H1 CONTROLLED WATERS RISK ASSESSMENT - POINT SOURCE EMISSIONS TO SURFACE WATER FROM AD PROCESS

Whitwick Manor, Lower Eggleton, Herefordshire, HE8 2UE

STL Energy Limited

Version:	1.6	**Date:**	04/08/2023		
Doc. Ref:	2102-006-H1	**Author(s):**	EC/CG	**Checked:**	
Client No:	2102	**Job No:**	006		

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Document History:

Version	Issue date	Author	Checked	Description
1.0	14/10/2022	EC/CG		Internal draft
1.1	11/10/2022	EC/CG	CG	Internal draft
1.2	25/11/2022	EC/CG	CG	Document issue
1.3	24/03/2023	EC/CG	CG	Updated with additional process information
1.4	26/04/2023	EC		Editing from comments
1.5	09/05/2023	EC		Updated
1.6	04/08/2023	EC	DY	Drainage plans updated

CONTENTS

1 Introduction

1.1 General

1.1.1 Oaktree Environmental was commissioned by STL Energy Limited to prepare a H1 Controlled Waters Risk Assessment. This assessment has been undertaken to assess the potential impacts from emissions to surface water associated with an anaerobic digestion (AD) process to be undertaken at the site, Whitwick Manor, Lower Eggleton, Herefordshire, HE8 2UE. This assessment is prepared in support of an application for an environmental permit to operate an anaerobic digestion plant at the site.

1.1.2 The EA H1 Screening Tool has been used to assess potential impacts due to the discharge of fully treated AD effluent on the system of surface water drainage receptors. This document outlines the method used and results from the assessment. A copy of the completed H1 screening tool showing inputs and outputs is included within Appendix I.

1.1.3 The site will be constructed and operated in accordance with the requirements of the WRAP Quality Protocol specifying the end of waste criteria for the production and use of quality outputs from anaerobic digestion of source-segregated biodegradable waste dated January 2014 and the PAS 110:2014 Specification for whole digestate, separated liquor and separated fibre derived from the anaerobic digestion of source-segregated biodegradable materials dated July 2014. Any solid or liquid output (referred to in this assessment as the thick fraction and thin fraction respectively) will therefore comprise a material and not a waste until such point as the holder either discards it or is required to discard it.

1.1.4 Due to the ongoing recording of elevated nutrient levels in the River Wye and its tributaries it is proposed that the liquid output from the AD process is treated to reduce the nutrient concentrations within the output to levels which will not cause further deterioration in water quality in the River Wye catchment. Any liquid effluent produced by the AD process will be re-circulated back into the process in the first

instance following treatment as appropriate. Only where liquid effluent can not be re-used and re-circulated will the effluent be treated and discharged in accordance with the concentration and volume limits set out in this assessment.

1.1.5 The discharge point W1 as shown at Appendix I will be the only discharge to surface or groundwater as part of the site operations. Two package treatment plants will be used to treat domestic sewage arising from the weighbridge offices and the grain store which will discharge to the drainage system consistent with the general binding rules for domestic sewage discharges and as such will be exempt from the need for an environmental permit.

1.2 Site Location

1.2.1 The site is located at an approximate National Grid Reference SO 60660 45744 and is located off the A417. The proposed site is currently in agricultural land use and is bounded to the north and north east by the A417 with agricultural land beyond. To the east lies agricultural and with the A417 beyond and to the south and west lies agricultural land.

1.2.2 It is the intention that the solid material generated by the AD process will be exported as a material. Notwithstanding the liquid fraction being PAS110 compliant, it is unlikely that any liquid effluent will be exported from the site for use on the land due to the potential for such as use to cause a further deterioration in water quality in the River Wye catchment.

1.2.3 Neither the thick fraction nor the thin fraction will be discharged to surface water due to the lack of a public sewer in proximity to the site operations. Any liquid effluent which can not be re-used and surface water generated at the site will be treated and discharged to the surrounding surface water drainage system.

1.3 Development Proposals

1.3.1 The development comprises an anaerobic digestion facility and an associated grain store. The development is presented in the Environmental Statement (Report Reference 2102-003-B). The plant will be capable of processing up to 176,000 tonnes/annum of feedstocks. These will comprise 100,000 tonnes/annum poultry manure, 16,000 tonnes/annum apple pomace and 60,000 tonnes/annum of liquid waste from dairy units and drinks industry processes etc.

1.3.2 The results of these processes are the production of biogas, which consists predominantly of methane (CH_4) and carbon dioxide (CO_2) and digestate product.

1.3.3 The proposals will allow for the construction of an anaerobic digestion plant as shown on Drawing No. 2102-006-02. All waste handling treatment operations will take place on a sealed drainage system with an impermeable base or will take place within covered areas or within the sealed vessels or tanks. The proposals also include reed and buffer lagoons for further treatment of liquid digestate and a network energy facility and compressor to export generated biogas to the National Grid, a CO_2 and dry ice manufacturing plant, two combined heat and power plants and an emergency flare. Energy generated in the combined heat and power plant will be used to dry grain in the proposed grain store.

1.4 Hydrological Setting

1.4.1 The site is in the catchment of the River Wye. The drainage system in respect of the operation will discharge to the field drainage system under the control of the operator as shown on Drawing No. 2102-006-03. The boundary of the operator's land comprises the drainage ditch running parallel with and to the north of the Herefordshire and Gloucestershire Canal which comprises an unnamed tributary of the Withington Marsh Brook. The Withington Marsh Brook comprises a tributary of the River Little Lugg which in turn comprises a tributary of the River Lugg. The River Lugg discharges to the River Wye.

2 Operations

2.1 Overview

2.1.1 The H1 Screening Tool has been used to assess potential impacts from the discharge of fully treated water from the anaerobic digestion (AD) process to the River Lugg via a settlement lagoon and unnamed tributary. The following sections describe and justify the input parameters which have been used in the H1 Screening Tool.

2.1.2 The site layout is shown on Drawing Reference 2102-003-03 which is presented at Appendix I along with a flow-chart schematic of the process which is presented at Appendix II. The discharge from the site will comprise only fully treated water from the AD process and rainfall runoff generated on the site surfaces discharged from the site drainage system. The mass balance calculations on which this assessment is based are presented also at Appendix II.

2.1.3 Liquid digestate from the anaerobic digestion process will be retained for as long as possible within the primary digesters. Digestate from the primary digesters will be pumped to the secondary digester to allow further gas collection which will maximise insofar as possible the methane gas yield. Only in the scenario where the digestate can not be re-used within the process with or without treatment.

2.2 Feeders

2.2.1 There will be 4 walking floor feeders of approximately 100m^3 capacity, sufficient for 12 hours. These will be filled twice a day, morning and evening.

2.3 Pre-treatment

2.3.1 There will be three hydrolysis/pasteurisation tanks, each being 1,000m^3 in volume to allow for the feedstocks to be pre-processed by hydrolysis, pasteurisation and de-ammoniafication. Approximately 55% of the ammonia is removed before the digestion process to prevent the nitrogen from inhibiting the digestion process and to extract

55% of the Nitrogen into a concentrated Ammonium Sulphate solution which can be sold as a fertiliser. A large 6,250m^3 Ammonium Sulphate storage tank is provided for.

2.4 Anaerobic Digestion

2.4.1 The pre-treated material is pumped into 4 primary digesters, each 6,250m^3 in volume and then into two secondary digesters, also providing 6,250m^3 of volume. These will be maintained at over 40 degrees Celsius for the digestion process and fully stirred. The biogas that is produced will bubble up to the headspace in the double membrane roofs. The roofspace has support straps and a de-sulphurisation net as well as a flexible gas membrane and air-blown outer weather membrane. The resultant biogas is around 55% CH_4 and 45% CO_2 and is piped via desulphurisation tower(s) for use in the Combined Heat and Power (CHP) units and the biomethane plant.

2.5 Nutrient Recovery

2.5.1 The phosphate recovery and treatment process document is presented at Appendix V. The digestate overflow will be treated to extract nutrients in a multi-stage process where the majority of the remaining Nitrogen, Phosphates and Potassium are removed. These processes collect the nutrients in a concentrated form including ammonium sulphate, calcium phosphate, which can be easily transported and then applied as available fertilisers where and when agronomically required.

2.6 Digestate Separation

2.6.1 The low nutrient digestate is then separated with screw presses and/or decanter centrifuges into a benign solid soil improver and a liquid stream. The liquid stream is still around 1% solids so requires further processing through a reverse osmosis membrane / ion exchange plant to create a liquid stream suitable for re-circulation or final polishing in a reed bed before discharge.

2.7 Reed Bed and buffer lagoons

2.7.1 An area of around 5.3ha has been allocated for a reed bed system which further cleans the run-off water. A buffer storage lagoon has been provided for to allow for maintenance and process control. A second lagoon has also been provided for to capture rain from the site which can be used in the AD process or discharged to the local ditch network. The layout of the reed bed system is shown on Drawing No. 2102-006-02 presented at Appendix I.

2.7.2 Water from the reed bed is discharged into the storm water lagoon which is discharged via a restricted outlet to the surrounding surface water system. The sampling point inf respect of Emission Point W1 will be located immediately downstream of the flow restriction device as shown on Drawing No. 2102-006-02 presented at Appendix I. The fully treated discharge will then be conveyed through ditches under land controlled by the operator to the drain running parallel with the Herefordshire and Gloucestershire Canal as shown on Drawing No. 2102-006-03.

2.8 Site hydrological setting

2.8.1 The site is in the catchment of the Withington Marsh Brook which is in the catchment of the River Lugg. The site and wider area are recorded as being in the operational catchment of the River Arrow, Lugg and Frome. The Withington Marsh Brook flows generally north east to south west along the northern boundary of the site. The confluence between the Withington Marsh Brook and the River Little Lugg is approximately 3km west of the site.

2.8.2 The sites is within flood zone 1 which is defined as land having less than 1 in 1,000 annual probability of flooding from rivers or sea. The site generally has a very low (less than 1 in 1,000 year annual probability of surface water flooding except within the areas immediately surrounding the ponds and watercourses at the site which is consistent with the site's topographic and hydrological setting. The site is not at risk

due to canal flooding, with the nearest canal comprising a disused section of the Herefordshire and Gloucestershire canal.

2.8.3 The land at the site falls generally towards the north west in the north and to the south in the south of the site. The site will be re-profiled as shown on Drawing No.s 0113-00-C – Whitwick Manor – Sheet 02 (site plan). Rainfall incident to the proposed concrete area in the current situation drains to the north to an unnamed tributary of the Withington Marsh Brook as discussed above. The drain discharges to the Withington Marsh Brook approximately 2.77m south west of the site.

2.8.4 Following the proposed development, rainfall incident to the impermeable concrete surface in the north of the site will drain to the storm water lagoon to the south of the proposed concrete surface as shown at Appendix I.

2.8.5 Based on the above and taking into account the general historic and current land uses at and in the area surrounding the site, it is considered that the hydrological receptors at the site and in the surrounding area have a low degree of sensitivity to the proposed operations at the site.

2.9 Flow in River Lugg and tributaries

2.9.1 Based on information presented on the National River Flow Archive Website[1] the Q95 within the River Lugg at Lugwadine is the closest river gauging station to the site. The median discharge rate or Q_{MED} for this period is 6.78m^2 and the average 95th percentile exceedance discharge is 1.62m^3/s. Based on information presented of the FEH online website, the catchment area of the River Lugg at Lugwadine is reported as 844.66km^2. The catchment area of the drainage ditch to the north of the canal downstream of the

[1] https://nrfa.ceh.ac.uk/data/station/meanflow/45003

area at Kymin is approximately 6.30km^2. The Q95 value at Kymin based on the catchment area is therefore:

1.62m^3/s x (6.30km^2 / 182.2km^2) = 0.0115m^3/s

2.9.2 The Q_{95} flow at the outfall from the STL AD facility to the unnamed tributary of the River Little Lugg is therefore modelled as 0.0115m^3/s.

2.10 Effluent flow rates

2.10.1 The mass balance calculations supplied by the technical provider, including the flow rates are presented at Appendix III. The discharge rate from the AD process is calculated as 478 tonnes / day which is 5.53l/s. The discharge of fully treated effluent from the AD process will not exceed this volume.

2.10.2 In order to provide a worst case assessment it is assumed that there will be no surface water discharged from the lagoon concurrently with the fully treated effluent from the AD process. It is likely that the fully treated effluent will be diluted further within the lagoon prior to discharge in comparison to the scenario modelled.

2.10.3 The discharge is also modelled assuming conservatively that the full discharge from the process is fully treated and then released to the unnamed tributary of the River Little Lugg. A proportion of the water within the process will be re-circulated back to the primary digestor tanks depending on the water demand within the process hence the modelling of the constant discharge of fully treated effluent equal to the output of the AD process is a worst case assumption.

2.11 Risk assessment

2.11.1 The discharge from the after storage tanks will be controlled so that it does not exceed an average of 5.53l/s.

2.11.2 The temperature of the surface water discharged from the site will be ambient due to the time spent in the reed beds and lagoon prior to discharge.

3 H1 risk assessment

3.1.1 There is the potential for the fully treated effluent from the process and the drainage at the site to contain ammoniacal nitrogen and phosphate. Notwithstanding the assumed removal of ammoniacal nitrogen and phosphate from the discharge both in the pre digestion treatment and the post digestion water treatment, the assessment and monitoring in the site discharge of ammoniacal nitrogen and phosphate concentrations will serve to verify the effectiveness of treatment process and confirm that the operations will not have an unacceptable impact on the water environment.

3.1.2 As discussed above the pH of the digestate is likely to be neutral to slightly alkaline therefore it is considered that the ammoniacal nitrogen present in the water within the treatment process is likely to be present almost exclusively as ammonium. It is therefore considered that the positively charged ammonium ions are likely to partition within the process towards the negatively charged clay and organic matter particles within the thick fraction of the process and sorb to the negatively charged clay surfaces within the clay filters and reed bed substrate. The negatively charged phosphate ions will be removed as struvite crystals through a process of ion exchange involving calcium, magnesium, ammonium and phosphate. The ammonia and phosphate removal processes will therefore be mutually complementary hence any malfunction within the treatment process will be readily detectable allowing for prompt identification and rectification.

3.1.3 Biochemical oxygen demand and chloride concentrations are assessed and will be monitored also in order to verify that the redox conditions and the total dissolved solids of the fully treated effluent are consistent with the assumptions made as part of the design of the process.

3.1.4 The elevation of the receiving watercourses in respect of the site discharge is less than 80m AOD and the background alkalinity recorded in the River Lugg at Wergins Bridge approximately 7.8km west south west of the site between January and September 2022 ranges between 130mg/l and 230 mg/l with and average of approximately

184mg/l. It is therefore considered that the receiving watercourse comprising the unnamed tributary of the River Little Lugg should be classified as Type 5 as set out in Table 1 of the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 as amended.

3.1.5 The overall water quality classification for the Withington Marsh Brook to the conference with the River Lugg is poor with a poor ecological class. The Withington Marsh Brook to its confluence with the River Lugg fails its chemical classification.

3.1.6 A H1 screening assessment is presented at Appendix III in which the likely impact due to the site discharge on water quality in the River Little Lugg.

3.2 Parameters modelled

3.2.1 The parameters used in the H1 assessment are as follows:

PARAMETER	UNIT	VALUE	JUSTIFICATION
Ammonia concentration in discharge	mg/l µg/l	0.13 130	Typical analytical detection limit assuming complete removal of ammoniacal nitrogen from water discharging from process.
Phosphate concentration in discharge	mg/l µg/l	0.05 50	Typical analytical detection limit assuming complete removal of phosphate from water discharging from process.
Biochemical oxygen demand	mg/l µg/l	6.5 6,500	Background concentration needed to achieve 'Moderate' standard for Type 5 rivers consistent with approach set out in Environment Agency H1 Annex D2 which would cause no deterioration in the catchment of the Whithington Marsh Brook whose current overall status is 'poor'.
Chloride concentration in discharge	mg/l	30	Estimated background concentration based on mean electrical conductivity of 441.2µS/cm, (converted using a factor of 1.9 to 232 mg/l) minus avarage alkalinty

PARAMETER	UNIT	VALUE	JUSTIFICATION
			of 184mg/l converted to chloride using a conversion factor of 17/28.
Effluent flow rate	l/s m^3/s	5.53 0.00553	Output from AD process presented at Appendix II.
Q95 flow in River Lugg	l/s m^3/s	11.5 0.0115	See paragraph 2.3.1 of this assessment
EQS for Ammonia concentration in discharge	mg/l µg/l	0.2 200	Used in the H1 assessment tool and is identical to that set out for ammonia (as N) for a high water quality watercourse below the elevation of 80m with a hardness greater than 50mg/l $CaCO_3$ (Type 3 or 5 watercourse) as set out in Reference[2]
Phosphate concentration in discharge	mg/l µg/l	0.05 50	Typical analytical detection limit assuming complete removal of phosphate from water discharging from process.
Biochemical oxygen demand	mg/l µg/l	6.5 6,500	Background concentration needed to achieve 'Moderate' standard for Type 5 rivers consistent with approach set out in Environment Agency H1 Annex D2 which would cause no deterioration in the catchment of the Whithington Marsh Brook whose current overall status is 'poor'.
Chloride concentration in discharge	mg/l	30	Estimated background concentration based on mean electrical conductivity of 441.2µS/cm, (converted using a factor of 1.9 to 232 mg/l) minus avarage alkalinty of 184mg/l converted to chloride using a conversion factor of 17/28.

[2] Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 as amended

3.3 Results

3.3.1 The results of the H1 assessment at Appendix IV show that the modelled BOD is equal to the EQS specified above which is in turn lower than the background concentration in the River Lugg catchment. BOD therefore screens out on this basis.

3.3.2 The chloride release concentration is greater than 1% of the EQS and the process contribution of chloride is calculated as 3.9% of the EQS. The chloride contribution therefore screens out at Test 2.

3.3.3 The release concentration of ammoniacal nitrogen is greater than 1% of the EQS and the process contribution is greater than 4% of the EQS. The predicted environmental concentration minus the background concentration is less than 10% of the annual average EQS, and the predicted environmental concentrations are less than both the annual average and maximum allowable EQS values. Therefore, tests 3, 4a and 4b are passed and further consideration or modelling in respect of the risk posed due to ammoniacal nitrogen emissions are not necessary.

3.3.4 The release concentration of phosphate is greater than 1% of the EQS and the process contribution is greater than 4% of the EQS. The predicted environmental concentration minus the background concentration is less than 10% of the annual average EQS, and the predicted environmental concentrations are less than both the annual average and maximum allowable EQS values. Therefore, tests 3, 4a and 4b are passed and further consideration or modelling in respect of the risk posed due to phosphate emissions are not necessary.

3.3.5 The discharge therefore passes the screening tests set out in the UK Government surface water pollution risk assessment for your environmental permit guidance[3] hence it is concluded that the proposed discharge will not have an unacceptable adverse impact on the water quality in the River Lugg.

[3] https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit

4 Compliance limits in respect of the discharge to surface water and monitoring

4.1.1 The following compliance limits are proposed in respect of the discharge to surface water:

DETERMINAND	LIMIT
Volume (Discharge from treatment process)	**5.53l/s**
Volume (Discharge at emission point W1)	**12.9l/s**
Chloride	**30mg/l**
BOD	**6.5mg/l (O)**
pH	**Between 6 and 9**
Phosphorous	**0.05mg/l (P)**
Ammoniacal Nitrogen (as N)	**0.13 mg/l**

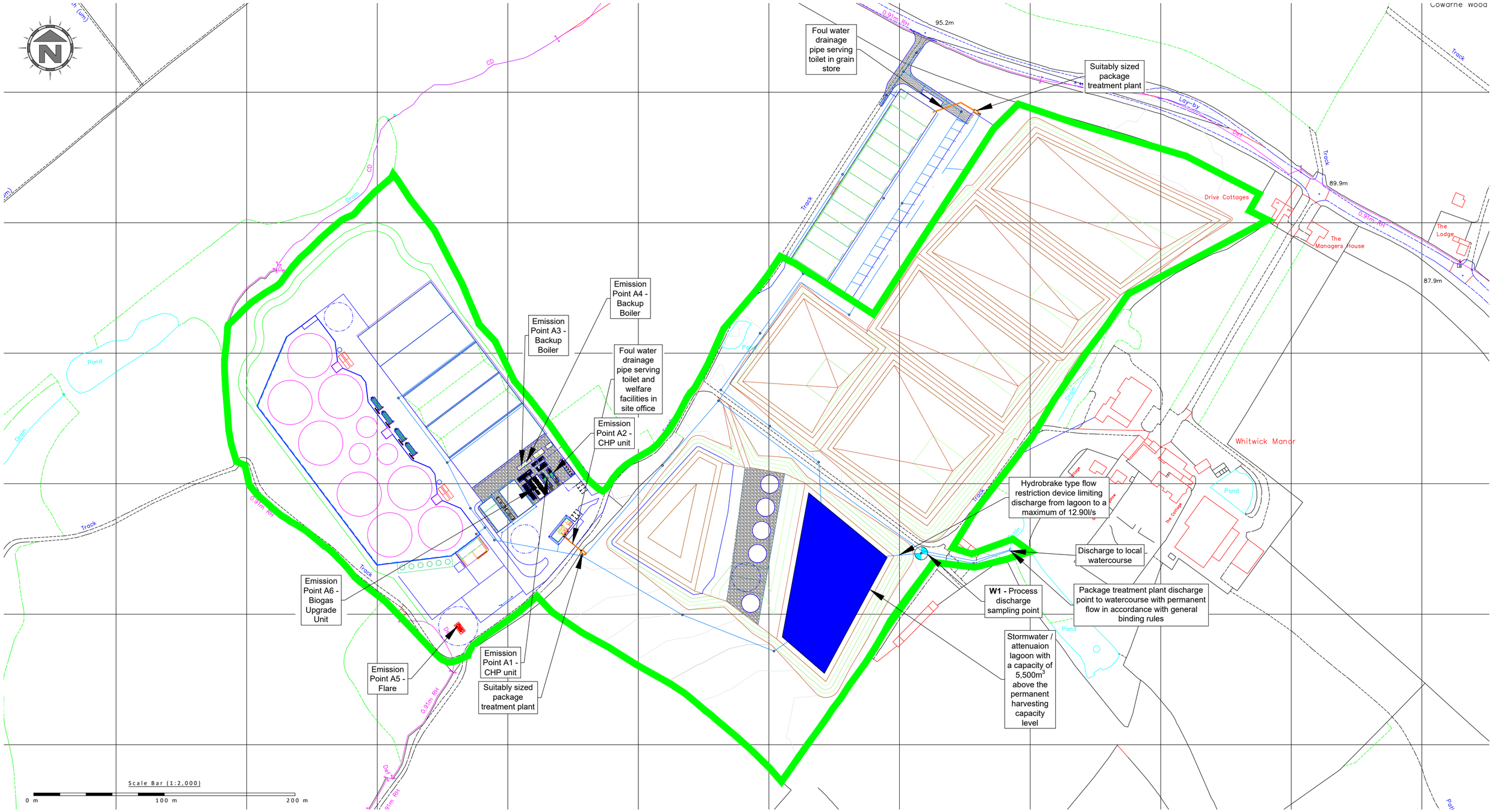
4.1.2 It is proposed that monthly samples are collected from emissions point W1.

5 Conclusion

5.1.1 It is concluded that the site fully treated effluent from the AD process can be discharged to the surface water treatment system without posing a significant risk to the water quality within the River Lugg including the unnamed tributary of the Withington Brook and the River Little Lugg.

Appendix I

Drawings



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DRAWING TITLE
SITE LAYOUT PLAN

CLIENT
STL Energy Ltd

PROJECT/SITE
Whitwick Manor, Lower Eggleton, Herefordshire, HR8 2UE

SCALE @ A2	CLIENT NO	JOB NO
1:2,000	2102	006

DRAWING NUMBER	REV	STATUS
2102-006-02	D	Issued

DRAWN BY	CHECKED	DATE
CG/IA	-	20.11.23

KEY:

- Site boundary
- 575mm diameter HDPE pipe with fall of at least 1 vertical in 50 horizontal
- 150mm diameter HDPE pipe with fall of at least 1 vertical in 50 horizontal

NOTES
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REVISION HISTORY

Rev:	Date:	Init:	Description:
-	25.11.22	CG	Initial drawing
A	28.11.22	CG	Minor amendment
B	27.04.23	IA	Boundary amendment
C	04.08.23	IA	Drainage revisions
D	20.11.23	IA	Drawing title change

Stream 3

Ocle Pychard

Stream 1

Discharge from process limited to a maximum of 5.53l/s

Stormwater / attenuaion lagoon with a capacity of 5,500m^3 above the permanent harvesting capacity level

Hydrobrake type flow restriction device limiting discharge from lagoon to a maximum of 12.90l/s

Discharge to local watercourse

W1 - Process discharge sampling point

Approximate route of surface water drainage system to the boundary of the land under the control of the operator

Drain to the north of Herefordshire and Gloucetsershire Canal flowing generally north west

Herefordshire and Gloucestershire Canal (disused)

Stream 2

Pond 6

Ash Coppice

Cowarne Wood

Boundary-lands End

Scale Bar (1:5,000)

0 m 250 m 500 m

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DRAWING TITLE
Water Features Plan

CLIENT
STL Energy Ltd

PROJECT/SITE
Whitwick Manor, Lower Eggleton, Herefordshire, HR8 2UE

SCALE @ A2	CLIENT NO	JOB NO
1:5,000	2102	006

DRAWING NUMBER	REV	STATUS
2102-006-03	B	Issued

DRAWN BY	CHECKED	DATE
CG/IA	-	04.08.23

KEY:

Application boundary

Land within the control of the Applicant

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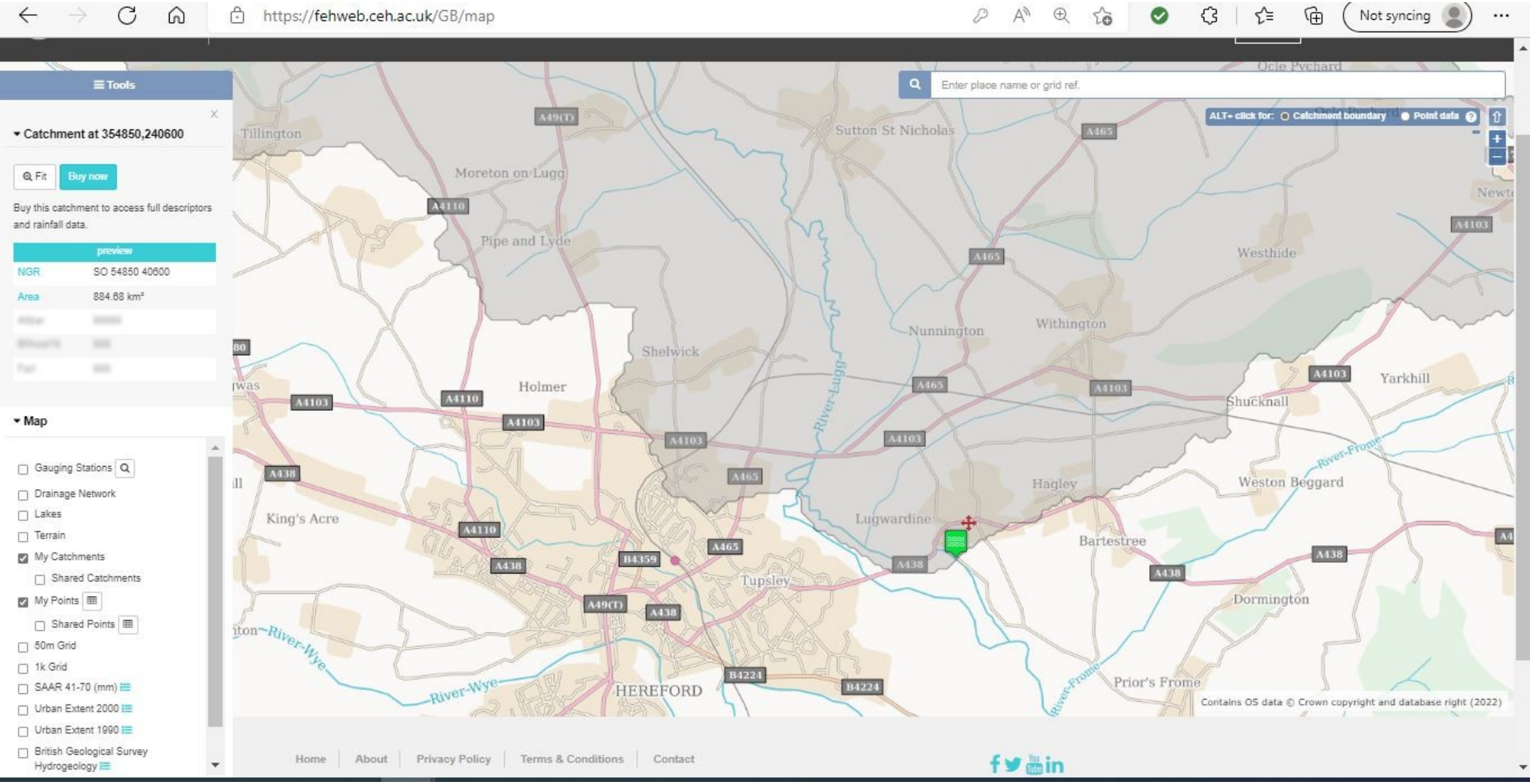
REVISION HISTORY

Rev:	Date:	Init:	Description:
-	25.11.22	CG	Initial drawing
A	27.04.23	IA	Drainage amendments
B	04.08.23	IA	Drainage amendments

Appendix II

Catchment areas of receiving watercourses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Tools
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Fit
Buy now
Buy this catchment to access full descriptors and rainfall data.
preview
NGR
SO 54850 40600
Area
884.68 km²
Map
Gauging Stations
Drainage Network
Lakes
Terrain
My Catchments
Shared Catchments
My Points
Shared Points
50m Grid
1k Grid
SAAR 41-70 (mm)
Urban Extent 2000
Urban Extent 1990
British Geological Survey Hydrogeology
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ALT+ click for: Catchment boundary Point data
Tillington
Moreton on Lugg
Pipe and Lyde
Sutton St Nicholas
Shelwick
Holmer
Nunnington
Withington
Westhide
Shucknall
Yarkhill
Hagley
Weston Beggard
Lugwardine
Bartestree
Dormington
Tupsley
King's Acre
HEREFORD
Prior's Frome
River-Lugg
River-Wye
River-Frome
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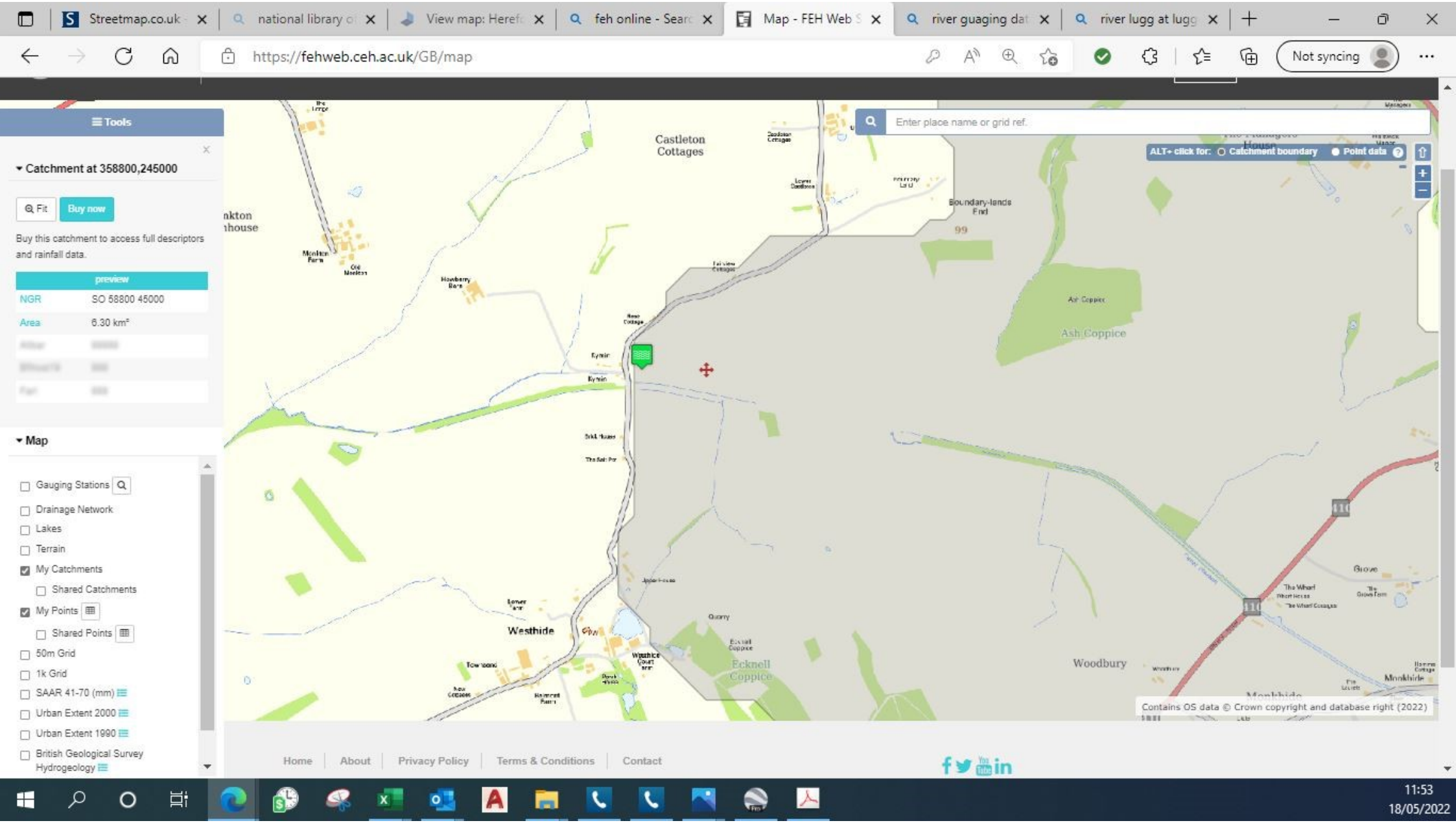
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Catchment at 358800,245000
Fit
Buy now
Buy this catchment to access full descriptors and rainfall data.
preview
NGR
SO 58800 45000
Area
6.30 km²
Map
Gauging Stations
Drainage Network
Lakes
Terrain
My Catchments
Shared Catchments
My Points
Shared Points
50m Grid
1k Grid
SAAR 41-70 (mm)
Urban Extent 2000
Urban Extent 1990
British Geological Survey Hydrogeology
Enter place name or grid ref.
ALT+ click for: Catchment boundary Point data
Castleton Cottages
Boundary-lands End
Ash Coppice
Westhide
Ecknell Coppice
Woodbury
Grove
Monkhide
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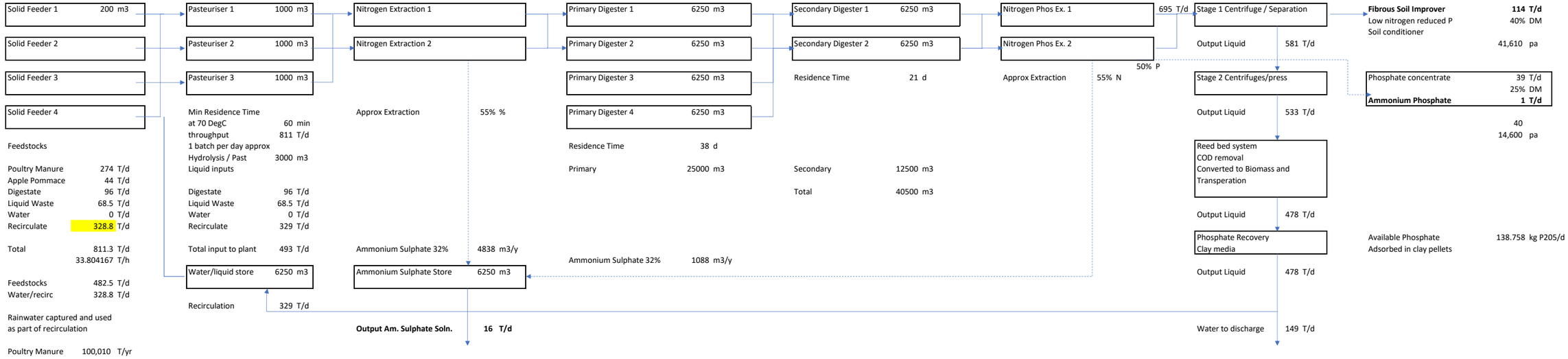
18/05/2022

Appendix III

Mass balance information

STL2 **Whitwick Manor Farm**

Process Flow Diagram



Feedstocks

Poultry Manure	274	T/d
Apple Pommace	44	T/d
Digestate	96	T/d
Liquid Waste	68.5	T/d
Water	0	T/d
Recirculate	328.8	T/d
Total	811.3	T/d
	33.804167	T/h

Feedstocks	482.5	T/d
Water/recirc	328.8	T/d

Rainwater captured and used
as part of recirculation

Poultry Manure	100,010	T/yr
Apple Pommace	16,060	T/yr
Digestate	35,040	T/yr
Liquid Waste	25,003	T/yr

Appendix IV

H1 Assessment

H1

Welcome to the H1 Software

Version 2.7.8 - January 2017

If you find the screen fonts in the H1Tool too small to read you can use the Windows zoom feature at any time to magnify the screen by holding down the 'Windows' key and '+' key. To cancel the feature hold down the 'Windows' key and 'Esc' key.

Introduction

This version of the tool accompanies the Horizontal Guidance Note H1 and the eleven supporting technical annexes.

Important Notes:

With the exception of Annex I (Landfill) and Annex J (Groundwater) this software tool can be used to complete risk assessments within the technical annexes which support H1. However, further information may need to be provided in the following areas:

- detailed assessment of fate and effects, where required
- decision-making trails for the comparison and ranking of options

This software provides a general structure for assessing costs and environmental impacts. You may need to decide the best way to apply this structure to fit the nature and pattern of your operation, in particular:

- where load is variable, such as seasonal or demand-led operations
- where a number of processes are conducted at the same time, such as integrated operations
- where a number of products are made, with possible differences in unit operations and release points employed
- where fugitive or potential emergency releases are of particular interest

Information in this database will be used to determine your EPR permit, therefore to get the most from this software tool, you should:

- read the H1 Overview document, to understand the basic principles, module structure and methods
- use the HELP boxes and refer to the H1 guidance as you progress to ensure that the data you input is representative and accurate
- use the comments boxes to clarify assumptions and data sources

This software will also output annual emissions data to an OPRA profile(s), which you can select on the Summary Tables page.

On line instructions on using this tool and on the H1 Methodology itself are available on Gov.UK (click here)

ENVIRONMENT AGENCY

In conjunction with:

www.ability-software.co.uk

Facility Reference Information

Please complete the following information:

Company Name: STL Energy Limited

Location: Whitwick Manor, Lower Eggleton, Herefordshire, HE8 2UE

Permit Number:

If you have data already stored in a previous version of the H1 software you may import it by pressing the button to the right.

Import Utility

Please note that before the import can take place any data that already exists in this copy of the tool will be removed. Please also note that any 'Operating Mode' information you had entered in your Air and Water inventories will defer to the default of 100% on data import

NOTE ON MICROSOFT ACCESS SECURITY WARNING
Depending on your security settings, you may get a security notice appearing each time the import routine connects to a table in your source database. You need to click 'Open' on this message for the Import routine to be successful. There are 18 tables to connect to in total but if you place your cursor over the 'Open' button you will be able to repeatedly click your mouse to make this process execute quickly and without too much frustration. We apologise for this inconvenience but it is an aspect of Microsoft Security provisions that are beyond our control.

Step 1

Introduction to Step 1

Step 1: Describe the Scope and Options

The aim of this step is to:

- state the OBJECTIVES of the assessment

- in the case of ENVIRONMENTAL ASSESSMENT of the whole facility, describe the scope of the activities to be included in the assessment;

- in the case of OPTIONS APPRAISALS, identify candidate options for BAT by considering all relevant techniques to prevent and minimise pollution and the scope of activities covered by the techniques.

Depending on the reason for the assessment, you will need to complete different modules of the guidance. The software will automatically select the required modules according to the responses you enter.

NOTE: If you are going to complete more than one assessment or appraisal, make sure that you create a copy of the H1 file for each new assessment BEFORE you begin to input data. This is because Microsoft Access automatically saves changes to the current file you are using, rather than allowing you to save your changes at the end of your work.

TO CONTINUE WITH STEP 1, PRESS "NEXT".

Water Discharge/Release Details and Flow Data

Please define your Release Points for Releases to Water

Number	Description	Location or Grid Reference	Activity or Activities	Final Discharge Point		Discharge via Sewer?	Mean Effluent Flow Rate* m3/s	Max Effluent Flow Rate* m3/s
1	W1	Discharge point from Whitwick Manor	Discharge to surface water	1	Unnamed tributary of River Little Lugg	No	0.0055	0.0055

Comments: It is conservatively assumed that no dilution of the treated water from the AD processf is occurring in the site drainage system

* When operating

Describe the Objectives

Depending on the reason for the assessment you will need to complete different parts of the tool.

Select the type of assessment:

◉ a)	to carry out an ENVIRONMENTAL ASSESSMENT of the releases resulting from the facility as a whole	Do Steps 1, 2 and 3 only
○ b)	to conduct a costs/benefits OPTIONS APPRAISAL to determine BAT or support the case for derogation under the Industrial Emission Directive.	Do Steps 1,2, 3 and 4 and continue with 5 and 6 if necessary

1.1 Briefly summarise the objectives and reason for the assessment in terms of the main environmental impacts or emissions to be controlled:

Discharge of fully treated water from AD process to an unnamed tributary within the River Lugg catchment

Scope of Environmental Assessment

List the activities included in the assessment

Number	Activity

Use the 'Add' button at the bottom left to create a new activity

1	Discharge of fully treated water from AD process to River Lugg.

Comments:

Describe the Candidate Options

Identify all reasonably applicable options of techniques

You should include:

a) a brief description of individual control measures or configurations of control measures seleted for each option, and the activities with which they are associated (the existing base-case may conveniently be the first option).

b) justification why any techniques generally applicable to the regulated facility have not been selected for assessment. (see relevant H1 annex) (This should be based on regulated facility-specific technical, not economic reasons).

c) for new projects, whether any initial environmental assessment that was done at the project evaluation stage, or any screening of technology or process routes prior to this assessment, particularly where this has a bearing on environmental performance. (see H1)

In the case of b) or c) please enter your Comments here:	It is considered that if possible, the fully treated water from the AD process should be discharged to surface water hence returned to the water environment rather than being treated elsewhere.

Option Number	Title	Description
1	Base-Case	Discharge of treated water to unnamed tributary of River Little Lugg
2	Tankering off site	Collection and removal of all site drainage for treatment at an off site facility is prohibitively expensive based on the likely composition of the fully treated water as being clean.

Once a series of options have been generated for the proposed project, it is recommended that the Operator discuss these with the local Regulator to check both parties agree that the options are satisfactory. This may save the Operator from spending resources on assessment of options which are unlikely to meet the required environmental performance.

List the main activity or activities to which the release control options are applicable and any other activities that will be affected by the candidate control option on the main activity:

Step 2

Introduction to Step 2

Step 2: Emissions Inventory

The aim of this Step is to produce an inventory of sources and releases of polluting substances from each option. This is used as the basis for the subsequent evaluation of environmental impacts.

For this Step you will require information on:

- release points and sources of emissions to air, water (inc. sewer) or land

- concentration and mass rate of released substances

- frequency and duration of releases and how these relate to long term and short term effects

IMPORTANT NOTES

- you may need to consider a suitable method for assessment of groups of pollutants, such as VOCs, heavy metals, uncharacterised liquid effluents, etc (see "Grouping air emissions" in Annex F).

TO CONTINUE WITH STEP 2, PRESS "NEXT".

Receiving Water Body(s)

Please define the Final Discharge Locations for Releases to Water

Are there any discharges to surface waters? Yes

Use the 'Add' button below to list all final discharge points.
For discharges to sewer, this should be the point where the sewage works discharges to a surface water

N.B. For Riverine discharges (River, Upper Estuary) you only need enter the River description and flow once. Further details of individual releases can be entered on the next page. For discharges to TRaC waters, seperate Discharge Locations must be added for each release point that has a different mixing zone

Number	Description	Final Discharge Category	Freshwater Q95 flow rate	
1	Unnamed tributary of River Little Lugg	R	River Flow (m3/s):	0.0115

Release Concentrations of Substances Present in Discharges to Water

Please list all Substances released to Water for each Release Point identified in the previous page.

Which type of assessment method are you using? (See help box & H1 Annex D for information)

Continue with the method below.

Method: Chemical Specific

Reference:

Number	Substance	Meas'ment Method	Operating Mode (% of	Average Concentration in the Effluent (AA)		Maximum Concentration in the Effluent (Max)		Annual Rate	Significant Load (PHS Only)
				Conc.	Meas'ment Basis	Conc.	Meas'ment Basis		
				µg/l		**µg/l**		kg/yr	kg/year
1	Ammonia CaCO3 >50mg/l (90 %ile)	Continuous	100.0%	130	Annual Avg	130		22.6712304	3
2	Chloride	Continuous	100.0%	30000	Annual Avg	30000		5298.048	
3	Phosphate	Continuous	100.0%	50	Annual Avg	50		8.83008	
4	Biochemical Oxygen Demand (Poor)	Continuous	100.0%	6500	Annual Avg	6500		1133.56152	

Comments:

Water Temperature

Where relevant, please enter temperature of effluent for each release point.

This table is to check that the effluent is acceptable, i.e. within the required temperature range. It is not used to make relative judgement between options.

Discharge Location	Release Point	Measurement Method	High Normal Rate	High Peak Rate	Max Temp. Difference	Benchmarks: Max Summer	Benchmarks: Max Winter	Benchmarks: Max Temp
1 Unnamed tributary of Riv	1 W1	Continuous				21.5	10	2

Comments:

Water pH

Where relevant, please enter pH of effluent for each release point.

This table is to check that the effluent is acceptable, i.e. within the required pH range. It is not used to make relative judgement between options.

Discharge Location	Release Point	Measurement Method	High Normal Rate	High Peak Rate	Low Normal Rate	Low Peak Rate	pH of Receiving Water	Do artificial variations caused by effluent exceed 0.5pH units?
1 Unnamed tributary of Riv	1 W1	Continuous	9	9	6	6	7.94	No

Comments:

Raw Materials

Please list all Raw Materials Consumed:

Number	Material	Annual Consumption	Units
1	Non-potable Water		tonnes/year
2	Potable water		tonnes/year

Comments:

Performance Indicators

Enter consumption data to determine your performance indicators

Which of the following parameters do you use for calculating your performance: Product

Please describe and justify your choice:

Basic Consumption Data:

	Name	Annual Quantity	Units
Amount of Product:			
Main Raw Material:			
Potable Water:			m3
Non Potable Water:			m3
Energy:			MWh
Waste: Inert:			tonne
Hazardous:			tonne
Stable Non-reactive Hazardous:			tonne
Biodegradable Non-hazardous:			tonne
Other Non-hazardous:			tonne

Specific Consumption per of :

Production Efficiency:		/
Potable Water:		m3
Non Potable Water:		m3
Energy:		MWh
Waste: Inert:		tonne
Hazardous:		tonne
Stable Non-reactive Hazardous:		tonne
Biodegradable Non-hazardous:		tonne
Other Non-hazardous:		tonne

Step 3

Introduction to Step 3

Step 3: Quantify Impacts

The aim of this Step is to quantify the effects on the environment of the releases listed in the inventory in Step 2. The guidance provides methods for assessing the eight main environmental considerations of most relevance to the EPR regime. Your releases may not result in effects to all eight of these considerations, and this tool allows you to screen out any that are not relevant.

The emissions you entered in Step 2 are automatically brought forward for assessment into each environmental consideration that is relevant for that type of release (e.g. a release may have more than one type of effect).

This part of the tool allows you to screen out any releases that are insignificant, and to identify those releases where further, detailed assessment of the potential environmental impact may be required.

IMPORTANT NOTE

This software tool only completes part of the requirements for Step 3, as described above. Depending upon the degree of risk to the environment presented by the releases, the operator may need to do further, detailed assessment of the potential effects using methodologies that are not provided here. This information should be submitted separately, as indicated within this part of the tool.

TO CONTINUE WITH STEP 3, PRESS "NEXT".

Identify Relevant Impacts

Identify any environmental impacts that are not relevant to this assessment by deselecting from the list below:

Releases in Part 2?			Justification for omission
No	☐	Air	N/A
No	☐	Deposition from Air to Land	N/A
Yes	☑	Water	
No	☐	Waste	N/A
No	☐	Visual	N/A
No	☐	Ozone Creation	N/A
No	☐	Global Warming	N/A

If you have deselected an environmental impact as not relevant to this assessment,
no further assessment of this impact will be carried out

Local Environmental Quality

Describe the Quality of the Environment:

Provide a brief description of the main local factors that may influence the importance of the impact of emissions in the surrounding environment

Air Quality

Are there any Environmental Quality Standards relating to substances released from the activities, which may be at risk due to additional contribution from the activity ?
(Environmental Quality Standards for air and water are described in EPR Technical Guidance Notes)

Are there any Local Air Quality Management Plans applicable to releases from the activity?

Water Quality & Resources

Are there any Environmental Quality Standards relating to substances released from the activities, which may be at risk due to additional contribution from the activity?	None
Are proposals to abstract water satisfactory in order to obtain an abstraction licence?	None
Is the activity located in a groundwater vulnerable zone (for activities with direct releases to land only)?	N/A

Proximity to Sensitive Receptors

Is public annoyance likely to be an issue for noise, odour or plume visibility ?

Are there any wildlife habitats, eg Special Areas of Conservation,or Special Protection Areas, likely to be affected by releases from the activity? (Description of requirements of Habitats Directive is provided in EPR Technical Guidance Notes)

Water Impacts - Fresh Water Releases

Apply Test 1 (See Guidance) and Calculate Process Contributions of Emissions to Water

This table applies Test 1 and also estimates the Process Contribution for Freshwater releases, this is calculated after dilution into the relevant surface water type for each emission to water listed in the inventory, according to the release point parameters input earlier. If you have more accurate data obtained through dilution modelling, this may be entered as indicated and will be used instead of the estimated PC. Any releases which 'Pass' Test 1 are screened out at this point.

Substance	Annual Avg EQS			MAC EQS		
	Release µg/l	EQS µg/l	Release conc < 10% EQS **Test 1**	Release µg/l	MAC µg/l	Release conc < 10% EQS **Test 1**
[W1] Ammonia CaCO3 >50mg/l (90 %ile) (Unnamed tributary of River Little Lugg)	130.0000	200.0000	Fail	130.0000		N/A
[W1] Biochemical Oxygen Demand (Poor) (Unnamed tributary of River Little Lugg)	6500.0000		N/A	6500.0000		N/A
[W1] Chloride (Unnamed tributary of River Little Lugg)	30000.0000	250000.0000	Fail	30000.0000		N/A
[W1] Phosphate (Unnamed tributary of River Little Lugg)	50.0000	120.0000	Fail	50.0000	120	Fail

Note that the Process Contribution shown for each substance is the sum of the individual process contributions of each point from which the substance is emitted. Process Contributions obtained from modelling data should incorporate all relevant release points and flow conditions.

* If you have valid dispersion modelling data available - please enter it here

Comments:

Water Impact Screening - Fresh Water Releases

Apply Test 2

This page applies Test 2 and displays the Process Contribution as a proportion of the EQS. Emissions with PCs that are less than 4% of the EQS can be screened from further assessment as they are likely to have an insignificant impact.

	Annual Avg EQS					MAC EQS				
Substance	Annual Avg EQS	PC	Modelled PC	% PC of EQS	PC < 4% of EQS?	MAC EQS	PC	Modelled PC	% PC of MAC	PC < 4% of MAC?
	µg/l	µg/l		%	**Test 2**	µg/l	µg/l		%	**Test 2**
Ammonia CaCO3 >50mg/l (90 %ile) (Unnamed tributary of River Little Lugg)	200	42.2137		21.11	Fail		42.2137		-	Pass
Chloride (Unnamed tributary of River Little Lugg)	250000	9,741.6324		3.90	Pass		9,741.6324		-	Pass
Phosphate (Unnamed tributary of River Little Lugg)	120	16.2361		13.53	Fail	120	16.2361		13.6	Fail

Comments:

Water Impact Screening (Predicted Environmental Concentration) - Fresh Water Releases

Apply Tests 3 and 4 and identify which releases may need more Detailed Modelling of Emissions/Discharges to Water

This page applies Tests 3, 4a and 4b and displays the Predicted Environmental Concentrations in relation to the backgound pollutant levels and the AA or MAC EQS. Any substances that pass all 3 of these tests can be screened out. Substances failing any of the tests must be modelled. Note that releases that have passed Tests1 and 2 are insignificant are not shown as they are already screened out.

			Annual Avg EQS					MAC* EQS			
Number	Substance	Bkgrnd Conc. µg/l	PC µg/l	PEC µg/l	(PEC - BC)/ EQS	PEC -BC >10% AA EQS **Test 3**	% PEC of EQS %	PEC >100% AA EQS **Test 4a**	PC µg/l	PEC µg/l	% PEC of MAC %	PEC >100% MAC **Test 4b**
1	Ammonia CaCO3 >50mg/l (90 %ile) (Unnamed tributary of River Little Lugg)	72	42.3	90.9	9.4%	Pass	45.5	Pass	42.3	0	-	Pass
3	Phosphate (Unnamed tributary of River Little Lugg)	76.6	16.3	68.0	-7.2%	Pass	56.7	Pass	16.3	68.0	56.7	Pass

* MAC = Maximum Allowable Concentration

Describe source of background information or reference to relevant documentation here:

Water Impact Modelling Assessment

See guidelines in H1 Annex D and respond to the following

Describe here the justification for whether detailed modelling is, or is not required for any of the releases. Refer to the quidelines in H1 Annex D.	Detailed modelling not requried as none of the process contributions in respect of the determinands modelled due to all substances modelled screening out at Tests 1 or 2 or passing Tests 3, 4a and 4b
Describe source of background information:	N/A
Describe location of detailed modelling work:	N/A

Summary Tables

Print or Preview summary tables:

Choose which summary tables

Water

Export to Excel

Export Releases to OPRA Profile

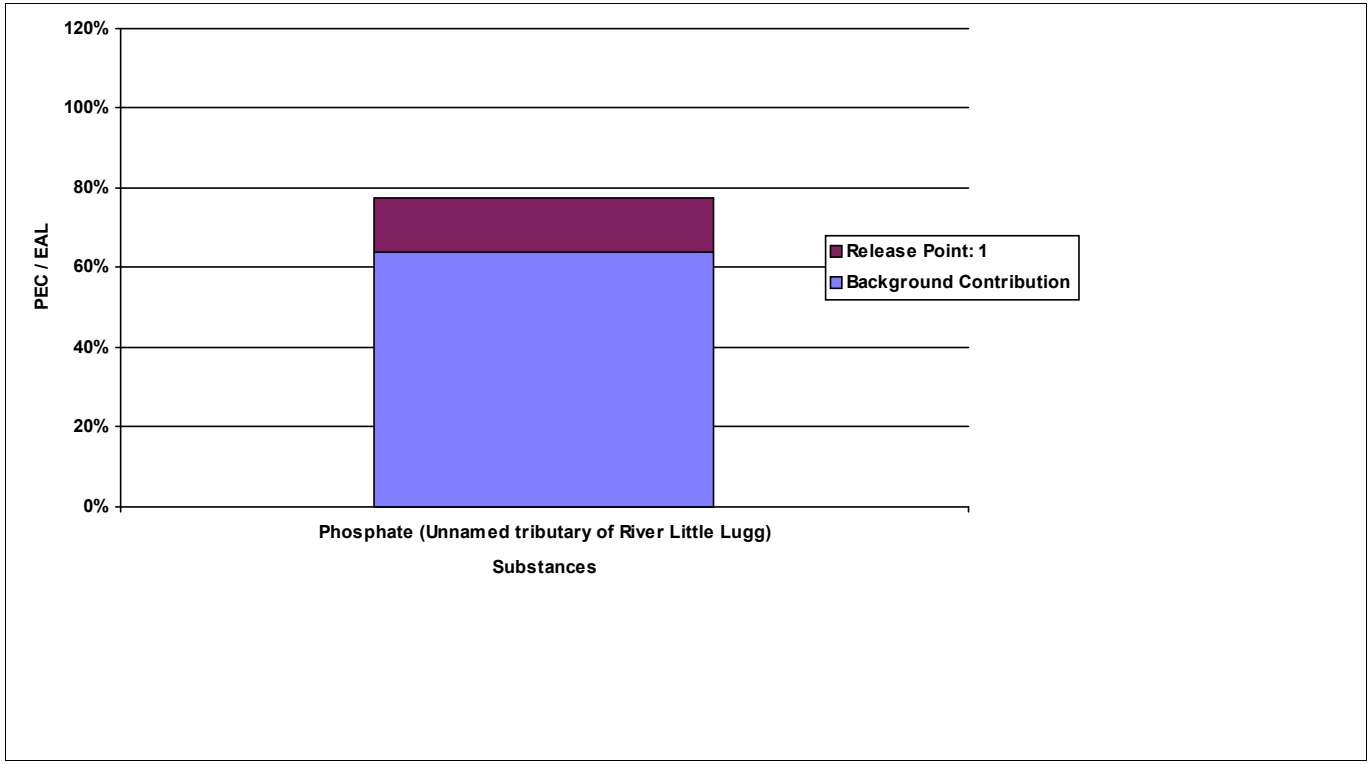
Preview

Print

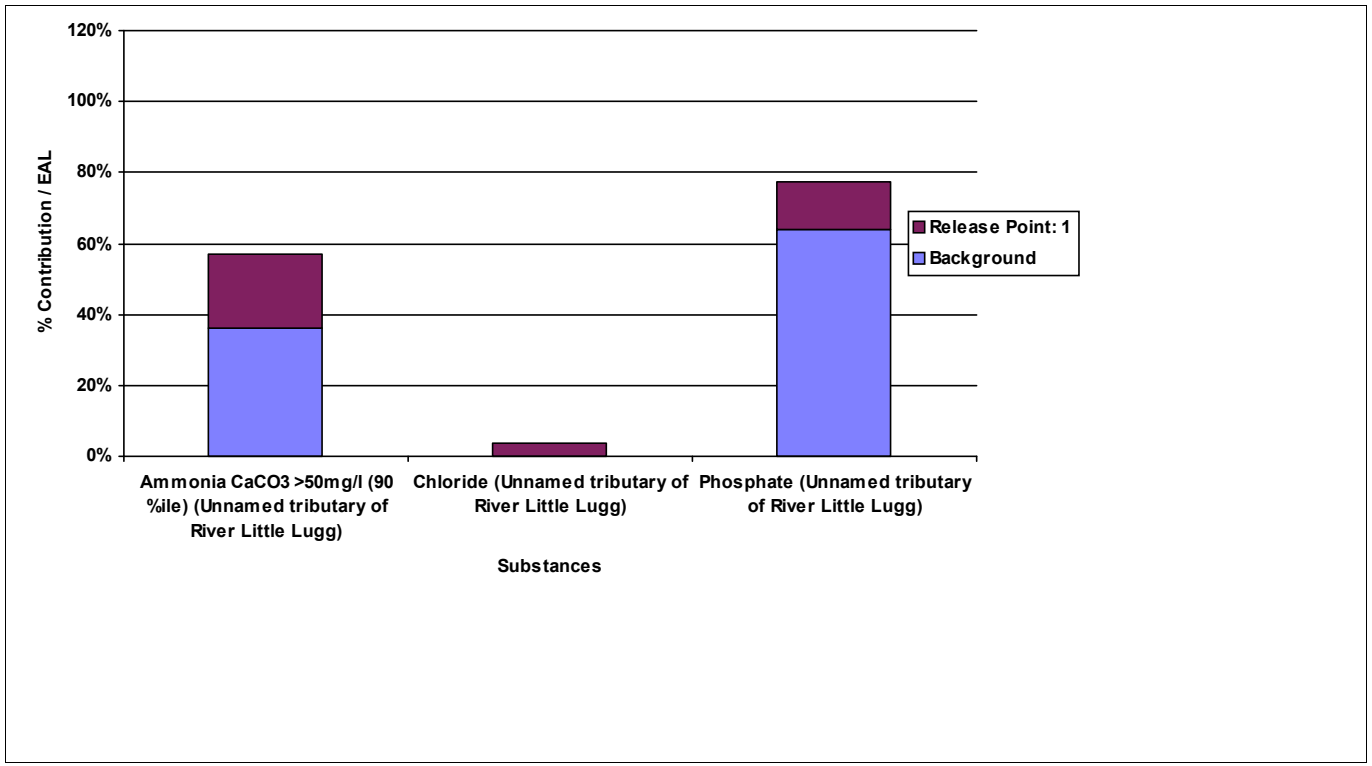
Include

- ○ All Air and Water Substances
- ◉ Air and Water Release Not Screend Out

Short Term Water - Substance Comparison



Water Long Term Effects - Comparison by Substance



Summary of Environmental Assessment

You have now completed all of the steps in this software for the environmental assessment. This will provide you with:

- an inventory of all emissions sources and substances emitted from your activities
- an information trail of how the impacts of these emissions have been assessed
- a summary of the impacts

You now need to use this information to confirm whether the emissions are acceptable, i.e. that they do not cause significant pollution to occur, by responding below:

Do any of the emissions exceed any of the folllowing

Statutory Emission limit values:	No	If yes, identify the substances concerned and improvements that are needed to at least meet the statutory requirement
Environmental Quality Standards (air and water):	No	If yes, identify the substances concerned, the contribution from the activities and investigate whether further detailed fate and effect modelling and/or pollution controls are needed. Ensure that the relevant EQS reference conditions are applied.
Environmental Assessment Levels:	No	If yes, identify the substances concerned, the contribution from the activities and investigate whether further detailed fate and effect modelling and/or pollution controls are needed.

Use the box below to provide further information on any of the above to which you have responded 'Yes':

Finally, print all of the information and submit with your application. Remember to include any supplementary information and reports that you have had made reference to during the assessment procedure.

Step 4

Compare Impacts between Options

The aim of this Step is to compare the overall performance of each option for all of the environmental considerations assessed in Step 3, in order to identify which option represents the lowest impact on the environment as a whole.

IMPORTANT NOTE

Unless the best option is self-evident (i.e. results in the lowest impact for all considerations), you will need to use professional judgement to decide which option is the best overall. This judgement should be made taking into account the considerations described in the H1 guidance notes and may require decisions about the relative importance of environmental considerations. The operator should submit a response to the Regulator that describes how the decision has been made. The following page provides a structure which may be used to summarise the decision-making process.

TO CONTINUE WITH STEP 4, PRESS "NEX

Compare the Options

Review the graphs and summary date to rank the options according to environmental impact

Is the best Option self-evident? i.e. results in the lowest impact in all environmental considerations	Yes
Are you going to implement the option that is self-evidently the best? If yes, no further assessment is necessary and you may end here.	Yes

Compare the Options

Review the graphs and summary date to rank the options according to environmental impact

Is the best Option self-evident? i.e. results in the lowest impact in all environmental considerations	No
Are you going to implement the option that is self-evidently the best? If yes, no further assessment is necessary and you may end here.	No

Resolve Cross Media Conflicts

Environmental Consideration		Importance	Comments / Justification
Releases to Air	Long Term:		
	Short Term:		
Deposition to Land:			
Releases to Water	Long Term:		
	Short Term:		
Visual:			
POCP:			
GWP:			
Disposal of Waste:			

Provide a description of how cross media conflicts have been resolved:

This will require reasoned judgement, with reference to any decisions or assumptions made over the relative importance of different environmental impacts. See H1 for requirements, guidelines and examples to assist in the process. You may submit this information

Location or reference to information on resolution of cross media conflicts:

Present a summary of the final ranking of options in the table below:

Number	Title	Ranking
1	Base-Case	
2	Tankering off site	

Resolve Cross Media Conflicts

Environmental Consideration	Importance	Comments / Justification

Releases to Air	Long Term:		
	Short Term:		
Deposition to Land:			
Releases to Water	Long Term:		
	Short Term:		
Visual:			
POCP:			
GWP:			
Disposal of Waste:			

Provide a description of how cross media conflicts have been resolved:

This will require reasoned judgement, with reference to any decisions or assumptions made over the relative importance of different environmental impacts. See H1 for requirements, guidelines and examples to assist in the process. You may submit this information

Location or reference to information on resolution of cross media conflicts:

Present a summary of the final ranking of options in the table below:

Number	Title	Ranking
1	Base-Case	
2	Tankering off site	

Summary of Option Appraisal

You have now completed all of the steps in this software for appraisal of BAT.

Finally, print all of the information and submit with your application. Remember to include any supplementary information and reports that you have had made reference to during the assessment procedure.

Appendix V

Phosphate Recovery and Treatment Process

STL2 Whitwick AD

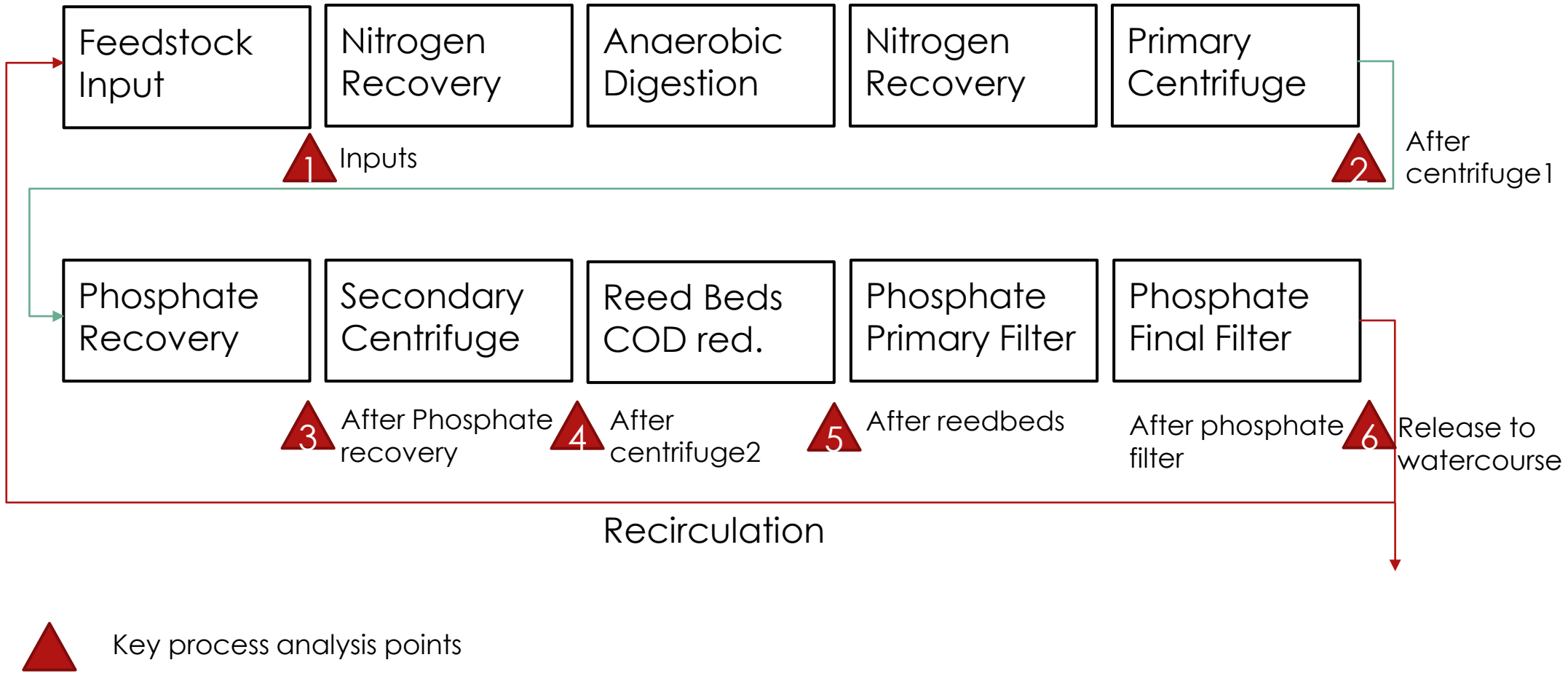
PHOSPHATE RECOVERY AND TREATMENT PROCESS
JANUARY 2023

Phosphate in Agriculture

- Phosphate is one of the three essential plant nutrients ("N**P**K") used as fertiliser in agriculture
- Poultry manure contains significant quantities of this valuable resource
- Historically the application of poultry manure to land has resulted in too much Phosphate (P_2O_5) being applied relative to the other plant nutrients especially Nitrogen ("N")
- This excess Phosphate has resulted in pollution of watercourses such as the River Wye

The solution is to remove Phosphate from poultry manure and transform it into products that can be appropriately and safely used as fertiliser in agriculture.

STL2 Whitwick Phosphate Recovery Process Flow



1 – Total Plant Inputs

Total Feedstock Inputs

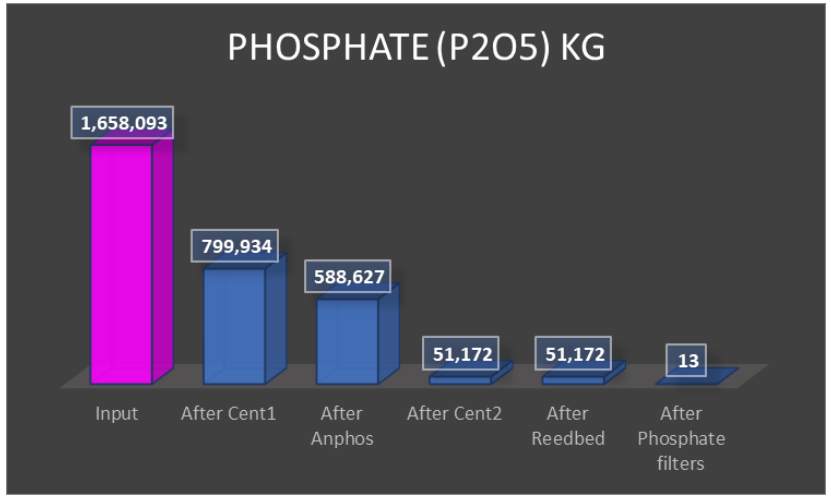
- 100,000 tpa* Poultry manure delivered by covered truck, stored under cover and fed quickly to plant
- 16,000 tpa Apple pomace transported locally by lorry and stored in clamp; then fed over 12 months to balance feedstock mix. Runoff captured and fed directly into digester
- 25,000 tpa Digestate from Hampton Bishop delivered daily and fed directly into sealed tanks
- 35,000 tpa Liquid waste delivered daily and fed directly into sealed tanks
- 170,000 tpa Recirculated water from end of process avoids water extraction

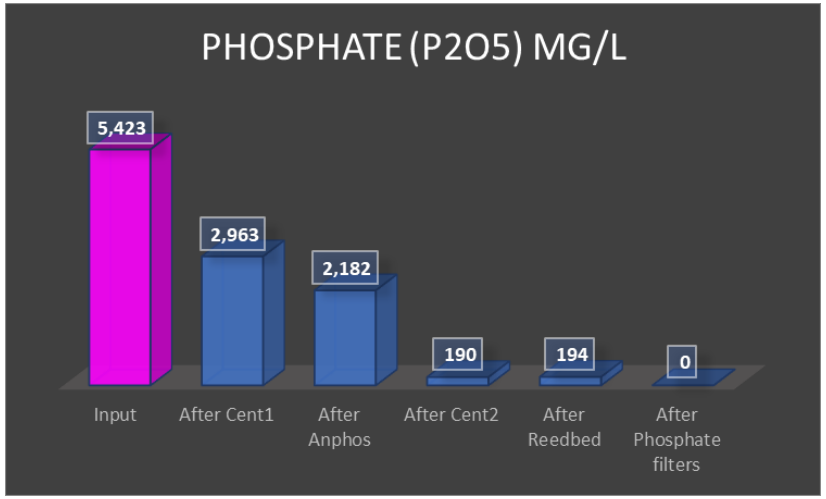
* tpa = tonnes per annum

Whitwick Process

- The feedstock mix is kept as stable as possible to promote a consistent biological process
- Due to pre-digestion Nitrogen stripping, liquid inputs are reduced by around 100,000 tpa
- Liquid inputs are pumped directly into sealed storage tanks from sealed delivery vehicles
- Solid inputs are fed into feed hoppers and incorporated into the sealed anaerobic (i.e. without air) digestion process
- Total Phosphate Input:

  1,658,093 kgs Phosphate per year





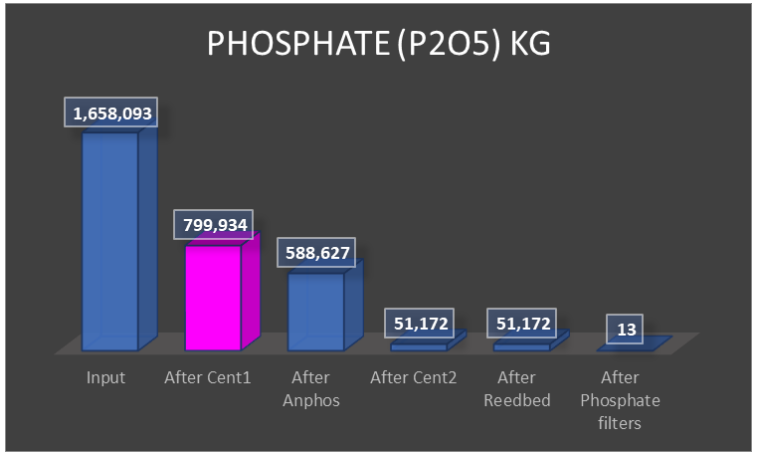
2 – Post Digestion and Centrifuge1

Typical AD Process

- Most AD plants use a single stage screw separator to remove a small proportion of solids to facilitate spreading of liquids to land
- The solid fraction is typically only 22% dry matter and contains significant soluble Phosphate and is also subject to leaching and runoff during field storage
- Both the solid and liquid including all the Phosphate are then spread to land

Whitwick Process

- The first Decanter Centrifuge produces a high quality soil improver with dry matter between 40-45%
- Approximately 35,000 tpa of this soil improver captures 830 t of very slow release insoluble, mineral Phosphate
- The balance of Phosphate remaining in the liquid fraction is:
  799,934 kgs Phosphate per year



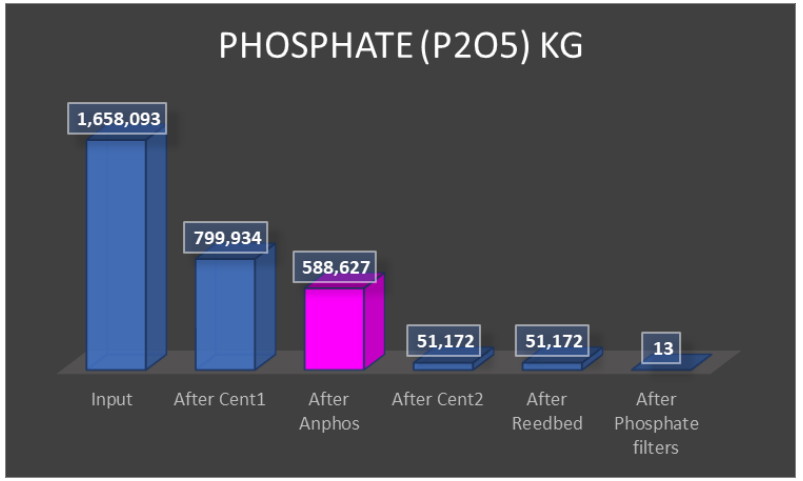
3 – Soluble Phosphate Recovery

Struvite Recovery System

- This technology is not usually deployed at AD plants and has been developed primarily for the sewage treatment industry

Whitwick Process

- Proven Struvite recovery technology uses Magnesium Hydroxide to make Struvite (Magnesium Ammonium Phosphate)
- This process captures Ammoniacal Nitrogen and 90% of the remaining soluble Phosphate for use as a fertiliser
- Remaining Phosphate: 588,627 kgs Phosphate per year



4 – Centrifuge 2

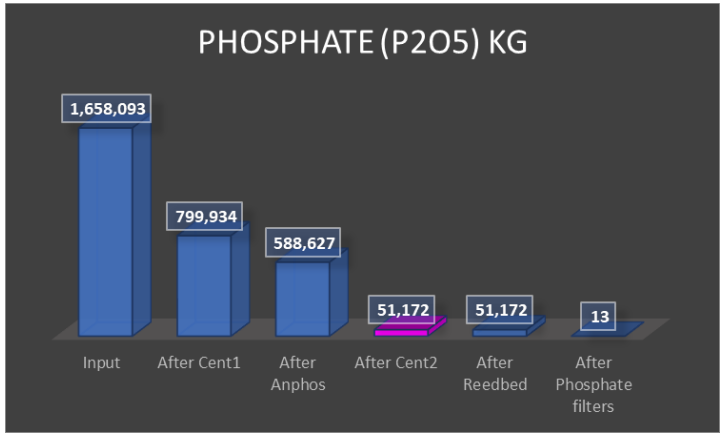
Centrifuge Stage 2

- During trials at STL1* the second stage centrifuge achieved a significant total Phosphate reduction (the results of the trials showed a 99% capture rate)

*STL1 – STL Energy's existing AD plant at Hampton Bishop

Whitwick Process

- At STL2 this process is split into three steps to optimise Phosphate recovery.
- Centrifuge2 is the third step prior to the reed beds. The design has been based on 95% Phosphate removal whereas in STL1 trials 99% was achieved.
- Approximately 1,300 tpa of solids are produced for use as fertiliser
- Phosphate remaining after Centrifuge2:
  51,172 kgs Phosphate per year



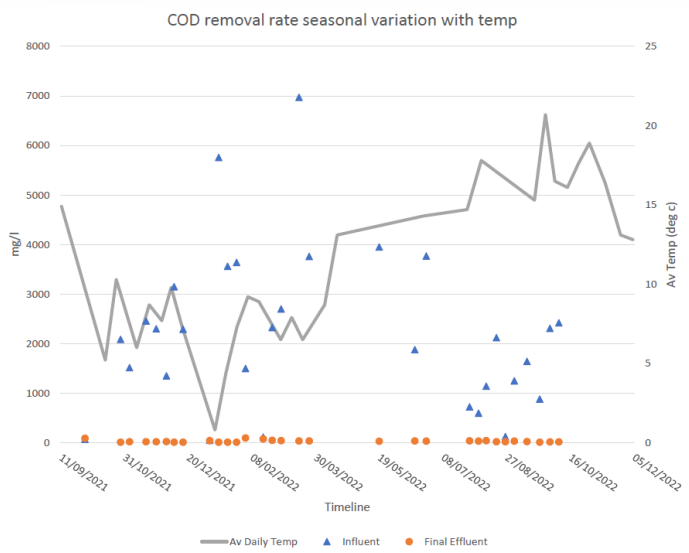
Further processing of liquid to allow discharge to watercourse

- The intensive Phosphate capture processes will remove in excess of 99% of the Phosphate from the input materials (including poultry manure)
- The remaining liquid stream coming from Centrifuge 2 still contains small concentrations of Phosphate, organic matter, plant nutrients and trace elements
- The remaining processes to treat these consist of:
  - Reed beds to remove organic matter, measured as Chemical Oxygen Demand (COD) potential
  - Phosphate filters in series, after the reed bed to reduce the Phosphate concentration to minimal levels allowing the treated water to be discharged to the watercourse

5 – Reed Beds COD reduction

Typical Reed Bed

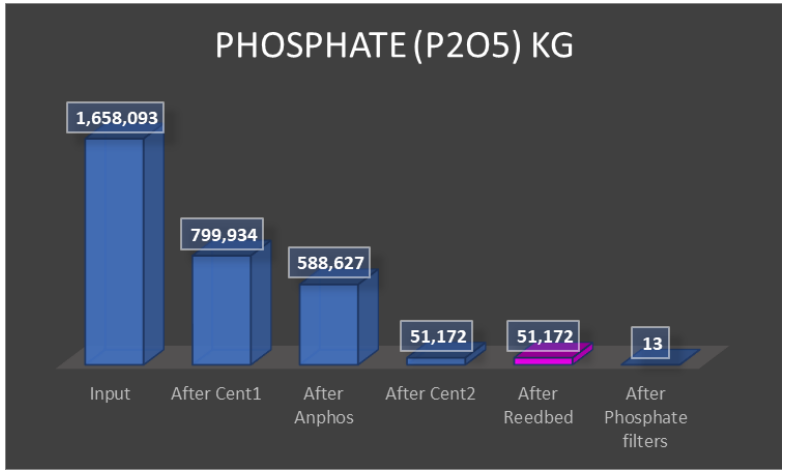
- Reed beds COD* removal efficiency over the year



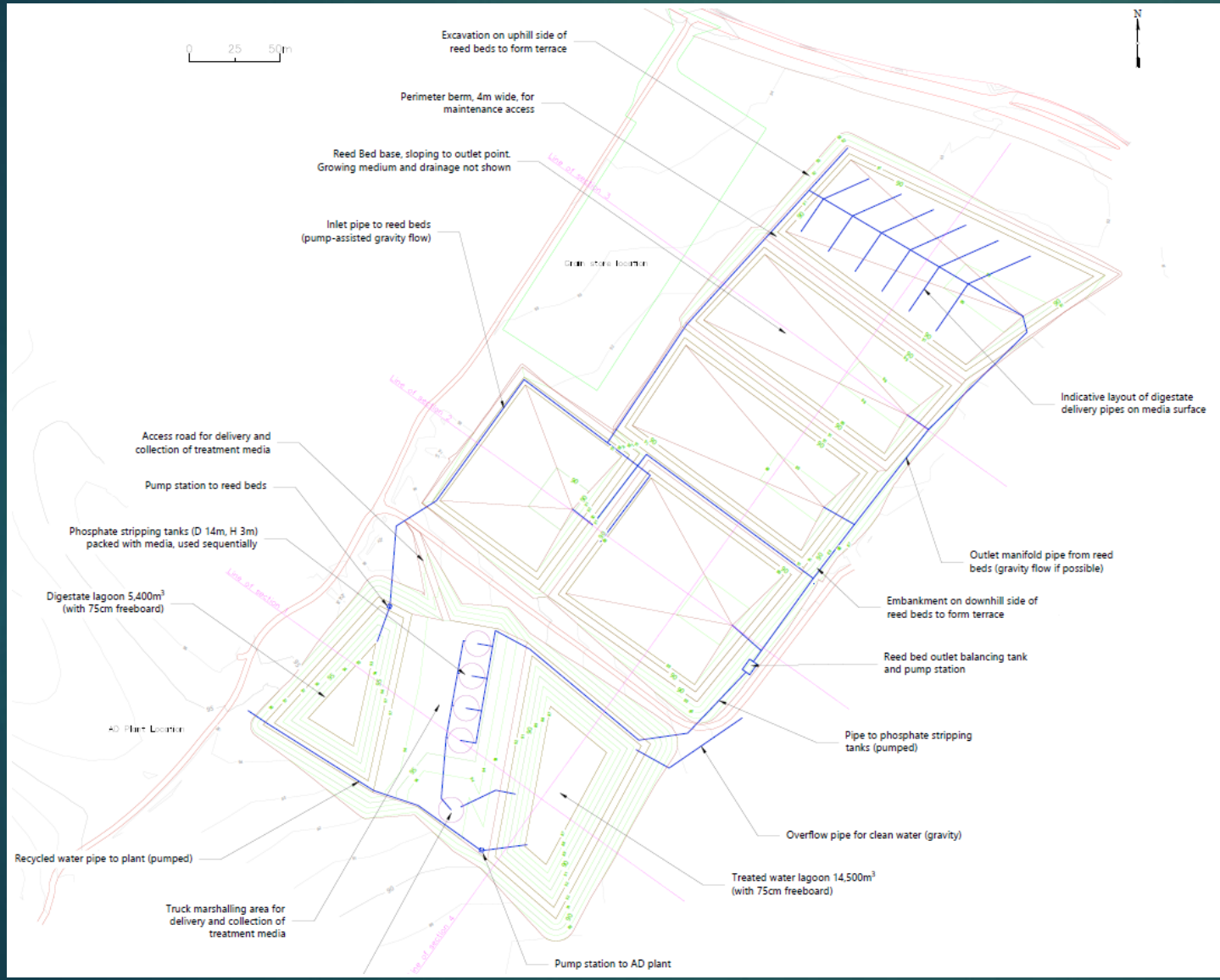
*COD – Chemical Oxygen Demand

Whitwick Process

- Nitrogen and Phosphorous recovery and organic solids separation in previous processes minimises the COD loading on the reed beds.
- The reed beds are primarily designed to remove the remaining COD
- Phosphate remaining after the reed bed: 51,172 kgs Phosphate per year



5 (cont.) - Reed bed layout



Whitwick Process

- There are five vertically fed reed beds in parallel to cope with the hydrological water loading.
- This allows for one red bed to be taken out of service in turn, for cleaning or replanting as necessary
- Treatment area is: 3.5 ha
- Phosphate remaining after the reed bed: 51,172 kgs of Phosphate per year

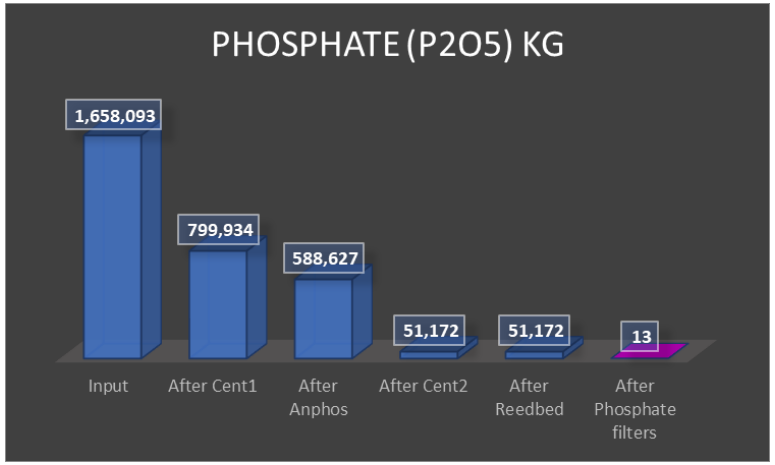
6 – Phosphate Filters

Phosphate Filters

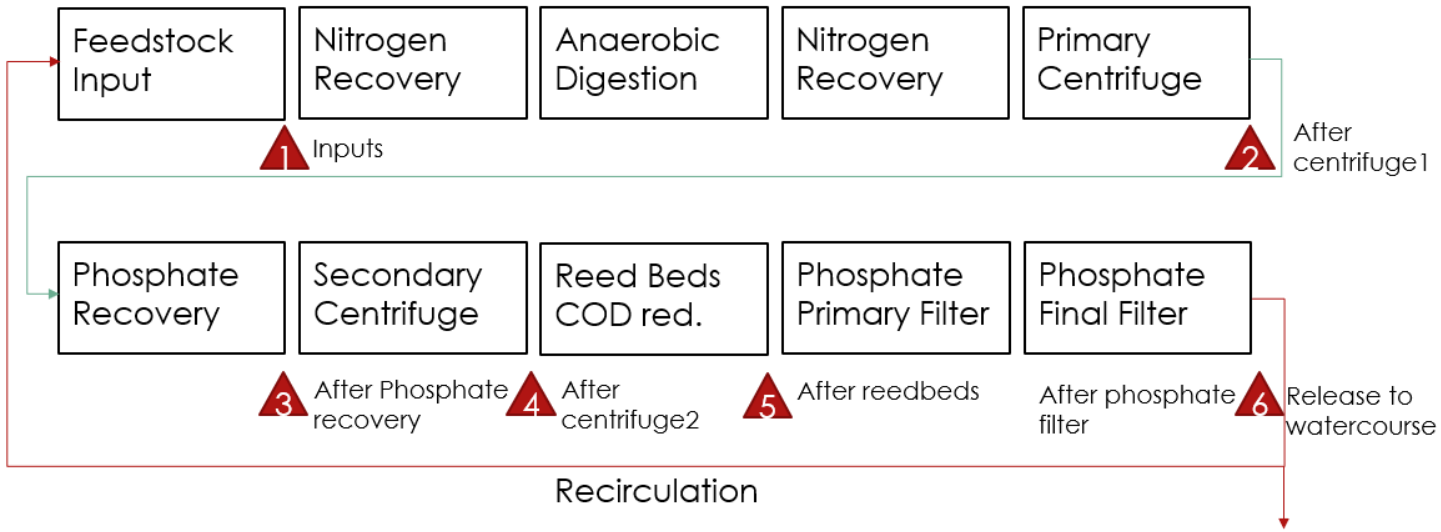
- The filters are a simple up-flow adsorption filter with the ability to bypass or add units in series
- The Phosphate levels will be monitored both before and after each unit to detect when the media is becoming saturated
- When a filter becomes saturated it will be bypassed emptied and refilled with new media
- The specific media has been developed and then tested with the Environment Agency

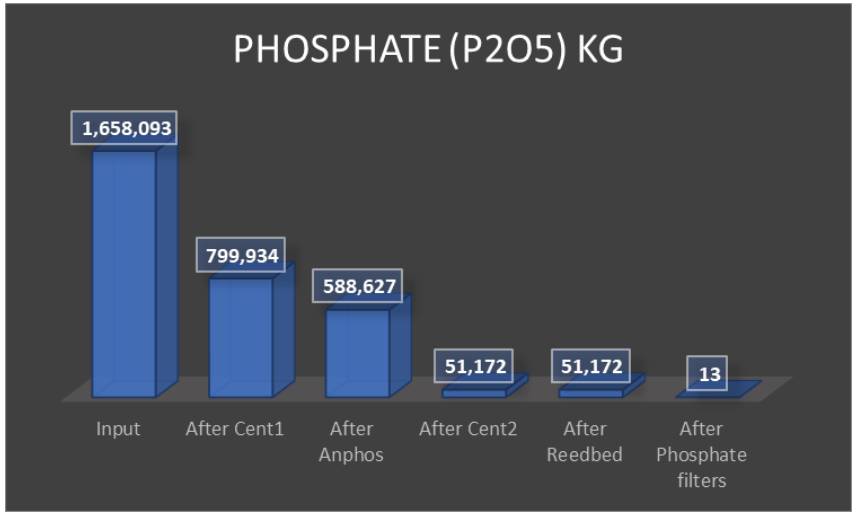
Whitwick Process

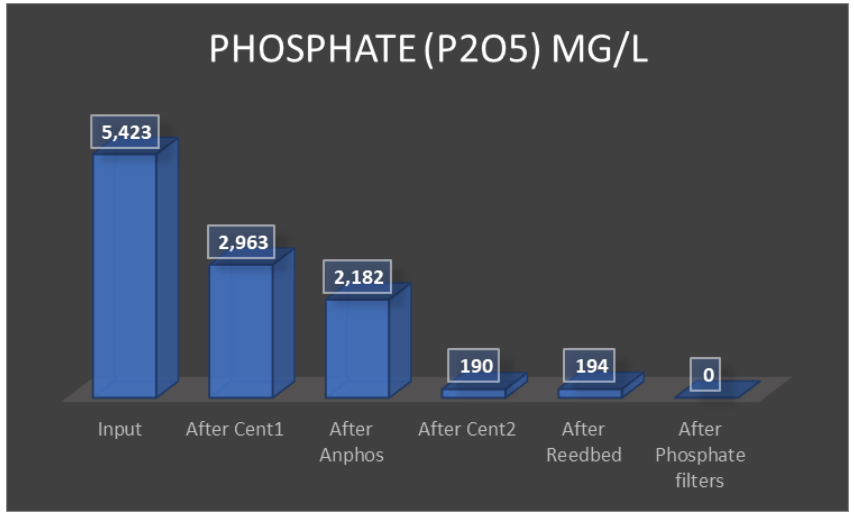
- The system has four main processing filters and a spare, to allow for cleaning and refilling or to provide extra protection if one of the upstream processes is undergoing maintenance
- When saturated, the Phosphate saturated media may be used as a slow release fertiliser
- The STL2 plant design allows for the additional final filter, to have a very low loading
- Phosphate remaining for release to watercourse: <13 kg of Phosphate per year or <0.05mg(P205)/litre



Phosphate reduction







- A typical house in the Wye catchment area produces around 0.5 kgs Phosphate per year or an acre of farmland 0.9 kg per annum.
- The STL2 plant will release less than 4.5 kgs per year of Phosphate to the watercourse, less than the amount of Phosphate produced by 5 hectares of farmland
- The phosphate release to the watercourse will be less than 0.039mg/l of Phosphate the minimum level detected at the nearest River Lugg measuring station
- The balance of Phosphate remaining in the liquid fraction released to the watercourse is: <5.5 kg of Phosporous (<13kg Phosphate P205) per year
- The phosphate removed during the whole STL2 process will be in formats suitable for transport and use as fertiliser or for further processing in fertiliser manufacturing plants
- The concentration of Phosphate released to the lagoon will be: <0.05 mg/l of Phosphate where it will be then further diluted by rainwater from the catchment