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PROGRESS REPORT

Interim Report

- Detailed account of previous operations
- Brief on each of the treatment processes
- Summary of results (DW)
- Upcoming developments

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Tywi Farm Nutrient Partnership: Interim report concluding 2021

Executive Summary

Recent innovations in dewatering technologies now increases suitability for the agriculture sector. The separation of liquid and solid from dairy slurry is demonstrated to reduce bulk volume, alleviating the pressure on farm storage capacity. Alongside successive wastewater treatment, we have seen overall removal rates of
and ~80% Potassium (K), in the separation of dilute
these nutrients presents an opportunity for poter
artificial fertilisers. Importantly, this also helps farm
legislation changes, in addition to preventing enviro
runoff). Further investigation will now incorporate r
N enhancement, an advanced oxidation process, a
utilising raw dairy slurry.

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Site Overview & Recent Developments

Based at the Agriculture Research Centre at Gelli Aur farm (Coleg Sir Gâr), the Tywi Farm Nutrient Partnership is a research collaboration between Welsh and internationally based organisations, each bringing their unique set of skills and industry-leading expertise. As the first further education institution in Wales to receive funding from the European Regional Development Fund SMART Expertise 2014-2020, our connection with N2-Applied, Power & Water, Netafim, GEA, Natural Resource Wales (NRW), Dŵr Cymru, Honesty foods, and Aquatreat, is unique by the fact we are working towards one common goal. This is to create a tried-and-tested nutrient management package through maximising the efficiency of a modular dewatering system and successive wastewater treatment, alongside the integration of precision farming techniques. As demonstrated by the process flow diagram found below (Figure 1), raw slurry is initially fed through a screw press to remove the bulk of the coarse solids (which are taken to solid store) and the remaining liquid (filtrate) held in a storage tank. The filtrate is then pumped into the reaction tank where the coagulation-flocculation process takes place, binding suspended and dissolved solids together through chemical addition. A decanter centrifuge finally removes these solids through centrifugal force (again, these are taken to solid store), and the remaining liquid is sent to a dissolve air flotation (DAF) unit for polishing. After, the liquid can either be delivered via the drip irrigation system, used to washdown the yard, or sent to the reedbed where the residual contaminants are removed by natural processes.

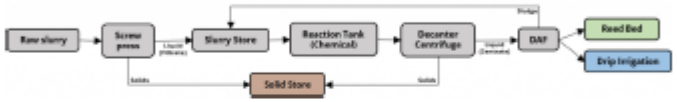

Figure 1. Flow diagram of the dewatering process. Up until now, filtrate in the storage tank has been diluted with rainwater after it has been used washing down the yard/parlour. In future, filtrate will not be diluted and will go straight to the reaction tank.

Since spring 2021, operations have primarily focused on developing the constructed wetland, refining the plant's infrastructure and chemical amendment process, alongside the installation of a pressure-compensated fertigation system (possibly the first kind in the UK within a grassland setting!). Widespread nutrient mapping and soil analysis has been

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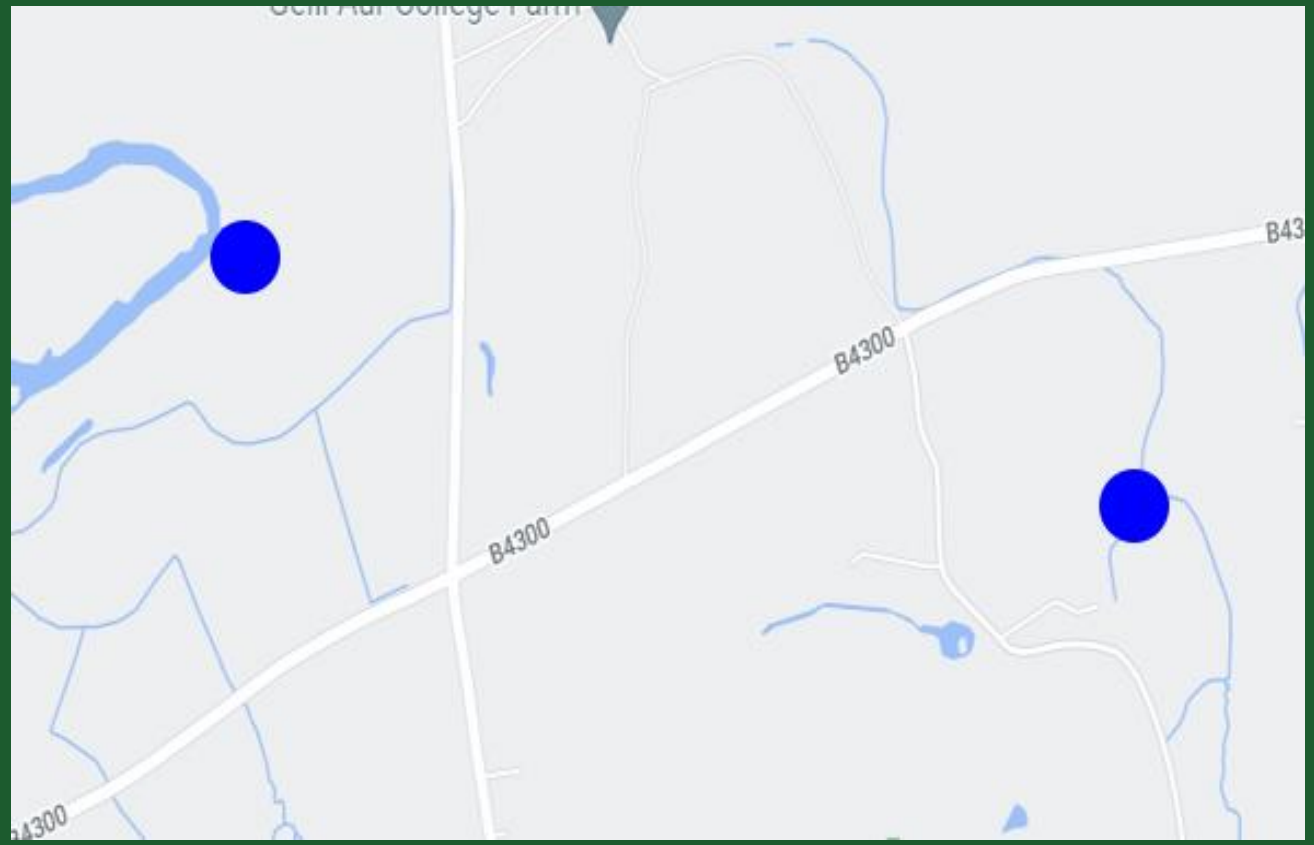
Cronfa Datblygu Rhanbarthol Ewrop
European Regional Development Fund

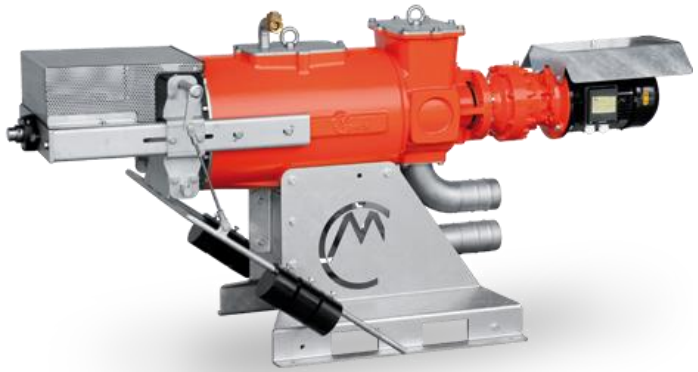
Progress

- Switched over to feedstock higher in TS (~4%)
- Dŵr Cymru sampling
- Continued sampling with NRW
- Infrastructure changes



Higher TS Trials

- First attempted to treat filtrate (~6%)
- Dilution factor mimics situation on farms
- Compare our slurry to others (mitigating the variability in the slurry matrix)
- Today, treating a blend of raw slurry and DW (4.6%)



Previous Results

Parameter	Reduction
Total Suspended Solids (TSS)	99.2 %
Total Nitrogen (TN)	94.8 %
Total Phosphate (TP)	99.9 %
Dissolved Phosphate (OP)	99.8 %
Total Potassium (K)	79.4 %
Total Aluminium	99.4 %
Chemical Oxygen Demand (COD)	95.8 %

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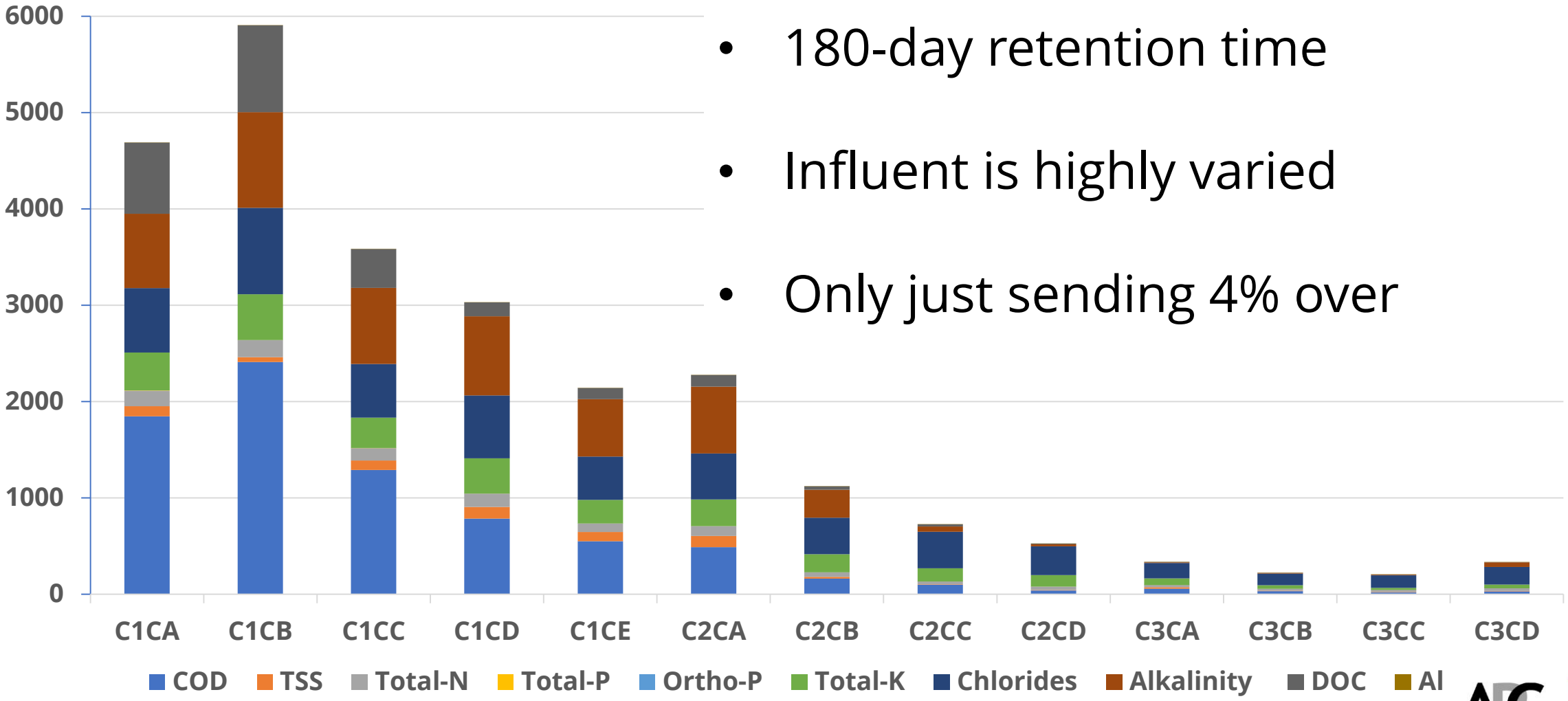
Current Removal Rates

Parameter	Reduction
Total Solids (TS)	85.3 %
Total Nitrogen (TN)	80.3 %
Total Phosphate (TP)	99.6 %
Dissolved Phosphate (OP)	99.8 %
Total Potassium (K)	95.1 %
Chemical Oxygen Demand (COD)	86.2 %

- From our own lab

Reed Bed Update



- 180-day retention time
- Influent is highly varied
- Only just sending 4% over

Reed Bed Removal Rates

Parameter	Removal	Inlet (mg/L)	Outlet (mg/L)
Total Solids (TSS)	95.8 %	104.6	4.4
Total Nitrogen (TN)	82.6 %	162	28.1
Total Phosphate (TP)	95.5 %	0.95	0.04 *
Total Potassium (K)	89.9 %	392	39.5
Total Aluminium (Al)	56.1 %	1.1	0.5 *
COD	98.5 %	1847.4	28
Chloride	72.8 %	670.4	182.4
Alkalinity	93.9 %	772.3	46.9
Dissolved Organic Carbon	99.8 %	739.2	1.7

- OP – undetectable

Overall Treatment Rates

Parameter	Removal	Raw Slurry (mg/l)	RB Outlet (mg/l)
Total Solids (TSS)	99.9 %	27506.6	4.4
Total Nitrogen (TN)	98.7 %	2107.6	28.1
Total Phosphate (TP)	99.9 %	407.9	0.04
Dissolved Phosphate (OP)	99.9 %	216	0.24
Total Potassium (K)	98.4 %	2454.9	39.5
Total Aluminium (Al)	99.4 %	76.9	0.5
COD	99.9 %	55000	28
Chloride	92 .1%	2293.9	182.4
Alkalinity	99.1 %	5266	46.9

- Another 180 days

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