PR24 Data Table Commentary
Section 6. Bioresources

1. Contents

2.BIO1 – Bioresources sludge data

BIO1.1-3 - Total sewage sludge produced.

These lines cover sludge production whether treated by third party sludge provider or the incumbent. Sludge production varies year to year in part dependent on the economy, the weather, behavioural habits of society, and how we operate our sewage treatment works.

In the forecast period we forecast that sludge production is growing, primarily due to WINEP schemes across multiple sewage treatment works, including many of our larger works.

Annual sludge production after completion of these schemes is expected to grow by 13.4% to 163.9 ttDS in 2025/26. The future sludge production number is calculated by Stantec using their sludge production spreadsheet which calculates sludge production from population equivalent, consent, and sewage treatment process information.

This model includes assumptions around load received:

Parameter	per capita loading (g/hd.day)
per capita TP	2.5
per capita NH3.N	7.7
per capita BOD	60
per capita TSS	65.9
COD/BOD **ratio**	2.3

Depending on the tightness of the consent applied, the sludge production for a given technology is calculated. For example, chemical dosing to remove P produces the following amounts of sludge.

Permit	Chemical Sludge Yield	Calibrated Chemical Sludge Yield
mg/l P	gDS / hd. /day	gDS / hd. /day
5	0.59	0.59
4	1.25	1.25
3	2.55	2.55
2	5.06	5.06
1	7.19	7.19
0.8	7.24	7.24
0.6	7.38	7.38
0.5	7.50	7.50
0.4	7.68	7.68
0.3	23.77	23.77
0.25	28.43	28.43

This would be above the amount of sludge that would be produced without the P permit.

Full details are not described here, as the model is very complex and is outside of our direct control and remit.

The model also includes for increasing or reducing population at each site as each treatment technology or consent is applied to the population at the location. However the model only produces outputs for each AMP, phasing requires scheme specific dates.

This model is used to calculate the amount of sludge post beneficial completion for each scheme (in 2025/26).

Due to phasing of scheme commissioning and regulatory compliance dates a partial phasing of the additional sludge production of 145.8 ttDS is expected in 2024/25. We have used the latest planned commissioning dates as of end June 2023. The confidence grade of this data reflects both the potential for commissioning dates to move forwards or backwards, and whether the forecast additional sludge production over or under calculates the actual achieved post scheme commissioning, as well as the underlying variation year to year.

Looking beyond 2025 to 2030, our sludge production grows to 167.8 TDS in 2029/30, through a combination of WINEP schemes at our STWs and population growth. All together this is an increase of 16% from 2022/23 to 2029/30.

Due to the lack of spare headroom in our assets and the need to deliver IED solutions over the same period, which may have some short-term impact on operational capacity we have included for 5ttDS (3.4% of production) to be provided by a third

party sludge service provider. This is under commercial evaluation and so is also subject, at this stage, to a level of uncertainty reflected in the confidence grades. This is likely to be in the form of a contract until the end of 2029/30.

BIO1.4 - Total sewage sludge produced from non-appointed liquid waste treatment.

Line 4 is not expected to change over this period.

This data estimates the total sludge from non-appointed liquid waste treatment. It covers all sewage sludge treatment imported into Yorkshire water in another means rather than direct by the sewer.

This is a relatively new line that has been previously reported via the APR reporting process since 2019 and is made up of 3 elements:

- Tankered Trade Effluent (General- from Domestic and Trade imports)
- Tankered Trade Effluent (Nufarm)
- Trade via 'Private pipe' Syngenta

The data for Nufarm has shown a small incremental decrease during the reporting years and has continued this year resulting in a small drop in the overall sludge figure from last year's report. Last year Syngenta's sludge production had almost halved, at the time of reporting we linked this to one of the final settlement tanks being out of service for a substantial part of the year, we suggested it would return towards previous years in the following year and that has appeared to be a true assumption in this year's reporting.

The volumes for Tankered trade effluent had increased steadily over the last 4 years as YW launched an initiative to grow this area of the business, unfortunately the last financial year was not as successful as previous years and as you'd expect there's been a slight decrease in sludge production in this area linked to reduced volumes imported.

The data shows a slight decrease on last year's submission for the following reasons:

The Volumes of Tankered imported waste have decreased.

This results in an overall decrease in sludge production which is proportionate to previous years.

We are satisfied we have a robust and accurate reporting mechanism to cover all sludge produced from non-appointed liquid waste treatment.

There is an intention to increase the Tankered effluent area of the business steadily over the years so subject to Nufarm and Syngenta remaining consistent there should be a small but steady increase in sludge produced over the AMP period.

However, both Nufarm and Syngenta are separate entities to YW and have no commitment to maintain the levels currently imported. Nufarm are actively looking to source alternative treatment so this sludge could be removed at any point over the coming AMP period.

Syngenta have a large volume of capacity that they currently don't use so this could be utilised which could significantly increase sludge from this source or equally they have no commitment to continue at these levels so could equally be reduced significantly. This year's data shows Syngenta's sludge production return to levels of previous years after the reinstatement of the Final Settlement tank, however we are aware that they are also looking to remove more sludge at source to reduce treatment costs. This could reduce sludge production for next year's reporting.

Although the Tankered effluents aim is to increase volumes year on year this is a competitive market, and this has resulted in a slight decrease based on this year's performance.

In summary, although we are confident that we have a robust mechanism to accurately record and calculate the data, this area of sludge production could be quite volatile over the coming years and sludge production will increase or decrease as demand for treatment fluctuates in line with market trends.

Line 5. Percentage of sludge produced and treated at a site of STW and STC co-location

We are not planning for changes to the number or location of our Sludge Treatment Centres over this period. The historic increase in this figure in 2021/22 is primarily due to the opening of our Huddersfield STC. Looking forward, the proportion of our sludge that is co-located with these sites is increasing due to the larger proportionate impact of the WINEP schemes on the sewage treatment works collocated with the STCs.

Our plan for the next AMP sees us rationalise some sites to:

- Increase capital efficiency and affordability, especially in the context of "appropriate measures".
- Improve biogas utilisation, reducing Opex, and reducing emissions in line with our carbon targets and emissions monitoring requirements.
- Increasing Opex efficiency on site treatment.

- Preparing ourselves for a shift to the use of destruction type technology, should they be required in the future.

It is acknowledged that this does increase transport work done for both intersiting and disposal activities, discussed below.

Lines 6-8. Total sewage sludge disposed

The APR 2021/22 and 2022/23 Sludge disposal figures are elevated above our underlying disposal rate due to the disposal of some legacy stocks arising from previous years' operations. These have been managed to satisfy the environment agency around appropriate disposal routes and standard for materials that arose from processes we no longer operate. We do not anticipate disposing of any additional legacy stocks over the next two years. A relatively small quantity of approximately 6ttDS of legacy material remains on our sites which we plan to dispose of in the next AMP. It cannot be disposed of earlier as it is being treated for removal of invasive species prior to disposal. For this reason, we expect a reduction in sludge disposal mass compared to 2022/23 even though we are seeing an increase in sludge production. We have assumed that any sludge treated through a third party provided in 2024/25 is treated through digestion and is recycled by the third-party provider, with similar solids destruction to our existing processes.

Looking ahead to 2029/30 the amount of sludge to dispose of increases in 2026-2028 as we dispose of the legacy sludges. Other than this the quantity of sludge disposed of increases only by about 6% from 2022/23 to 2029/30 because increases in sludge production of 16% over this period are offset by a greater proportion of sludge undergoing Advanced Anaerobic Digestion which provides additional solids destruction.

Lines 9-13 Intersiting work done.

Work done by tanker is expected to reduce by 21% from 2022/23 to 2024/25. Truck work is expected to reduce by 14% in the same period. 2022/23 tanker data was high compared to previous years. This was caused by refurbishment of two of our sites in the south of our area, Old Whittington and Woodhouse Mill, which significantly impacted on sludge logistics in the south of our region, as well as diversions away from Knostrop and Blackburn Meadows due to temporary issues with bio-gas users on site (to minimise environmental impacts of excess flaring). Although the direct impact of these changes was predominantly on tanker movements there is an associated impact on truck movements too.

Although there may be small scale disruption to imports during delivery of IED, we anticipate being able to manage this through if necessary, using a third-party treatment contract without extending our average distance. No further large scale digester refurbishments are planned this AMP, and increased resilience of biogas utilisation is planned, enabling routings to be better optimised across our sites. For context, the large drop in truck work done in 2020/21 to 2021/22 was due to the commissioning of our Huddersfield sludge treatment centre, and the completion of refurbishment work at Dewsbury.

From 2024/5 onwards we expect intersiting work done to increase. This is due to the rationalisation of sites and replacement of conventional digestion with advanced digestion. The majority of the additional intersiting work will be provided by truck.

Work done by pipeline – 2 km*ttDS - no significant changes anticipated.

Total measure of intersiting 'work' done by tanker (by volume transported)

This measure has increased in recent years in part due to the arguments made above and is anticipated to reduce on the same basis. In addition, the volume moved depends on the performance of networks plus assets on the thickness of the sludge exported. Our forecast assumes this remains at current levels for the next two years. Some sites will be receiving chemical dosing for P removal. We have not got sufficient information to predict whether this increases or decreases the percentage DS at which sludge will be exported. From 2025 onwards, this increases due to rationalising STCs.

Lines 14-18. Total measure of "work" done in sludge disposal

We do not dispose of sludge through tanker or pipeline (Lines 14 and 15). All our activity in this area is by truck – The supporting Procedure 'Price Review 2023 Procedure Bio1 Lines 14 to 18v2.docx' states under line 16 that we do not undertake this activity and do not plan to do so during the time period data is provided for which contradicts the actual data in this line Bio1 Line 16.

The mass of sludge disposed of in 2021/22 and to a lesser extent in 2022/23 was elevated due to legacy sludge stock disposal. This activity has now ceased for the rest of the AMP, as discussed above, reducing the increase in work done going forwards. In general, the legacy sludges have had also to be disposed at longer distances due to the location of the single land restoration site, which though in central Yorkshire, was further from some of the sites that would normally be travelled. Sludge production increases in 2025/26 due to the completion of the WINEP programme, which is likely to increase these numbers significantly from 2025/26 onwards. In addition, we have two STCs we are planning to close at the end of the AMP, which will mean we will reduce

the number of sites we recycle from. This will increase the distance required to be travelled.

From 2025, the distances required to travel continue to increase.

The underlying increase after taking this into account is due to a tightening of the EA's interpretation over the "Farming Rules for Water" and the industry adopting twenty measures in response. These measures began to impact on deliveries from June 2022. These immediate and ongoing pressures on the land bank include:

- We have lost farming customers due to these rule changes, some of this has already materialised, other customers will no longer have suitable land moving forwards
- Increasing competition from other sources of biosolids in our region, leading to increased distances to find customers.
- We have been "filling the gap" created by these changes of rules with customers that are "as near as possible" in the short term, i.e. the "low hanging fruit" has been picked, so that as these impacts continue to roll out, distances will increase.

We have not assumed in the forecast above significant further changes in the interpretation of the rules. The following are **assumed not to materialise** by the end 2029/30.

- EA sludge strategy and move to deployments under EPR for sludge recycling.
- Further restrictions on spreading in autumn ahead of winter cereals
- Restrictions in application rates on P index 2 and 3 soils.
- Restrictions due to ongoing investigations into microplastics and PFAS
- Major supply chain shock in the agricultural/food sector outside of our control.

Any changes to the above would have a large impact on this metric, potentially to the extent that we would be unable to find a disposal/recycling route for all our sludge.

Line 19. Chemical P sludge as % of sludge produced at STWs

At present we only have a small number of our smaller sewage treatment works that treat for P removal and use chemicals. We report this measure as all the sludge produced on a STW that has as one of its treatment processes chemical P dosing, as it is not practicably possible to identify what element of the sludge is directly associated with the chemical P dosing. The number of sites is increasing significantly through our WINEP programme, particularly on our larger sites (see also percentage collocated, line 5) in the period up to 2025/26, and across many of our smaller sites in the period through to 2029/30.

3.BIO2 - Bioresources operating expenditure analysis

Bio2.20 does not reconcile to CWW1 due to an error in the formula as identified in "PR24 Business Plan Data Tables Errata Log". The total value for sludge treatment costs excluding third party costs are as follows:

2022/23: 14.629

2023/24: 15.545

2024/25: 19.416

2025/26: 25.495

2026/27: 25.249

2027/28: 24.792

2028/29: 24.362

2029/30: 24.210

AMP8 will see a step change in total Opex costs excluding third party for Bioresources from 2024/25 of £33.9mto £45.7m at the end of AMP8 for several reasons:

- An increase in sludge production, primarily due to WINEP schemes across multiple sewage treatment works, including many of our larger works and population growth.
- Rationalisation to a smaller number of larger, more efficient sludge treatment centres will allow a strong focus on process improvements and energy generation. This will be delivered by utilising new technologies, market delivery and financing. We will see an overall Totex benefit as it will lead to capital efficiencies as well as Opex efficiencies through process improvements. However, we will see an increase in Opex costs to deliver market solutions as well as additional transport and disposal costs.
- Rationalisation will also improve our biogas utilisation, reduce Opex and reduce emissions in line with our carbon targets and emissions monitoring requirements.
- At the end of AMP7 we will see the first market delivered, owned and operated gas to grid facilities at two of our largest sites which deliver Opex benefits. Further sites will be included towards the end of AMP8.

Please see accompanying commentary for Bio tables 1-6 and Chapter 8.8 for Bioresources.
In AMP8 we have applied Jacob's methodology for sludge liquor recharge within our Opex numbers which leads to increased Opex costs.

We assess the data in this table to be an A2 confidence grade.

4. BIO3a - Bioresources energy analysis

Energy Consumption is forecast to increase significantly in bioresources.

Overall consumption increases by 136.2 GWH (196%). This is largely driven by the adoption of a biomethane approach to biogas utilisation, but there are also significant increases elsewhere.

Impact of biogas to biomethane plants

This is mostly driven through the introduction of biomethane plants, which will lead to an increase in fossil fuel consumption as CHPs and boilers are switched to natural gas supply. In 2025 we expect an increase in fossil fuel use of 345% (from 26.78 GWH to 119.30 GWH) due to the introduction of biomethane plants at Knostrop and BBM.

The biomethane plant will be fuelled by biogas. This reduces the biogas available for the CHP and boiler on site, leaving the CHP and/or boiler to run on fossil fuels. The exact ratio of fuel to CHP or boiler will fluctuate depending on the relative heat and electricity demand on site at the time and the relative cost of fossil fuels and electricity. The increase in 2028/29 is from a planned gas to grid plant at Hull, with similar impacts in terms of use of fossil fuels – an increase to 147.54 GWH of fossil fuel use.

In total this is an increase in fossil fuel consumption of 120.76GWH (451%).

Impact of rationalisation and loss of landbank on logistics
We also expect to see significant increases in fuel use on transport due to the rationalisation plan and landbank issues discussed in BIO1.

Liquid intersiting will increase from 9.76GWH to 12.3 GWh (26%) by 2030.
Cake intersiting will increase from 2.19 GWH to 5,64 GWH (158%) by 2030.
Cake transport to agriculture will increase from 7.07 Gwh to 13.49 GWH (91%) by 2030.
Taken together this is an increase of 12.4GWH or 65%.

Impact of additional quantities of sludge to treat
Electricity demand grows due to increasing sludge production by 2.4 GWH (13.4%).

Biomethane to grid options have been chosen despite this increase in consumption in order to facilitate compliance with IED in the long term, as emissions from pressure relief valves and flares during extended CHP breakdowns make it difficult to achieve the requirements of IED at each of our sites, especially where this would lead to export of electricity to the grid, and grid connections are not able to take this increase. In addition, although energy consumed in bioresources increases, so does energy generated, and the amount of energy that is not used falls.

Energy generated by Bioresources control – electricity.

By 2029/30 the electricity generated in bioresources and used will increase by 2.38 GWH (18%) despite the generation of biomethane, due to the use of fossil fuels on CHPs installed in bioresources. These units will produce both heat and electricity for use in bioresources.

In addition the electricity generated in bioresources and used in networks plus is increased by 11.7 GWH (20%), and the electricity generated in bioresources and exported is increased by 2.91 GWH (59%). The export is expected to occur from Huddersfield STF after addition of extra CHP capacity following the upgrade to ephyra at that site, which is currently not thought suitable for a gas to grid plant. Huddersfield STF, although collocated with Brighouse STWs and Deighton and Colne Bridge for sludge production purposes, is on a separate power system and is not therefore able to provide as much electricity directly to networks plus as other STFs currently do.

Energy generated by Bioresources control – heat.

Heat is not exported to networks plus.

Heat is not exported to third parties. We have previously been involved in schemes with councils to assess the viability of transferring heat to local heat networks, but none of these have so far proved financially viable. In part this is because we typically have excess heat in the summer when it is of lower value.

Heat generated and used in bioresources is expected to grow by 5% (6GWH). This is caused by increased sludge volumes requiring treatment but is not as high as it would be if we did not rationalise sites, as the heat loss from the rationalised sites is lower.

Heat that is unused is reduced by 110.9 GWH (76% reduction) due to the adoption of gas to grid plants. This will reduce the running of CHPs in the summer which “dump” heat that is not required in order to continue producing electricity which is required. This is caused by decoupling the electricity demand and the heat demand through

biomethane plants. This will also reduce significantly the flaring of biogas which is required under IED.

Energy generated by bioresources and exported to the grid or third parties - Biomethane

We are planning three biomethane plants at Knostrop, Blackburn Meadows and Hull. These are designed to maximise the utilisation of biogas. These will produce 185.9 GWH of energy.

Total useful energy generation

In total, the amount of energy generated in bioresources and used in either bioresources or elsewhere, will increase by 2029/30 to 208 GWH (108%), through these measures. The increase is predominantly through biomethane (89% or 185.9 GWH) with electricity generation increasing 8% and heat generation increasing 3%.

Bio 3a Line 7 – 11 and 18 – 22

As mentioned, overall consumption increase is largely driven by the adoption of a biomethane approach to biogas utilisation, but there are also significant increases elsewhere, including the impact of rationalisation and loss of landbank on logistics as well as the impact of additional quantities of sludge to treat. For further information please see commentary above.

The unit prices used for power assumes that costs remain at the 2024/25 levels due to lack of certainty around future energy prices.

In addition, we have enhanced the methodology used to calculate the financial data for total energy consumption.

We have a range of confidence grades across these lines and so have pulled them into a table below.

			Confidence Grades							
			22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30
Energy consumption - bioresources - Total	MWh	total	B3	B3	B3	B3	B3	B3	B3	B3
Energy generated by and used in bioresources control	MWh	electricity	B2	B2	B2	B2	B2	B2	B2	B2
Energy generated by and used in bioresources control	MWh	heat	C3	C3	C3	C4	C4	C4	C4	C4
Energy generated by and used in bioresources control	MWh	biomethane	A1	A1	A1	A1	A1	A1	A1	A1
Energy generated by bioresources and used in network plus control	MWh	electricity	B3	B3	B3	B3	B3	B3	B3	B3
Energy generated by bioresources and used in network plus control	MWh	heat	A1	A1	A1	A1	A1	A1	A1	A1
Energy generated by bioresources and used in network plus control	MWh	biomethane	A1	A1	A1	A1	A1	A1	A1	A1
Energy generated by bioresources and exported to the grid or third party	MWh	electricity	A1	A1	A1	A1	A1	A1	C3	C3
Energy generated by bioresources and exported to the grid or third party	MWh	heat	A1	A1	A1	A1	A1	A1	A1	A1
Energy generated by bioresources and exported to the grid or third party	MWh	biomethane	A1	A1	A1	B3	B3	B3	B3	B3
Energy generated by bioresources that is unused	MWh	electricity	A1	A1	A1	A1	A1	A1	A1	A1
Energy generated by bioresources that is unused	MWh	heat	B3	B3	B3	B3	B3	B3	B3	B3
Energy generated by bioresources that is unused	MWh	biomethane	B2	B2	B2	B2	B2	B2	B2	B2
Energy bought from grid or third party and used in bioresources control	MWh	electricity	B3	B3	B3	B3	B3	B3	B3	B3
Energy bought from grid or third party and used in bioresources control	MWh	heat	B3	B3	B3	B3	B3	B3	B3	B3
Energy bought from grid or third party and used in bioresources control	MWh	biomethane	A1	A1	A1	A1	A1	A1	A1	A1

5. BIO3b - Bioresources; income, liquors and metering analysis

BIO3b.1–8: Towards the end of AMP8 most of our existing subsidies will expire (ROCs), this accounts for the step change from £2.714m in 2027/28 to £0.413m in 2028/29.

BIO3b.9–10: Biosolids liquors are expected to grow by 23% BOD liquors and 14% ammonia liquors. This is largely driven by increased sludge production of 16.1% (Bio1.3).

The reason that BOD liquors increase by more than 16.1% and ammonia liquors by less is due to the following factors:

- A small proportion of sludge (5 TDS/3.4%) is treated by third parties, the post treatment dewatering liquors from this activity are not returned to networks plus by bioresources, but raw liquors from producing raw cake to transport to the third party is included. Raw liquors produce less ammonia than digested liquors.

- When sites are rationalised and sludge is transported as raw cake to another site, where the cake is re-wetted prior to treatment additional volumes of liquors are produced, although these are low in ammonia and higher in BOD, this does increase the liquor load in total.

- Liquors produced at Bridlington and Hull do not require treating for ammonia as there is no ammonia consent for these sites.

BIO3B.11:
Please see commentary above. As biosolids liquors are expected grow due to increased sludge production we will see liquor recharge costs go up as well.

There are a range of confidence grades assigned to this table.
Lines 9 -11 = C5.
Line 12: A1 – D3:

6. BIO4 - Bioresources sludge treatment and disposal data

As the amount of sludge we produce increases (see BIO1), we will need additional treatment.

We have some aging assets which require significant expenditure now and, in the future, to comply with IED and "Appropriate measures".

We expect to see increasing competition for the landbank for biosolids and organic waste recycling.

We expect increasingly strict interpretation of the farming rules for water from the Environment Agency.

An investigation into microplastics and PFAs is ongoing, this has the potential to introduce further restrictions on biosolids recycling.

The EA strategy is to introduce a deployment system for biosolids recycling, which is likely to cause difficulties with the operation of the supply chain for biosolids.

From these drivers we expect to find our current biosolids recycling route increasingly challenged. We have not developed this plan on a "worst case" scenario and are working on an assumption of some loss of landbank, but with sufficient capacity available at a workable distance. For further discussion see BIO1 lines regarding work done in sludge disposal. However, to prepare ourselves for the likely tightening of landbank and potential wholescale loss it is prudent to rationalise uneconomic sites now and create a foundation to build on for the future. In addition, the costs of appropriate measures in the next decade are likely very high an impracticable if applied across all our sites.

These drivers of change have been the impetus to our new strategy of rationalising our sites through the introduction of Ephyra Digestion process (a form of advanced digestion) over the next AMP, with one plant operating from early in the AMP, and two further plants operating later in the AMP, enabling a rationalisation of sites.

The accuracy of this forecast is dependent on the delivery and scope of contracts that are still to be put in place and are therefore subject to change.

BIO4.8 – In 2022/23, there was an increase from previous years, 0.3% of Raw sludge was disposed of to landfill because of a storm tank cleaning project, whereby the sludge was contaminated with toxic metals. A small amount from the same project has been disposed of early in 2023/24, but it is expected there will be no more going forwards.

BIO4.9 – In 2022/23, a single disposal project of legacy materials from four sites, in which two were contaminated with Giant Hogweed plants and seeds and the remaining two other sites analysis failed the lead limit for acceptance under the Land Reclamation site permit therefore these materials were disposed of to Landfill. This material has all been disposed of, and it is not expected that there will be any more.

BIO4.10 – In 2022/23, there was a decrease in the amount disposal route to Land Reclamation, compared to previous years. This is due to the majority of the legacy material being recycled for land reclamation during the previous reporting year (2021/22), and only a small tonnage in 2022/23. There was a slight increase of digested sludge to land restoration due to deterioration in quality, material unlimed due to process failure and non-Biosolids Assurance Scheme (BAS) compliant due to pre-Hazard Analysis Critical Control Points (HACCP) validation sludge.
There has also been some material disposed of to land restoration during this reporting period which has been double counted in the previous reporting year as recycled to agriculture. This is due to a potential breach on a level 3 exemption. Four stockpiles at a customer's property which had already been relocated to a new S3 were intended to be spread outside of the S3 window, it was decided to eliminate the risk of a non-compliance by lifting three of the stockpiles and recycle to land restoration and offer to spread the fourth within the S3 time to avoid an Unsatisfactory Sludge Disposal. This tonnage totals 267.41DT, 0.3% of the total disposed.

In 2023/24, it is expected that 2,000 wet tonnes, (400 tds), will be recycled to land restoration due to failure to meet standards for agriculture, and lack of internal (re)treatment capacity.

In 2024/25, it is expected to be the same as 2023/24.

In 2025/26, it is expected to be the same as 2024/25.

In 2026/27, it is hoped that approximately half of the legacy material currently being treated to eradicate Himalayan Balsam, will be declared biosecure, and recycled to land restoration (half is c 3,000tds). It is also expected that 2,000 wet tonnes, (400 tds), will be recycled to land restoration due to failure to meet standards for agriculture, and lack of internal (re)treatment capacity.

In 2027/28, it is hoped that the second half of the legacy material will be declared biosecure and recycled to land restoration. It is also expected that 2,000 wet tonnes, (400 tds), will be recycled to land restoration due to failure to meet standards for agriculture, and lack of internal (re)treatment capacity.

In 2028/29, it is expected that 2,000 wet tonnes, (400 tds), will be recycled to land restoration due to failure to meet standards for agriculture, and lack of internal (re)treatment capacity.

In 2029/30, it is expected that 2,000 wet tonnes, (400 tds), will be recycled to land restoration due to failure to meet standards for agriculture, and lack of internal (re)treatment capacity.

BIO4.11 – In 2022/23, there was an increase in percentage of the annual total disposed of to Farmland due to a decrease of legacy material disposal.

In 2023/24, this figure is expected to increase, as it will not be offset by the legacy material to land restoration.

In 2024/25, this figure is expected to decrease, as due to lack of internal treatment capacity, some sludge is expected to be sent to external sites for treatment and disposal, so is in line 11, but as 'By 3rd parties' category. The overall figure for line 11, for both 'incumbents' and '3rd party', is 100% - all sludge is intended to be sent to agriculture.

In 2025/26, same as 2024/25, but slight change in the proportions, with more done by incumbent, and a lower proportion via 3rd party.

In 2026/27, a lower proportion to farmland due to the additional tonnage of legacy material creating an overall greater tonnage to recycle.

In 2027/28, as per 2026/27.

In 2028/29, all sludge is again intended to be recycled to farmland, mostly by incumbents, and some by treatment and recycling by third parties, with the exception

of the c 2,000 wet tonnes, (400 tds), will be recycled to land restoration due to failure to meet standards for agriculture, and lack of internal (re)treatment capacity.

In 2029/30, as per 2028/29.

BIO4.12 – 2022/23, there was nil sludge disposal via other routes.

All future years to 2030 are expected to be the same.

BIO4.13 – 2022/23 and 2023/24, all sludges are expected to be recycled/disposed by the incumbent.

However, in 2024/25, some sludge is expected to be sent to external sites for treatment and recycling to farmland, so is in the 'By 3rd parties' category.
In 2025/26, the proportion by '3rd party service providers' decreases slightly.

In 2026/27, the proportion by '3rd party service providers' drops due to the increased overall tonnage when including the legacy material.

In 2027/28, as per 2026/27.

In 2028/29, slightly decreased proportion by incumbents, as we will no longer have the legacy material to recycle.

In 2029/30, as 2028/29.

The cessation of sending raw or 'failure' sludges to land restoration, assumes that we have sufficient capacity to treat either internally (asset resilience, success and timeliness of Ephera plants), or by a third party service provider. If these are not in place or at the expected capacity, there is likely to be some in line 10 in future years, by incumbents.

The timescales and years outlined for recycling the legacy material are an estimate. If the Himalayan Balsam is eradicated sooner or later, then the timescales would change. It also assumes continued viability of the one site in the country permitted to take this material for restoration (Skelton Grange at Leeds).

The accuracy of this forecast is dependent on the delivery and scope of contracts that are still to be put in place and are therefore subject to change.

There are a range of confidence grades across these lines of data between A1 to B3.

7. BIO5 – Bioresources additional treatment and storage data

The information provided in the data tables is based on our WINEP submission as accepted by the Environment Agency, with the other investments that we requested but were denied removed. Our data submission and this assurance statement is based on our delivery of our original WINEP plan, based on the information we had to produce that plan.

We expect to improve dewatering at three sites. These were chosen as the sites that were failing the minimum standard of 20% dry solids at the time of assessment in September 2022. These sites were Dewsbury, Calder Vale and Sandall, which are designed to process 16423/year raw TDS of sludge with a volume onto the dewatering plants of 492266m3/year. Under our rationalisation plans we currently expect to close Calder Vale and transfer this investment to another site in need of improvements for dewatering. Any improvement in dewatering will reduce the need for storage, reduce the risk of the product being unsuitable for use in agriculture and meet the WINEP guidance. However, the information provided here is based on the original submission to WINEP.

We expect to increase storage by 82089m2, through a range of pad and barns. This provides enough storage for most circumstances but leaves a residual risk if through the EA sludge strategy there are further tightening of regulations or enforcement positions, or delays caused by deployments. This storage is roughly equivalent to 11.5 football pitches and covering this (and our existing storage) in odour-controlled buildings, if required under appropriate measures, would be more expensive than we have currently allowed for.

In those circumstances we may either switch locations for storage away from sensitive receptors or reduce storage volumes required through advanced digestion or drying. None of these solutions will be sufficient however, should the EA approach to the landbank increase to the extent that agricultural recycling becomes unviable.

If landbank becomes unavailable, a change of strategy will be required.

There are a range of confidence grades across this table from A1-E5.

8. BIO6 – NMEAV for capital enhancement schemes

Investment in Bioresources WINEP schemes begins in financial year 2027-28, and the relevant Capex is included in this table.

CPIH / CPIH lagged – all sections

The CPI-H inflation factor is sourced from submission table PD1 and uses the average forecast CPI-H for each financial year to inflate the opening MEAV balance.

Opening NMEAV balances - all sections

As investment in WINEP capital enhancement schemes begins in 2027-28, there is no opening NMEAV balance in 2022-23.

Capex – all sections

Capex relating to WINEP enhancement is summarised below at outturn prices:

Asset type	2027/28 (£m)	2028/29 (£m)	2029/30 (£m)
Sludge storage - Cake pads / bays; (WINEP/NEP) bioresources	10.249	13.585	11.978
Sludge treatment - Thickening and/or dewatering; (WINEP/NEP) bioresources	2.030	2.412	1.194
Total	**12.279**	**15.997**	**13.172**

CCA depreciation

Depreciation has been calculated using the following asset lives on the assumption that the relevant projects will be completed during 2029-20:
Sludge storage – 60 years
Sludge treatment – 35 years
Depreciation is deemed to begin in year 2029-30 when the relevant capital schemes are forecast to be completed.

Disposal adjustment

No disposals are expected in the period in relation to the above investment.

Other adjustments

There are no other adjustments to be made.

A confidence grade of A2 is given for this table.