recycle system
- 1 x 2.8m diameter Final Settlement Tank (FST)

Primary Settlement:

To meet Anglian Water requirements, a two-stage cylindrical Primary Settlement Tank was proposed upstream of the RBC.

- Recommended volume: 36 m³ minimum
- Detailed design recommendation: 45 m³ cylindrical tank
- Outlet configured at lower level to provide flow attenuation
- Integral attenuation achieved within tank structure

In addition, the RBC incorporates an integral 10 m³ inline balancing chamber, satisfying AWA's 20% balancing capacity requirement.

Rotating Biological Contactor (RBC)

The biological treatment stage is provided via a 3m diameter, 3-bank NIFAS® RBC, delivered fully assembled within a GRP tank.

- Designed for full inlet BOD₅ load of 10,560 g/day
- Assumes no BOD reduction within primary settlement
- Substrate loading rate: 2.5 g BOD/m²·d
- Shaft-mounted bucket flow management system
- Adjustable forward feed rate for process optimisation

Flow Management System:

The RBC incorporates a unique bucket-based forward feed system mounted on the shaft. This provides:

- Controlled, pre-determined hydraulic progression
- Adjustable feed rates
- Improved biological stability
- Enhanced nitrification performance

NIFAS® Chamber & Internal Recycle:

The integrated NIFAS® chamber acts as:

- An inline attenuation tank
- A receiver for internal recycle flow
- A process stabilisation zone

Internal Recycle Objectives:

- Reduce and eliminate foul odour potential
- Recover alkalinity
- Promote partial denitrification
- Maintain biologically “sweet” mixed liquors
- Improve overall nitrogen removal performance

This configuration enhances resilience while maintaining compact plant footprint.

Final Settlement

Treated effluent flows to:

- 1 x 2.8m diameter Final Settlement Tank (FST)

The FST provides:

- Effective solids separation
- Stabilised sludge settlement
- Return of settled solids to maintain biomass health

Final Effluent Discharge Standard (95%ile Basis):

Parameter	Consent Standard
BOD	≤ 15 mg/l
TSS	≤ 20 mg/l
NH ₄ -N	≤ 1.15 mg/l

Key Benefits of the Proposed System:

- Fully compliant with British Water Code of Practice – Flows & Loads 4
- Designed to meet Anglian Water Authority requirements
- Compact footprint with integrated balancing capacity
- Enhanced nitrification reliability
- Odour reduction through internal recycle
- Adjustable hydraulic control for operational flexibility
- Delivered as pre-assembled GRP unit for rapid installation

Project Outcome

The proposed system provides a robust, compact, and technically optimised treatment solution capable of achieving::

- Superior BOD reduction
- Excellent solids removal
- High-level ammoniacal nitrogen reduction
- Stable total nitrogen control

The integrated design approach ensures regulatory compliance while providing operational simplicity and long-term process resilience.



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