SRN43 WINEP – Bioresources Additional Cake Storage Enhancement Business Case

2nd October 2023
Version 1.0

from Southern Water

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Glossary

Acronym	Term
AAD	Advanced Anaerobic Digestion
BAS	Biosolids Assurance Scheme
CAD	Conventional Anaerobic Digestion
EA	Environment Agency
EPR	Environmental Permitting Regulations
FRfW	Farming Rules for Water
IED	Industrial Emissions Directive
NE	Natural England
R&V	Risk and Value
SUiAR	Sludge Use in Agriculture Reg
TDS	Tons of Dry Solids
WINEP	Water Industry National Environment Programme
SPS	Sewage Pumping Station
NRT	Near Real Time

Executive Summary

We currently produce c. 66,000 tons of dry solids (TDS) p.a. of biosolids (treated sludge) through our wastewater & Bioresources (sludge) treatment processes. We employ a number of treatment technologies to produce biosolids that can be recycled and used in agriculture as a soil enhancer under the Sewage Sludge Directive 86/278/EEC, implemented in England and Wales through the Sludge (Use in Agriculture) Regulations 1989 (SUiAR) and in accordance with the Biosolids Assurance Scheme (BAS), the industry quality assurance scheme which is third party accredited and audited.

Feedback from our customers (including farmers, the end users of our Biosolids) is supportive of recycling treated biosolids to agriculture. This is because it is a good source of organic matter and nutrients and avoids extensive use of manufactured fertilisers. However, concerns over emerging contaminants and changes in current regulations are impacting the longevity of this option. For example, the impact of the full implementation Reduction and Prevention of Agricultural Diffuse Pollutions (England) Regulations, more commonly known as the "Farming Rules for Water" (FRfW) has been modelled collectively by the industry (with other changes) and could lead to more land required for biosolids recycling than there actually is in the UK.

Solutions to mitigate or reduce the impact of the landbank availability challenge and improve resilience in the supply chain to agriculture (and other relevant outlets) were considered and some of them were put forward as WINEP exercise for Bioresources under the two sludge drivers (SUiAR_IMP and SUiAR_ND). The Environment Agency (EA) accepted our proposal to provide additional covered cake storage across our operation in order to provide contingency in periods of low demand for biosolids. Analysis of options available for cake storage suggested the following specific solutions:

- in areas where there is likely to be a significant change in our operation within the next 10-years (e.g. Hampshire & Sussex), we are considering a lower cost and modular covered structures (e.g. fabric buildings or similar) which will provide 3 months' worth of storage
- elsewhere, where there is greater certainty of long-term stability (e.g. Kent), we are proposing more robust and long-lasting structures with 6 months' worth of storage

The scheme has associated expenditure of £51.1m (TOTEX in AMP8 – See Section 4)

Table 1: Summary of Enhancement Case

Summary of Enhancement Case	
Name of Enhancement Case	Bioresources WINEP Additional Cake Storage
Summary of Case	• This enhancement case is to invest £51.1m (TOTEX in AMP8) in building additional covered cake storage across our operation • Agriculture is currently the only outlet for our biosolids (treated sludge) • Whilst our customers (famers) are supportive of our product, contingency is required in periods of low demand for biosolids or at time where access to farmlands is made difficult • Other risks such as emerging contaminants or change in regulations (e.g. Farming Rules for Water) are likely to put more pressure on the availability of the landbank • As part of the WINEP Bioresources exercise, the EA approved our solution to supply additional covered storage for our digested cake • In order to keep costs efficient we are proposing different solutions depending on the locations and assessed risk – both in terms of type and capacity of storage

Expected Benefits	• Additional cake storage will improve resilience in the sludge supply chain to agriculture and other relevant use or disposal outlets, in accordance with WINEP sludge driver SUiR IMP and approved by the EA • It will provide contingency in periods of low demand for biosolids • It will help mitigate - in the short-term – the challenge related to the landbank availability following for example impact from change in legislation (eg Farming Rules for Water) • Covering our storage will also ensure we comply with the requirements related to the Industrial Emissions Directive and the Biological Waste Treatment: Appropriate Measures guidance • It will also ensure the quality of our product doesn't deteriorate before it is sent to farms which will help with acceptance from farmers
Associated Price Control	100% allocated to Bioresources
Enhancement TOTEX	£51.1m
Enhancement OPEX	£1.3m (in AMP8)
Enhancement CAPEX	£49.8m
Is this enhancement proposed for a direct procurement for customer (DPC)?	Elements of this programme are under consideration for alternative funding arrangements, in particular the work we are proposing in Kent.

1. Introduction

Biosolids are produced through our wastewater & Bioresources (sludge) treatment processes. We employ a number of treatment technologies to produce biosolids that can be recycled and used in agriculture as a soil enhancer under the Sewage Sludge Directive 86/278/EEC, implemented in England and Wales through the Sludge (Use in Agriculture) Regulations 1989 (SUiAR) and in accordance with the Biosolids Assurance Scheme (BAS), the industry quality assurance scheme which is third party accredited and audited.

Currently, most of the c. 66,000TDS p.a. of biosolids (treated sludge) produced is either stored for a short period of time at some of our 16 Sludge Treatment Centres or stored directly on the fields ('landbank') where it will be eventually applied as soil enhancer. A combination of limited control on our access to this landbank and imminent challenges driven by change of regulation now requires us to enhance our operation to maintain resilience in the supply chain to agriculture.

Whilst our Bioresource long-term strategy core pathway currently assumes access to the landbank will continue in some capacity, we recognise the solutions described below need to stay adaptive to potential changes (e.g. alternative pathway potentially leading to thermal destruction technologies) and work in combination with other schemes to be delivered in AMP8 (e.g. Advanced Anaerobic Digestion schemes as per SRN21 Advanced Digestion Cost Adjustment Claim), as described in more detail in section 3.

Table 2: Links to Data Tables Lines

Links to data table lines		
Enhancement	Table	Line
Bioresources cake storage	Regulated Delivery: CWW3 Alternative Delivery: SUP12	Regulated Delivery: CWW3.137 (CapEx): £30.345m CWW3.138 (OpEx): £1.259m CWW3.139 (TOTEX): £31.604m Alternative Delivery: SUP12 (CapEx & TOTEX): £19.46m

2. Needs Case for Enhancement

2.1. Our reliance on agricultural land as our only outlet & Risks

We currently produce c. 66,000TDS p.a. of biosolids at our 16 STCs across our region through Conventional Anaerobic Digestion (CAD). Agricultural land is currently the only viable strategic outlet for our Biosolids. Whilst other alternative outlets are available, they are only practical to mitigate short-term tactical issues and their long-term strategic potential is limited due to infeasibilities of costs, capacity, competition and geographical proximity to our operating region. Over the past five years, 99.7% of sludge has been recycled to agriculture with the remaining 0.3% going to land restoration.

Feedback from our customers (including farmers, the end users of our Biosolids (Appendix 1) and bill payers (Appendix 2) is supportive of recycling treated biosolids to agriculture. This is because it is a good source of organic matter and nutrients, cost-effective and avoids extensive use of manufactured fertilisers that are short of supply and for which the manufacturing process can be energy intensive. However, they are mindful that this product should not be damaging to the environment / soil. This raises questions over contamination and safety including the potential risk of spreading human diseases through food or by seeping into waterways, contaminating crops, and the impact it could have on the health of livestock. These stakeholder concerns therefore have the potential to impact the longevity of this option.

An increasing number of factors outside of the control of the water industry are also threatening the use of this option in the long-term. Exceptional weather events are likely to make access to fields more challenging (e.g. flooding). As a few examples, the “Beast from the East” in 2018 impacted farm access for greater than 10 days; and the unprecedented wet winter of 2015/16 which saw 11 named storms produce record level of rainfall from November 2015 - March 2016 in both monthly and seasonal accumulation records (Appendix 3a). Whilst these might seem to have a small impact in terms of days, depending on what period of the year these occur (for example a very wet summer going into autumn), the loss of access over these additional few days can make our existing storage operation significantly more challenging.

By the end of the 21st century, all areas of the UK are projected to be warmer, more so in summer than in winter and by 2070 precipitation is expected to change by -47% in summer, and +35% in winter. These significant changes are likely to have an impact on soils (e.g. moisture content) which could in turn change farming practices and therefore biosolids quality and quantity needs.

One of the most significant risks to be considered moving forward is the impact of the change in regulation and especially the implementation of the Reduction and Prevention of Agricultural Diffuse Pollutions (England) Regulations, more commonly known as the “Farming Rules for Water” (FRfW[1]), as discussed in section 2.2 below.

2.2. The impact of the regulatory environment change

In addition to the above, the cumulative impact of changes to the regulatory environment governing biosolids treatment and its management (e.g. Farming Rules for Water (FRfW) full implementation, EA’s Sustainable Sludge Strategy intention to move biosolids recycling to land activities from the Sludge (Use in) Agriculture Regulations to the Environmental Permitting Regulations (EPR) based framework) will add further stress onto the industry’s ability to recycle Biosolids to agricultural lands. This has a greater impact on Southern Water than other WaSCs because, adjusted for population, the Southeast of England has the smallest farmed area and second lowest area of farmed cereals among English regions (as demonstrated in our SNR21 Advanced Digestion Cost Adjustment Claim).

We, along with the wider industry, are fully supportive of the objectives of the Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations, more commonly referred to as Farming Rules for Water (FRfW) which manage diffuse pollution from agriculture including nutrient management and planning. The

more significant risk is the regulators' (EA/DEFRA) interpretation of Rule 1, which imposes restrictions on the timing of organic manure applications and would affect the spreading windows and application rates of biosolids to land by effectively banning most biosolids applications in late summer/autumn, which contributes to approximately 75% of our application.

As an industry, we have been working closely with the EA throughout AMP7 to mitigate some of the risks associated with the autumn spreading ban through the development of the BAS Standard Package of Measures to Benefit the Environment, also known as '20 measures', to meet the outcome focussed objectives and written requirements of the FRfW. The water industry committed to only recycling biosolids to land in England in compliance with these measures from 1st July 2022. Due to a statutory guidance note issued by DEFRA in June 2022, the EA are not currently enforcing Rule 1 of the FRfW but this may change as a review is planned for 2025 and would result in further restrictions to agricultural recycling from AMP8 onwards.

Because of the perceived significance of the above risk on access to landbank for our Biosolids, the industry decided to collectively assess the impact of Farming Rules for Water at national level. Through Grieve Strategic, a National Landbank assessment was commissioned to test the below scenarios, in relation to increasingly stringent environmental restrictions on the landbank (Appendix 4 & 5).

- **Scenario 1: Baseline – business as usual:** existing assets and regulatory controls (i.e., current Biosolids Assurance Scheme (BAS) restrictions)

- **Scenario 2: Baseline post FRfW – minimal restrictions (e.g. Now):**
  - increased sludge volumes (predicted 2025 levels and properties)
  - restrictions in line with the initial BAS scheme amendments ('20 Measures') in response to EA concerns regarding the FRfW

- **Scenario 3: AMP8 low change – modest restrictions:**
  - increased sludge volumes (predicted 2030 levels)
  - slightly increased restrictions on phosphate application to soils (e.g. no application of Biosolids to soils with high Phosphate levels and reduced application on soils with medium phosphate content to match crop uptake)
  - reduced farmer acceptance to model concerns over contaminants (e.g. PFAS and microplastics or regulatory uncertainty)
  - restrictions in line with the initial BAS scheme amendments ('20 measures') in response to EA concerns regarding FRfW.

- **Scenario 4: AMP8 medium change – significant restrictions:**
  - increased sludge volumes (predicted 2040 levels)
  - increased restrictions on phosphate application to soils (e.g. no application of Biosolids to soils with high Phosphate levels and reduced application on soils with medium phosphate content to match crop uptake)
  - further reduced farmer acceptance to model concerns over contaminants (e.g. PFAS and microplastics or regulatory uncertainty)
  - restrictions in line with the initial BAS scheme amendments ('20 measures') in response to EA concerns regarding FRfW
  - restrictions on applications in sensitive catchments
  - no applications within 500m of sensitive sites or within groundwater source protection zone 2 areas
  - increased restrictions on applications to grassland.

- **Scenario 5: AMP8 high change – plausible worst-case:**
  - increased sludge volumes (predicted 2050 levels and properties)
  - no application of Biosolids to soils with high phosphorus levels and reduced application on soils with medium phosphorous content to match crop uptake
  - limited farmer acceptance to model concerns over contaminants (e.g. PFAS and microplastics or regulatory uncertainty)

- restrictions in line with the initial BAS scheme amendment ('20 measures') in response to EA concerns regarding FRfW
- no applications in sensitive catchments
- no applications within 500m of sensitive sites or within groundwater source protection zone 2 areas
- restrictions on applications to grassland
- reduced application rates (as a result of concerns over nitrate leaching).

The two key areas of sensitivity driving the change between scenarios 3 & 4 are no late summer/autumn applications and increased restrictions on Phosphorus application to soil, which is essentially the full interpretation of the Farming Rules for Water, as described above.

The results of the assessment summarised in Table 3 below show that enough agricultural land is available for Biosolids recycling across the industry for Scenarios 1 to 3. However, as the number of constraints increases – especially throughout Scenarios 2 & 3 (compared to historical Scenario 1) - we will need to travel further and potentially expand to areas where other WaSCs are better situated to access it, creating competition and pressure points, especially at company borders. In comparison to the rest of the industry, this increase in distances travelled will be more significant for Southern Water and will result in higher operating costs.

Results for Scenarios 4 and 5, shows there is likely to be insufficient available agricultural land for all biosolids in the UK. This is mainly due to the land required to satisfy the restrictions developed above, especially the impact of Rule 1 of the FRfW.

Historically, the percentage of farmland required by the industry for the recycling of Biosolids - compared to the land available – was circa 10% which leaves a significant buffer should farmers decide to change their operation and needs (Scenario 1). The revision of the baseline to account for the current impact of FRfW – as it is currently being implemented – suggests already a significant increase of this percentage up to 33% and the projection for the more conservative approach of Scenario 3 (further but moderated restrictions to be applied in AMP8) shows this percentage increasing further to above 44%. This leaves us with insufficient contingency should these additional agricultural lands required not be available.

Because of the above and the uncertainty related to the application of Rule 1 of the FRfW, we are currently planning for a potential scenario sitting between Scenarios 3 & 4. Additional storage is required to mitigate the risk related to a significant increase in the landbank required to recycle our Biosolids (Scenario 3) and also prepare the organisation for further restrictions imposed in the likely event of the full application of Scenarios 4 & 5.

Should Scenario 4 fully materialise, there is a risk that – whilst it will help in the very short-term – additional Biosolids storage might not suffice. In which case we will have to resort to alternative solutions such as landfill or thermal destruction type of technologies (e.g. incineration). This will have to be included as part of specific uncertainty mechanisms (as described in our SRN36 Bioresources Strategy Technical Annex and SRN58 Uncertainty Mechanisms Technical Annex).

Table 3: National Landbank Assessment Outputs Summary

Scenario	Land available (GB - ha)	Land required by SWS (ha)	Land required by industry (ha)	% of farmland needed (industry)	Av. haulage distance SWS (km)	Av. haulage distance industry (km)
1	4,781,000	33,800	488,400	10.2	22	30
2	2,958,000	68,600	980,000	33.1	40	40
3	2,688,500	92,200	1,195,800	44.5	70	50
4	2,407,000	329,700	5,475,900		-	-
5	1,745,000	705,700	11,628,700		-	-

NOTE: True comparison between scenarios is made more complex because of the different growth factor associated with each scenario (e.g. 2022/2023 for Scenario 2 and 2040 for Scenario 4). When challenged - Grieve Strategic who produced this study - confirmed the growth impact was minimal between scenarios. For example, the sludge production increase to account for growth between Scenario 2 and 4 results in an additional 750,000ha of land required for the industry. This is about 14% of the total land requirement increase between Scenarios 2 and 4. Without this growth element, the land required for Scenario 4 would be about 4.7m ha which is still above the land available (2.4m ha).

3. Best Option for Customers

Given our current total reliance on agricultural land for recycling of the final biosolids product, any restrictions to this outlet poses an existential risk to the viability of our Bioresources operations.

The sewage sludge drivers within the WINEP are aimed at delivering improvements in the resilience of the sludge management chain as well as the non-deterioration of the environment surrounding any of the biosolids outlets as summarised in Table 4.

Table 4: Summary of the WINEP Bioresources drivers

WINEP Driver code	Description
SUiAR_IMP	Actions to improve resilience in the sludge supply chain to agriculture and other relevant use or disposal outlets
SUiAR_ND	Actions to meet requirements to prevent deterioration in soil quality or water quality

Various options were considered as part of the WINEP exercise and some of them were submitted as part of our initial Bioresources WINEP submission in November 2022. Overall, the drivers for these options were focused on:

- Biosolids volume reduction so that supply of Biosolids to farms stays either at the same level or below the demand
- Temporary mitigation (e.g. storage) during periods of low demand

These options are summarised in Table 5 below. The optioneering exercise followed Southern Water's standard Risk and Value approach, described in Part A of our SRN15 Optioneering and Costing Methodology Technical Annex, adapted to PR24 process & timescales. This involved stakeholder engagement including Southern Water experts, operations personnel and asset management leadership to produce a long list of potential solutions. These were then reviewed for feasibility and affordability to obtain a short-list of solutions which were then investigated, costed and benchmarked to constrain the short-list to Lowest Cost and Best Value options, presented here.

Table 5: Options Summary

Scheme Proposed	Decision	Overview
Assessment & Development of Advanced Thermal Destruction technology	Discounted from Bioresources WINEP	Reduction or complete mitigation of the landbank challenge as Biosolids is converted to ash or biochar material. The technology readiness level is not high enough yet for the industry to adopt this at the current time. As no investigation driver was included in the Bioresources WINEP, this option was discarded. However, a joint submission with the rest of the industry was approved by the EA with the view to start developing this type of concept.
Planning of thermal destruction technology (e.g. incineration)	Submitted (WINEP) EA – "Remove"	Reduction or complete mitigation of the landbank challenge as Biosolids is converted to ash material. Incineration is seen as a last resort as it is undeliverable for at least 10 years and does not align with our carbon strategy. Classed as "Remove" by the EA as they considered these schemes to be outside of the Sludge Drivers (Appendix 6).

Advanced Anaerobic Digestion (AAD) (2 Kent sites)	Submitted (WINEP) EA – "Remove"	AAD to provide better product quality and volume reduction through greater solids destruction and improved dewaterability. Classed as "Remove" by the EA as they considered these schemes to be outside of the Sludge Drivers (Appendix 6)
Cake Storage	**Submitted (WINEP) EA – "Proceed"**	Additional storage to provide contingency in period of low demand for biosolids Classed as "Proceed" by the EA

NOTE: As we strongly believe the implementation of AAD should be the focus of our Bioresources strategy in the medium-term, this scheme is now being submitted as part of our SRN21 Advanced Digestion Cost Adjustment Claim for Ashford and Ham Hill.

A need for the appropriate standard of sludge storage to be available to provide flexibility and contingency in recycling logistics and manage periods where outlets might not be available was highlighted and approved by the Environment Agency as part of the Bioresources WINEP.

The number of options for cake storage is limited. However, Atkins on behalf of the industry, were asked to provide specific expert subject matter support and evidence to help the optioneering exercise undertaken by each company on cake storage (Appendix 3). The findings of the report were presented to the Water Industry, Ofwat and the EA at various workshops and regulators were supportive of the risks and conclusions presented.

Atkins' analysis focused on three main points:

- **A review of best practices,** to build a picture of current requirements, guidance, and examples of best practice for biosolids and adjacent industries e.g., agriculture, food waste management etc.
- **Data analysis**, including WaSCs' qualitative and quantitative data surrounding current storage practices, assets and drivers and future strategies, and analysis of data pertaining to the influencing factors on storage strategies drawn from publicly available datasets. This looked at the day-to-day operational storage requirement but also need for contingency storage for exceptional events
- **Landbank assessment (as per section 2.2)**, to consider the potential storage capacity required aligned to scenarios associated with the implementation of the Environment Agency's 'Strategy for Safe and Sustainable Sludge Use' which is an alignment with a move to Environmental Permitting Regulations (EPR) regime against the baseline.

The study concluded that climate change will result in increased periods where access to land cannot be guaranteed, additional storage will be required to mitigate this, but as this is likely to occur over an undefined period of time, this capacity could be delivered incrementally, in relation to each company's long-term strategy.

Additionally, contingency storage would be needed to address the risk of agricultural epidemics (e.g. foot and mouth disease) that may limit access to field storage. Historically, water companies found alternative storage sites, such as disused airfields and industrial sites, however most of these locations have been developed and are no longer widely available.

Some additional storage is required now to manage current levels of risk around the changing recycling regime (e.g. impact of FRfW) with further storage provided to address ongoing resilience needs. The water industry, in collaboration with the EA, have evaluated a number of immediate and future scenarios impacting the availability of land outlets (see landbank assessment in section 2.2). Together, these were expected to generate an indication of acceptable levels of storage to mitigate operational risks and provide resilience, thereby mitigating the risk of potential environmental impacts of extended storage on farms.

The study concludes that storage should be nominally (Appendix 3b):

- 1-month additional storage (short term, for immediate implementation, e.g. AMP7) to allow changes in current practice (best case) deployment application

- 3-month on-site storage (mid-term, to be addressed in AMP8) to allow for extended over-winter storage, move to EPR and mean deployment periods
- Up to 6-month on-site storage (long term, AMP8 and beyond) to address risks around loss of spring spreading due to climate change, resilience around epidemics and unforeseeable restrictions

Increased on-site storage - rather than on fields – alleviates the risks for WaSCs over winter access to land, thus contributing to resilience as per Bioresources WINEP drivers. It also promotes greater environmental control measures in-line with the Industrial Emission Directives[2] and the Biological Waste Treatment: Appropriate Measures[3] guidance recently issued by the EA to reduce emissions to land, air and water.

Concerns about pollution to the environment also increase the risk that current EA's S3 exemption field storage guidance[4] –which allows companies to store sewage sludge at a site for a strictly limited amount of time before it can be applied in accordance with the Sludge (Use in Agriculture) Regulations 1989 – could be phased out. S3 exemptions are commonly utilised by WaSCs as they are easy to deploy instantly. For context, SWS data from May-22 to April-23 suggests 65% of the Biosolids we produced are stored for more than 30 days on fields under S3 exemptions. The issue is more prominent in our Sussex & Hampshire regions where a significant proportion of the Biosolids (43.5% of total throughput) is sent almost immediately to fields under S3 exemption as very limited storage is available on our sites (silos with up to 2 days retention time). Under the current EA sludge strategy proposals, S3 exemptions could be replaced with a standard rules deployment mechanism such as that currently in use for land recycling of clean water sludges/sediments from ground water abstraction operations. Analysis undertaken in Atkins study (Appendix 3c) shows that the average deployment approval time is about 40 working days, a significant increase in approval time. This reinforces the need for additional storage of Biosolids to be made available on our STCs.

The study also highlights that the Bioresources WINEP should support greater investments in covering storage pads, to prevent re-wetting of material in storage during adverse weather. Covered storage is essential to mitigate the risk of re-wetting and has evidenced %dry solids (DS) benefits. Covered storage should consist of a Dutch barn (i.e., roof cover with open sides (thrust/push walls and containment drainage) as this assists ventilation and drying of the sludge. This is also a requirement driven by both IED regulation and Appropriate Measures guidance. Fully enclosed hard-standing storage should only be employed if required by drivers such as planning requirements (odour) due to increased health and safety concerns of vehicles operating inside a building.

Given that there is no defined standard for storage and the increased risk posed by climate change, changes to farming practice and recycling regulations, we assessed our storage facilities against the above recommended standards and summarised the options we considered in Table 6: Options summary for Cake Storage solutions below.

Table 6: Options summary for Cake Storage solutions

Area	Option	Decision	Overview
All	Uncovered Storage	Discounted	As per Atkins study, covered storage was adopted as it complies with IED/Appropriate Measures requirements. It will also prevent the cake from re-wetting, decreasing risks of run-offs and therefore pollution once applied to land. Uncovered storage was discontinued specifically for the above reasons.
	Covered Storage	**Adopted**	

Kent	6-month storage	**Adopted**	In line with the implementation of our Bioresources long-term strategy in Kent in AMP8 and as recommended by Atkins, 6-month storage for Kent is the preferred solution.
	3-month storage	Discounted	
Hants/Sussex	6-month storage	Discounted	No major plans in AMP8 for these areas of operation. Because of the uncertainty on longevity of the available landbank and the need to keep an adaptive strategy, 3-month storage is favoured as per recommendations in Atkins' report.
	3-month storage	**Adopted**	
Hants/Sussex	Covered (e.g. Dutch-barn)	**Considered**	Due to the uncertainty around the type of technologies which will be in operation post-AMP8 and impact on cake storage requirement, a more modular approach would be preferred here.
	Modular covered (e.g. fabric building or similar)	**Adopted**	

We concluded that only covered storage options were to be put forward. Covered storage increases dry solids (DS) benefits and mitigates the risk of re-wetting. This is also a requirement driven by both IED regulation and Appropriate Measures guidance.

In terms of storage capacity (expressed in months of storage available in relation to the amount of Biosolids produced), the recommendations from Atkins state that up to 6-month storage should be allowed for any long-term planning. This rationale fits well with our long-term strategy for Bioresources which aims to start our transformational journey in Kent with the consolidation of sites and conversion to Advanced Anaerobic Digestion. Based on a combination of the implementation of our long-term strategy and the rapid - and already significant – loss of landbank buffer (i.e. % of land required compared to land available) highlighted in section 2.2, the remaining sites producing Biosolids in Kent (Ashford and Ham Hill) would need to include 6 months of covered storage. This will also account for the nature of how often the sludge is currently applied onto fields (driven by crops rotation) as our application windows are every 6-months.

Our proposal for cake storage in Kent is directly linked to other planned schemes in AMP8, which involve the conversion of our operation to Advanced Anaerobic Digestion and consolidation of 7 digestion sites to 2, as described in our SRN36 Bioresources Strategy Technical Annex and SRN21 Advanced Digestion Cost Adjustment Claim. The resilience we are building in this region is for the long-term and therefore the choice of storage should also reflect this. For this reason, the more traditional but robust Dutch-barn style type of solution is the preferred option. It is designed to last much longer than other more modular options discussed below.

As discussed in our Bioresources long-term strategy, uncertainties remain on the longevity of the landbank as our main outlet for Biosolids recycling. Significant change in legislation might force us to move to other types of technology, which may negate the need for Biosolids to be stored (e.g. thermal destruction). Currently, we expect this risk to materialise beyond AMP8 which means it will have a greater effect on our Hampshire and Sussex regions where the implementation of our core strategy will occur after this date. Because our strategy needs to stay adaptive, we decided to follow the 3-month storage recommendation within Atkin's report, with the view to potentially increase this at a later stage. This also aligns with the modular approach recommended by OFWAT.

Because of the need for adaptivity, we decided to look at more innovative and modular type of structure to cover the storage area (e.g. fabric buildings or similar) and compare this against the more traditional hard-standing Dutch-barn type of storage cover. A whole life cost analysis was carried out for the Hampshire/Sussex case and summarised in Table 7 below.

- CapEx costs were derived by SWS' costing team through the use of cost curves built upon previous projects that included similar items
- High level average OpEx (across AMP8) was calculated based likely locations of the new cake storages and subsequent increase transport
- Carbon was calculated based on the likely locations of the new cake storages and subsequent increase transport

Table 7: Whole Life Cost Analysis (example for Hampshire/Sussex case)

Option	CapEx (£m) (Total cost)	OpEx (£k/y)	Carbon (tCO_2/y)	Whole Life Cost (Across 30 years - £m)
Modular Cover	46.2	139.70	133.98	48.2
Dutch-barn	61.7	139.70	133.98	62.6

As such, we have reviewed our cake storage facilities and proposed investment at several sites. Whilst the Atkins report recommended Dutch barns, we have concluded that this might not be the best-value solution at all our facilities.

- in areas where there is likely to be a significant change in our operation within the next 10-years (e.g. Hampshire & Sussex), we are considering a lower cost and modular covered structures (e.g. fabric buildings or similar) (3-months)
- elsewhere, where there is greater certainty of long-term stability (e.g. Kent), we are proposing more robust and long-lasting structures (6-months)

The work we are planning on undertaking as part of our base expenditure for Bioresources (for example improving reliability and resilience of our digestion and dewatering operations) will provide the foundation for this additional cake storage enhancement programme and will result in a more efficient overall operation. Long-term outcomes will only be met through both approaches.

We have assessed the solutions against the criteria for low regret investment identified in the LTDS guidance and Appendix 9 of the Final Methodology. The guidance identified that low regret investments meet the needs across a wide range of plausible scenarios, meet short-term requirements; or keep future options open, including cost minimisation.

We consider that the investment proposed in this enhancement case is a least regret investment for the following reasons:

- **Need:** This scheme is required to mitigate the impact of the landbank loss currently experienced because of limited control over its access and potential further reduction through regulatory changes
- **Timing:** Landbank availability is already reducing as per scenarios presented in this document (1 and 2) with further reduction expected in AMP8 (scenario 3 and potential for 4 or 5)
- **Optioneering:** We have carried out an assessment of options and identified the solutions described above are the lowest regret solutions
- **Future:** In line with our long-term strategy and adaptive pathways, the solutions will mitigate an imminent need and are not forecast to be obsolete in future plans

4. Cost Efficiency

Southern Water's standard enhancement solution costing approach, described in Part B of our SRN15 Optioneering and Costing Methodology Technical Annex was followed to estimate the costs of the selected options. This approach involves pricing solutions based on the best available information for the expected scope. The level of design development completed determines the granularity of scope that is available and therefore the specific costing approach used. Costs are predicted using our libraries of standardised cost models developed from historical cost data, augmented with industry information where required, and regularly updated. These cost libraries are benchmarked internally and externally by our Cost Intelligence Team (CIT) to understand relative cost efficiency.

In the Hampshire/Kent example, high-level design and costing was carried out on the basis of 3 large sites ("Hampshire", "Sussex" and "Isle of Wight") sized based on the amount of Biosolids produced. The reason for this is whilst we would prefer to build these cake storages on digestion sites, most of our Sludge Treatment Centres (STCs) in these regions do not currently have the physical space within their footprint for these facilities. Work is therefore underway to understand where storage would likely be implemented.

A benchmarking exercise was carried out internally using experience from previous similar projects and summarised in Table 8. The comparison was carried out on total costs – rather than direct – as these were the figures available. Where required, costs of the different projects used for comparison were adjusted for inflation. For easier comparison, the costs from various projects used for benchmarking were extrapolated to match the size of storage required in relevant areas (Hants/Sussex or Kent):

- Costs from our recently built Cake Barn at our Goddards Green THP plant were used to benchmark our plans for Kent
- Costs from our recently built modular cake cover at Aylesford were used to benchmark our plans for Hants/Sussex

Table 8: Benchmarking exercise

	Hants/Sussex	Kent
Area of storage (incl. Growth – m^2)	51, 833	23,630
Type of storage selected	Modular	Dutch barn
Business Case - CIT Costing (Direct cost - £m)	19.1	11.2
Business Case - CIT Costing (Total cost - £m)	46.2	22.8
Benchmark - Goddards Green THP Cake Barn (2023 project)	-	28.1
Benchmark - Aylesford modular cake cover (2022 project)	45.2	-
% difference (costed solution in comparison to the benchmark)	+2.2%	-19%

NOTE: Cost multipliers of 2.420 (for Hants/Sussex) and 2.040 (for Kent) were used to calculate total costs for this project, as described further below.

The benchmarking exercise suggests the total initial costs put forward for this project by our CIT team are broadly similar to costs for comparable projects (+2.2% and -19% lower for Modular cover and Dutch barn respectively). As these figures are within the expected range difference for this class of costing, no adjustments were made to the initial costing going forward.

The assumptions for the initial costing were complete "greenfield" sites, therefore further refinements were then required. These are summarised in Table 9 below:

- Existing facilities:

- In Hampshire and Sussex, some of the sites where cake storage facilities are likely to be built already contain a concrete slab. Even though some of these slabs will require further work to be fully functional, we assumed this would be included into the modelled bioresources efficient totex allowance and have therefore removed these elements form the costing.
- In Kent, the 2x consolidated sites where Advanced AD will be implemented will require full rebuild due to the size upgrade, therefore the above was not applied.

- We then removed the growth element of each scheme as we expect this to be included into the modelled bioresources efficient totex allowance.
- Finally, we added indirect costs and overheads of 2.420x (for Hants/Sussex) and 2.040x (for Kent) of direct costs, which are based on the design maturity and complexity of the schemes underpinned by an analysis of historical data benchmarked against industry comparators. Description of the tool used and rational is available our SRN15 Optioneering and Costing Methodology Technical Annex. Different cost multipliers were used for the two schemes as we are proposing to deliver the work in Kent through Alternative Funding (as described further below)

Table 9: Costing adjustment summary

Costing Adjustment	Type of Costs	Cost Source	Hants/Sussex (£m)	Kent (£m)
Initial Costing	**Direct**	**SWS Internal cost curves**	**19.1**	**11.2**
Existing Facilities	Direct	SWS	-5.1	-
Growth	Direct	SWS	-1.5	-1.7
Final Direct Costing	**Direct**	**SWS**	**12.5**	**9.5**
Total Cost (incl. Indirect)	**Total**	**SWS; external benchmarks**	**30.3**	**19.5**

As part of the wider strategic work in Kent (consolidation of sites and conversion of operation to Advanced AD), we are considering delivering the Kent element of this projects through our alternative financing route (£19.5m TOTEX) - As described in our SRN21 Advanced Digestion Cost Adjustment Claim for Ashford & Ham Hill and our SRN36 Bioresources Strategy Technical Annex. The proposed delivery model is also set out in our Ham Hill & Ashford business case for alternative financing, including the delivery schedule, tender and commercial models and the associated development costs. The remaining £31.6m TOTEX (AMP8) will be delivered through traditional route.

In addition to the CapEx costs developed above, we are expecting to spend an additional total OpEx of £1.3m in AMP8, related to the gradual use of our additional storage in Hampshire and Sussex. As a large proportion of our sites in these regions do not currently have space, the increased storage build through this enhancement will have to be on other strategic sites. The OpEx above accounts for extra movement of treated cake from site of production to site of storage.

The TOTEX (AMP8) required as part of this enhancement case is therefore £51.1m

5. Customer Protection

The selection of this option and the type of cake storage chosen will help improve the resilience of the supply chain to agriculture. It will also have positive impacts on biosolids quality and will comply with current legislations and guidelines. The wider industry has extensive experience in delivering the type of chosen technology across the world and this therefore protects customers from the risk of abortive spend.

There are also benefits for the nearby communities associated with reduction in odour and fugitive emissions as well as increasing the flexibility of Biosolids deliveries to farms.

However, in order to protect our customers in case of non or late delivery, we are proposing a scheme specific price control deliverable (PCD) based on the amount of storage which will be built (in m^2). Where the schemes do not progress or do not manage to build agreed capacity, the costs will be returned to our customers.

The expected timescales for implementation of both schemes are described in Table 10 below:

Table 10: Delivery targets

Scheme	Value	Output	25/26	26/27	27/28	28/29	29/30
Hants/Sussex Storage (incl. OpEx)	£31.6m	Built surface capacity (m^2)					46,650
Kent Storage	£19.5m	Built surface capacity (m^2)					20,085

If we deliver either of the schemes late, we expect to pay a penalty of £0.013k per m^2 for every month the scheme is delivered late (this will be dependent on the delivery route of the scheme). This is based upon the total scheme value and the total months in an AMP period.

Any non-delivery of capacity across both sites will be returned to customers at the rate of £0.77k per unit below the 66,735m^2 level.

An assurance exercise will be completed ahead of AMP9 to assess the completion dates of both schemes.

The details of the PCD are set out in Table 11 below:

Table 11: PCD Summary

Component	Output based on Capacity of Biosolids
Output	66,735m^2 total surface capacity built as part of this enhancement
Total cost	£51.1m
Unit cost	£0.77k per m^2 surface capacity
Penalty rate	£0.77k per m^2 surface capacity
Scheme Delivery Date	31st of March 2030
Gated dates	Assurance of the scheme will be delivered on time at 31st March 2028/29
Late penalty	£0.013k per m^2 for every month late.
Measurement	Performance reported in APR

Conditions (if required)	If applicable
Assurance	Third party assurer will assure conditions have been met

NOTE: The late penalty is derived from £51.1m (total claim cost)/60(months late)/66,735 (total surface capacity built)

If a higher amount of capacity is constructed, there will be no adjustment.

6. Conclusion

To summarise, we have proposed an Enhancement Case as part of the Bioresources WINEP process. The scheme – as agreed with the Environment Agency will delivery additional covered cake storage solutions across our operation with the view to:

- Improve resilience in the sludge supply chain to agriculture and other relevant use or disposal outlets, in accordance with WINEP sludge driver SUiR_IMP and approved by the EA
- Provide contingency in periods of low demand for biosolids
- Help mitigate - in the short-term – the challenge related to the landbank availability following for example impact from change in legislation (eg Farming Rules for Water)
- Covering our storage will also ensure we comply with the requirements related to the Industrial Emissions Directive and the Biological Waste Treatment: Appropriate Measures guidance
- It will also ensure the quality of our product doesn't deteriorate before it is sent to farms which will help with acceptance from farmers

The scheme has associated expenditure of £51.1m (TOTEX in AMP8) to deliver a suite of solutions which were selected based on assessment of risks and location of storage:

- in areas where there is likely to be a significant change in our operation within the next 10-years (e.g. Hampshire & Sussex), we are considering a lower cost and modular covered structures (e.g. fabric buildings or similar) which will provide 3 months' worth of storage
- elsewhere, where there is greater certainty of long-term stability (e.g. Kent), we are proposing more robust and long-lasting structures with 6 months' worth of storage

References

1 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/695598/farming-rules-for-water-policy-paper-v2.pd f
2 https://environment.ec.europa.eu/topics/industrial-emissions-and-safety/industrial-emissions-directive_en
3 https://www.gov.uk/guidance/biological-waste-treatment-appropriate-measures-for-permitted-facilities/1-when-appropriate-measures-apply
4 https://www.gov.uk/guidance/waste-exemption-s3-storing-sludge

Appendix

A 1 The future of Southern Water's sludge – farmer survey (Yonder for SWS - 2022)
A 2 Water Future 2030 – Potential Changes to Sludge Regulations (Relish for SWS - 2022)
A 3 WINEP Sludge Driver Evidence – Biosolids Storage (Atkins for Water Industry - 2022)
A 4 Southern Water National Landbank Study Results (Grieve Strategic for SWS - 2022)
A 5 National Landbank Study (As part of the Collaborative Bioresource Meeting presentation - Grieve Strategic for the water industry - 2022)
A 6 WINEP Sludge Update (EA to the water industry - 2023)

Appendix 1 - The future of Southern Water's Sludge – Farmer Survey (Yonder for SWS - 2022)

SOUTHERN WATER

The future of Southern Water's sludge

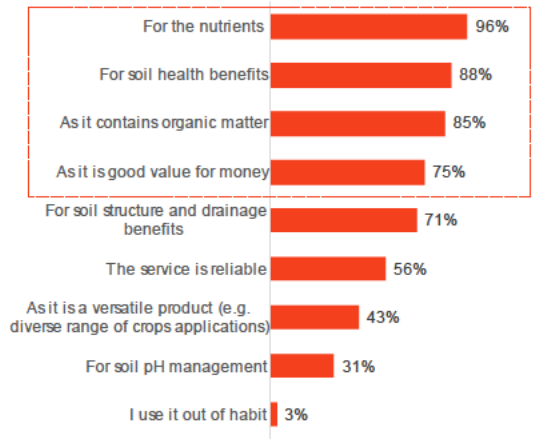
.YONDER

Qualitative & Quantitative research debrief

a. *Biosolids seen as a value material*

The main advantages of biosolids are the nutritional benefits to soil health, alongside being good value

REASONS TO USE BIOSOLIDS - PROMPTED



REASONS TO USE BIOSOLIDS – SPONTANEOUS COMMENTS

Improves soil health/ organic benefits

"Good source of organic fertiliser/improves soil health, greater than its technical nutrient value"

Phosphate and nitrogen:

"Biosolids supply important key nutrients including phosphate and nitrogen. It also is very important as a soil conditioner and enhancer to maintain and improve my soil organic matter"

Good value

"Because it's cheap organic/nutritional content. Also, a belief that a society ought to be returning its waste to the soil"

11 | WATER for LIFE from Southern Water

Q7. Why do you use biosolids ("treated sludge / treated cake") on your land? / Q8. Below are some reasons others have provide d for using biosolids ("treated sludge / treated cake") on their land. Which of the following are reasons that you use biosolids? All respondents (68)

.YONDER

WATER for LIFE from Southern Water

b. Limitations of current Biosolids from SWS

Additional external factors are also identified as downsides to sludge

Smell

- The potent smell is consistently cited as a negative
- Can lead to complaints from neighbours. This can be exacerbated upon learning what sludge is

Inconsistent product

- That the product can vary from being sludge-like to cake-like is a source of frustration
- Sludge-like is much harder to store and cultivate

Spreading and cultivation

- The requirement to cultivate soon after spreading can be a challenge with unpredictable weather
- Heavy machinery is at odds with a regenerative approach

Delivery of the sludge

- Large haulage delivery trucks can impact the local community and local road networks

Microplastics

- Concerns are increasing around the digestion of microplastics
- Microplastics risk damaging crops and soil quality

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c. Benefits expected from Advanced Digested cake

Whilst confusion exists over what Advanced Digestion is, a drier product has clear advantages

Less smell

- Drier is less odorous
- Significant improvement for locals (and farmers)
- Supported by Thames sludge users and those who used to use pellets

Easier to cultivate

- Far better for the soil when cultivating as requires less heavy machinery
- Granules could be easily 'sprinkled' down tram lines and top dressed

More concentrated product – cheaper to transport

- Transporting organic matter rather than water
- Anticipated this will impact costs and operations – easier to transport dry product than a liquid

Easier to stack and store

- A drier product can be more easily protected against rain/snow and stored for longer
- Locals would be happier not to have a sludge heap

Better for the environment

- Easier cultivation and transportation means fewer trucks / heavy machinery
- Easier cultivation is better for soil regeneration

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.YONDER

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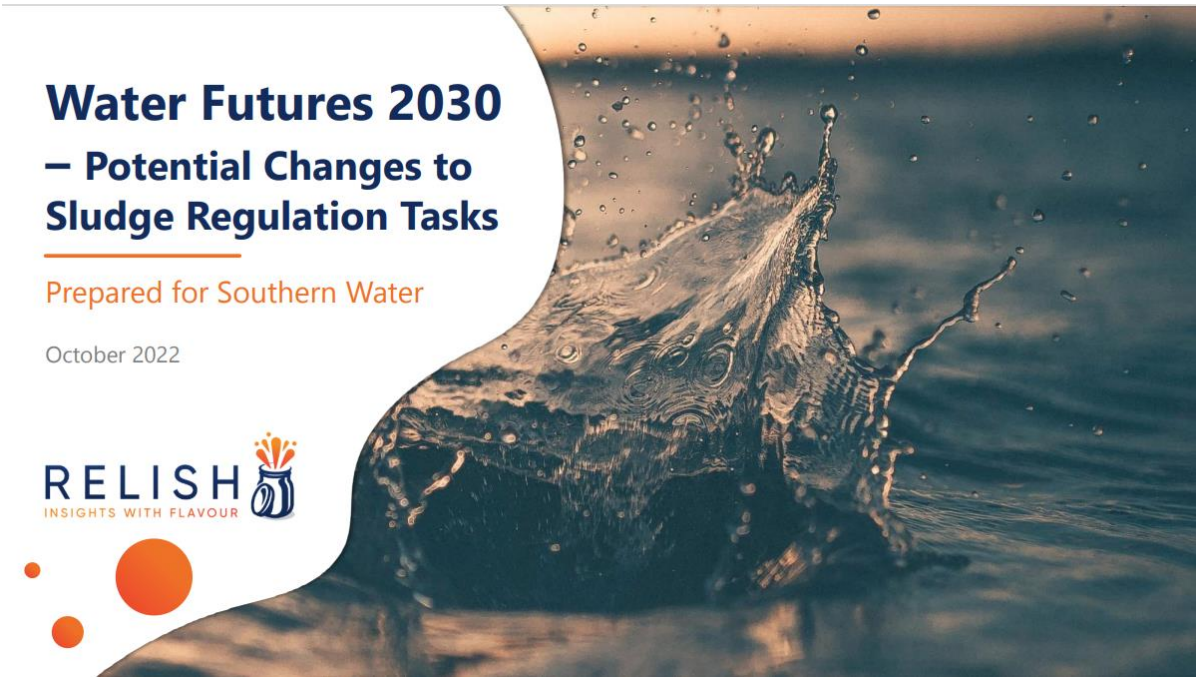
Appendix 2 - Water Future 2030 – Potential Changes to Sludge Regulations (Relish for SWS - 2022)



a. Positive feedback on AAD from customers

Advanced Digestion feels like the next logical step, however, there are concerns over timescales and in turn, future proofing

Impressions of Advanced Digestion

Advanced Digestion
- Wastewater is treated to a high standard with lots of regulations and criteria we need to meet. An end product called 'sludge' or 'cake' is provided to farmers and spread on their crops.
- There is a process called '**advanced digestion**' which is essentially a more advanced type of treatment.
- This means that the end product (sludge) is of higher quality.
- It can then be spread on more and different types of crops – so is more versatile and better used by farmers.
- Southern Water are currently planning to propose to introduce advanced digestion across their sites.
- It is likely to take between 10-15 years to complete – partially due to the spreading the cost but also the resource needed to upgrade sites.
- The current proposal being worked up is to focus on Kent in 2025-2030, and then across to Sussex and Hampshire after this.
- Southern Water have been working with Famers – who are supportive of the plans.

✓ Initial reactions are positive, with many feeling that anything more advanced or that produces a higher quality product is beneficial

✓ Being able to use this more broadly across more types of crops feels like we are making the most of what we have already got, again fitting well with sustainability

✓ It is assumed that this would have potential to replace current, harmful fertilisers and chemicals and as such, feels like a logical step to take

As such, overall customers are supportive of Advanced Digestion, however …

‼ Timescales do raise some concern, especially considering farmers are supportive – *if it is so good, we need to be doing this as soon as possible!*

‼ Although the need to plan resources and keep costs low is understood, there are worries that the technology may be out of date by the time it is implemented - *could it be a waste of time and money? And who is paying for this – farmers, customers?*

I think it is a good thing, making better use of what is probably, technically a waste product. Hopefully over the course of the expected 15 year timescale, technology will also improve/adapt to assist.

Seems like a good idea and if this is good for the environment, then I can't see why they wouldn't put this in place. I understand the need to do this slowly but it does feel like a long, long time.

My concern is who pays. The farmers should be paying a contribution here and not customers as it is they who directly benefit. The lead time of 15 -20 years seems very long though, and could be costly, is it worth the wait?

This sounds great I would be supportive of this. I would want to know though whether this means there are other more harmful products/ chemicals that can be used less?

4

b. Customers views on Incineration as a potential answer to mitigate impact of FRfW in the short-term

Customers initially feel that changes in regulations are a positive step, however, the need for incinerators brings this into doubt

Reaction to Potential Changes to Regulation

Potential Changes to Regulation

- There are currently discussions from the Environment Agency (EA) around how farmers use sludge on their lands.
- Many farmers store the sludge during the year, and the main use is in the Autumn – when spreading on their crops.
- The EA is concerned about the release of nitrogen and other elements, damaging soil health and waterways when used in a short period of time.
- As such, they want to change the regulations so sludge is spread less intensely (especially in Autumn).
- There is some dispute from the others about the extent of damage – and investigations and environmental impact studies are ongoing.
- If the new regulation changed, the volume of sludge produced and the need to spread with less intensity will mean that there isn't enough land available for farmers to spread this sludge in this way.
- This would then mean that Southern Water (and other wastewater companies) would need to use regular incinerators to dispose of the sludge – until the new technologies are available.
- Wastewater companies have been moving away from the use of incinerators as treatment has become more advanced.
- This is because they make a big difference to carbon emissions released.
- If the change to regulation happens, companies have said they would need to start bringing back incinerators in the shorter term.

✓ Initially the situation makes sense, it feels positive that if there are concerns over damage then this should be investigated and other plans put on hold ....

‼ ... However, the need to bring back incinerators makes customers question this

‼ It feels like a huge backwards step especially in an era of climate change and looking for more sustainable solutions. Almost a knee jerk / over reaction, surely the current damage cannot be that significant?

‼ Customers want to see proof of the damage currently being caused and how this compares to the damage that would be caused by bringing back incinerators, to understand if this step is justified

‼ There is disbelief that the damage from nitrates can be as bad as the damage to the environment from incinerators

My initial reaction to this is that it sounds counter-productive and leads to a backwards step which feels unnecessary. Bringing back incinerators seems like a big backwards step.

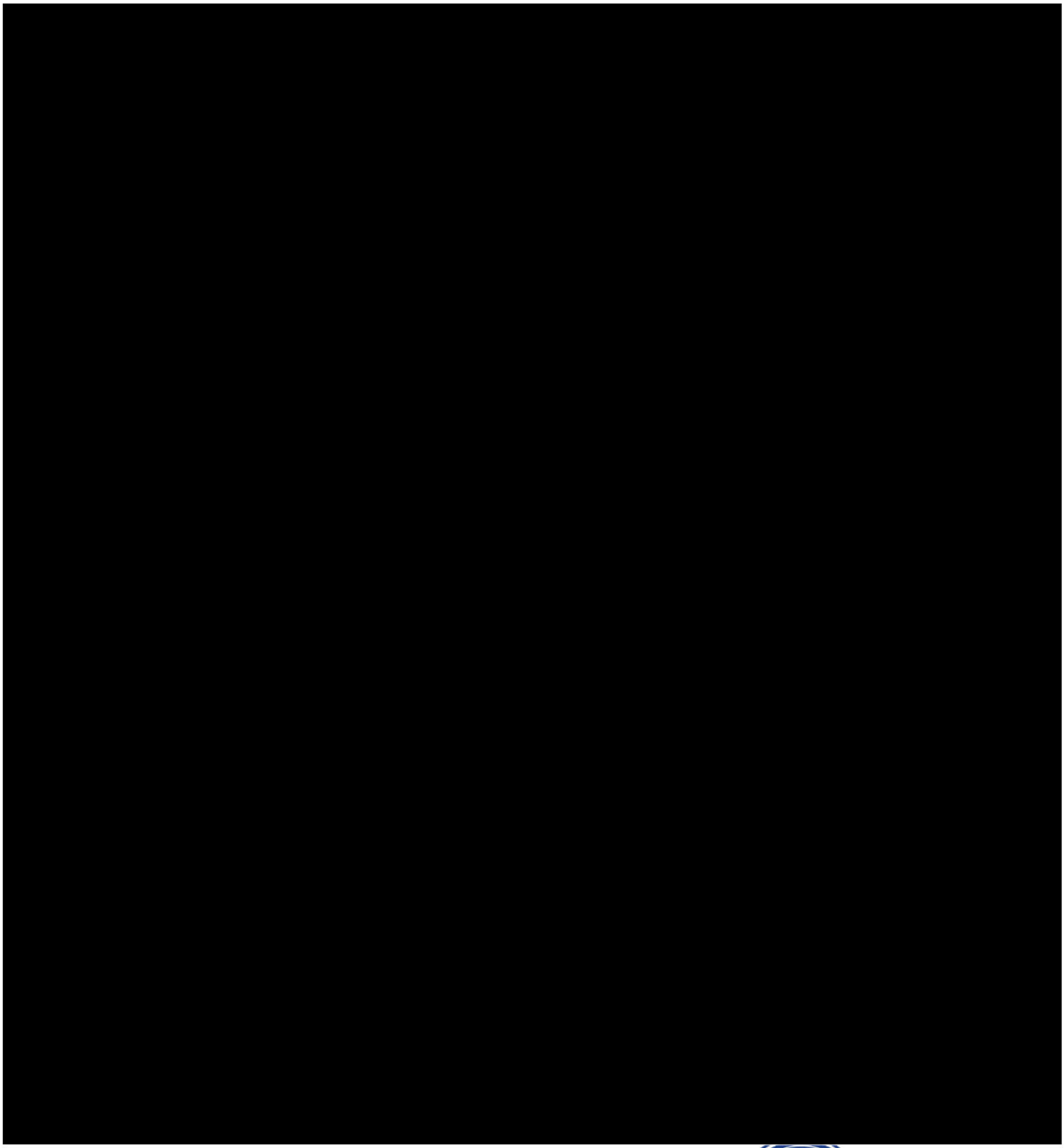
The regulations shouldn't be brought in until the new technologies are widely available, but I suppose it would depend on how much of an impact on soil the sludge has at the moment. I'm not sure it would be worth bringing back incinerator usage until the new technologies are available.

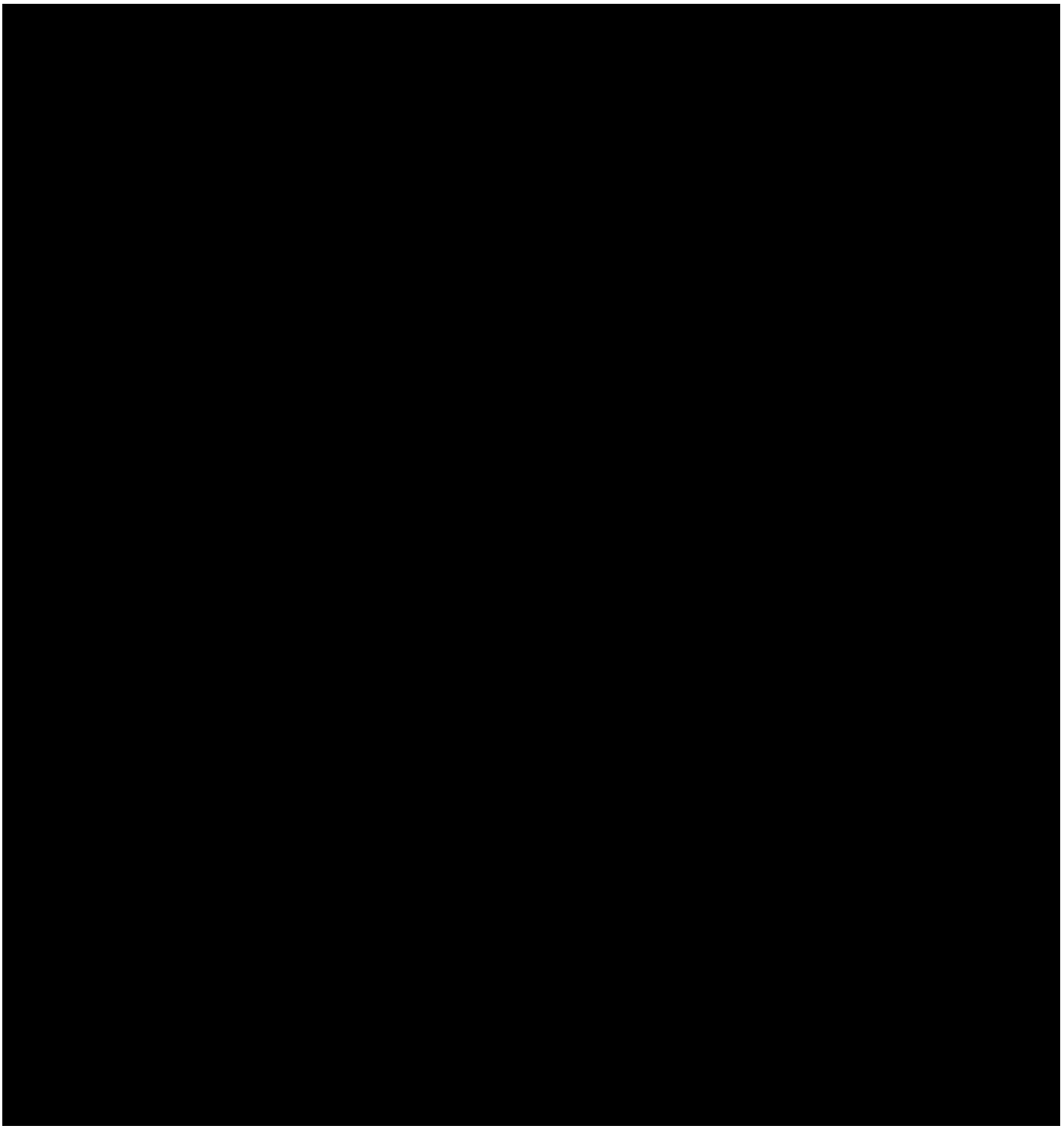
This feels frustrating because to protect soil health and waterways, water companies will incinerate waste thereby polluting the air, which I would imagine is another area of responsibility of the EA. I guess the question is which is the lesser of the two evils?

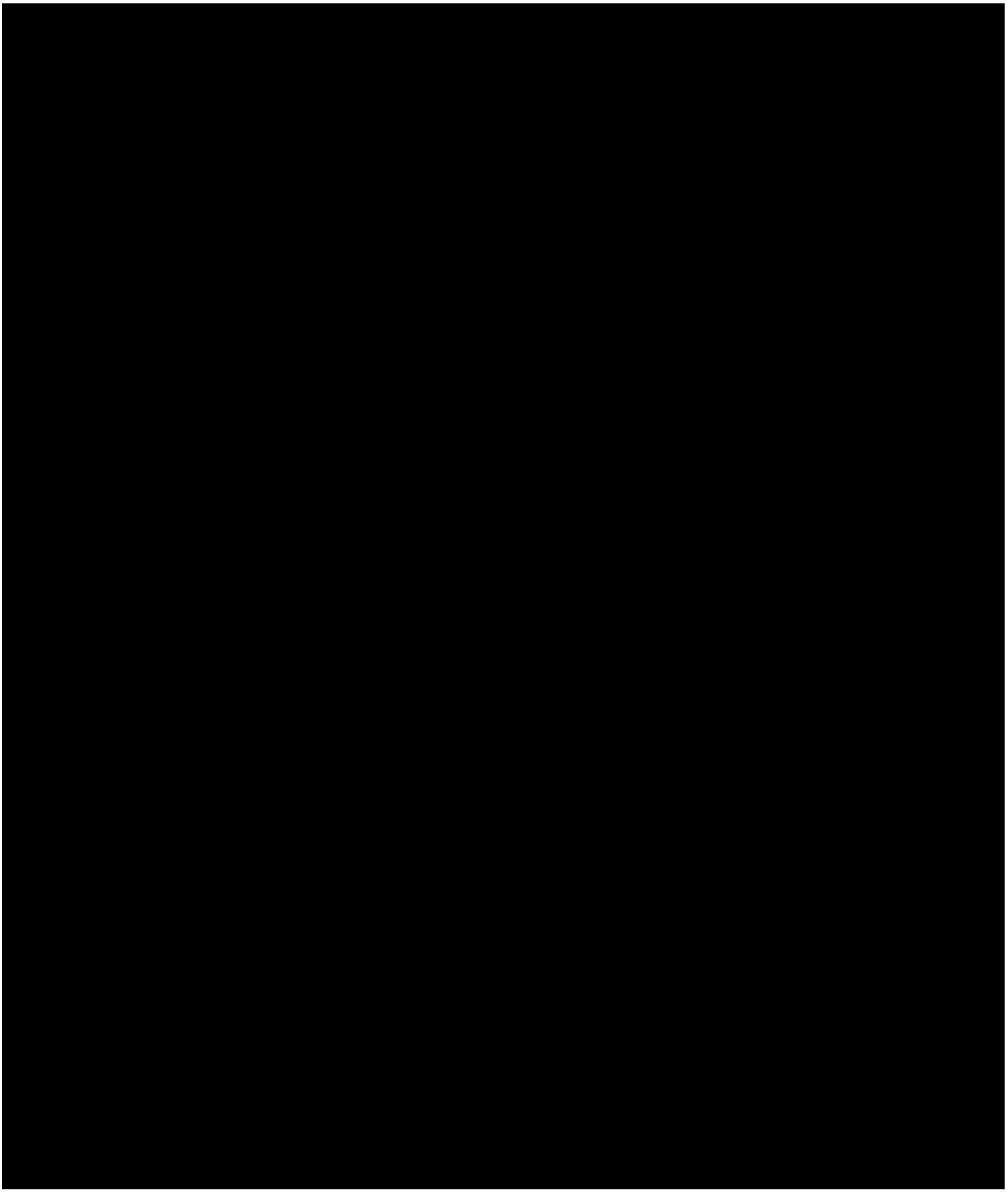
I would want to see definitive proof from the EA that additional nitrates are an issue in the autumn before going back to incinerators. There needs to be a balance of risks: how bad is the release of nitrogen compared to bringing back incinerators and damaging the atmosphere?

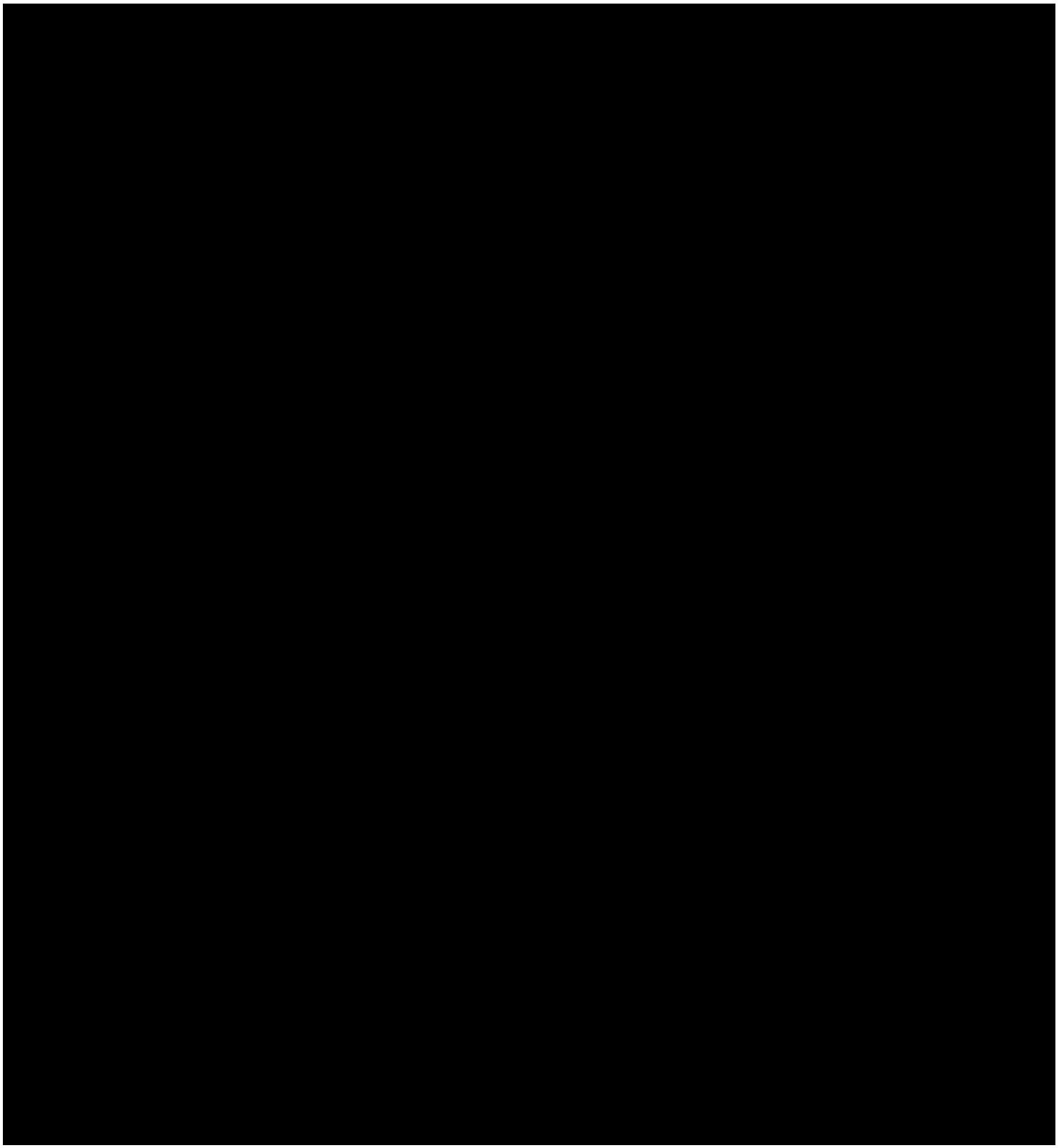
5

Appendix 3 – WINEP Sludge Driver Evidence – Biosolids Storage (Atkins for the Water Industry - 2022)









Appendix 4 – Southern Water National Landbank Study Results (Grieve Strategic for SWS - 2022)

ADAS grieve strategic

National Landbank Study

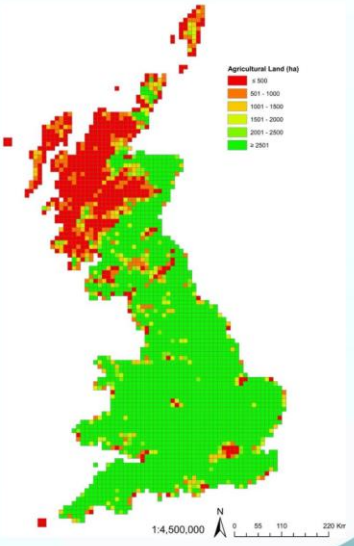
Southern Water results

25/10/2022

ADAS grieve strategic

Outline methodology

- Mapping and associated statistics showing change in available land between the five scenarios (i.e. colour coded maps showing available land across GB)
- In addition to the restrictions posed by the different scenarios, the mapping includes:
  - Physical legislative restrictions
  - Livestock manures
  - Competing non-farm organic manures
- Landbank required calculated based on three STC locations per company using bespoke company data
- Radial rings merge within companies, but overlap between companies



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Scenario 1

- Land available (GB): 4,781,000 ha
- Land required by Southern Water: 33,800 ha
- Total industry land required: 488,400 ha
- Haulage distance
  - Kent: 17 km
  - Sussex: 24 km
  - Hants & IOW: 25 km
- Average industry haulage distance *c.*30 km

Scenario 2

- Land available (GB): 2,958,000 ha
- Land required by Southern Water: 68,600 ha
- Total Industry land required: 980,000 ha
- Haulage distance
  - Kent: 31 km
  - Sussex: 45 km
  - Hants & IOW: 45 km
- Average industry haulage distance *c.*40 km

Scenario 3

- Land available (GB): 2,688,500 ha
- Land required by Southern Water: 92,200 ha
- Total industry land required: 1,195,800 ha
- Haulage distance
  - Kent: 70 km
  - Sussex: 70 km
  - Hants & IOW: 70 km
- Average industry haulage distance *c.*50 km

Scenario 4

- Land available (GB): 2,407,000 ha
- Land required by Southern Water: 329,700 ha
- Total industry land required: 5,475,900 ha
- Haulage distance
  - Kent: 146 km
  - Sussex: 146 km
  - Hants & IOW: 146 km
- Average industry haulage distance *c.*200 km

Scenario 5

- Land available (GB): 1,745,000 ha
- Land required by Southern Water: 705,700 ha
- Total industry land required: 11,628,700 ha
- Haulage distance
  - Kent: >500 km
  - Sussex: >500 km
  - Hants & IOW: >500 km
  - Note there are no distances quoted or radial rings as there is insufficient landbank for Southern Water's biosolids under this scenario
- Average industry haulage distance >500 km

Appendix 5 – National Landbank Study (As part of the Collaborative Bioresource Meeting presentation - Grieve Strategic for the water industry - 2023)

Collaborative Bioresource Meeting

30th March 2023

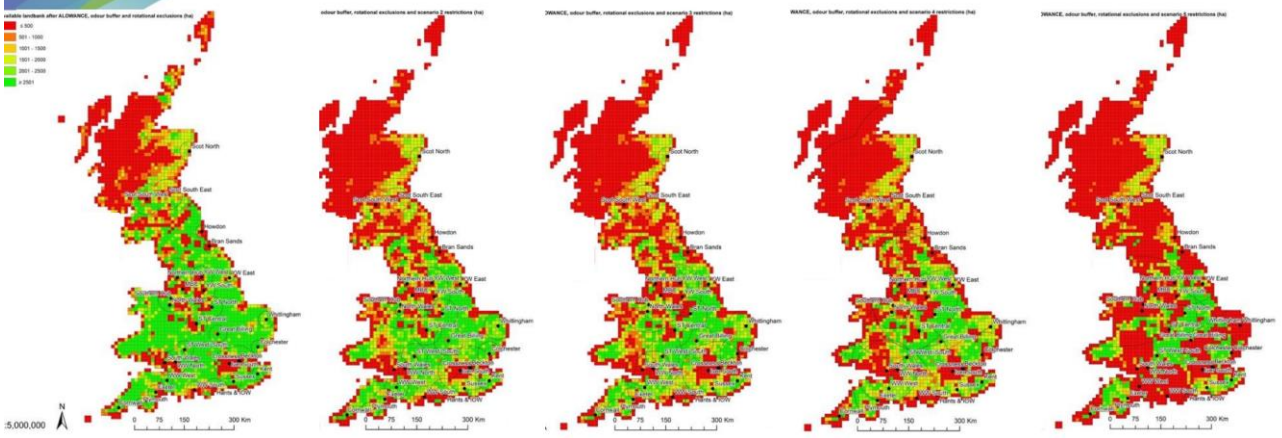
ADAS grieve strategic

National Landbank Study

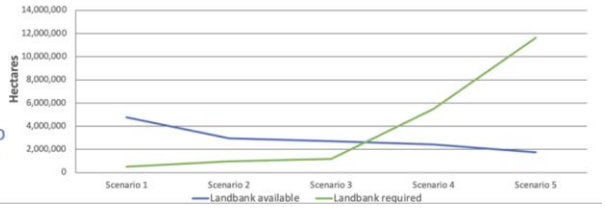
Clarification on scenarios and modelling

WATER for LIFE from Southern Water

Summary results



- For scenarios 1, 2 and 3 there is sufficient available agricultural land to recycle all GB biosolids via the modelled STC configurations
- For scenarios 4 and 5 there is insufficient available agricultural land to recycle all GB biosolids via the modelled STC configurations
- The two key areas of sensitivity driving the change between S3 & S4 are no autumn applications before winter cereals and increased restrictions on P additions



Key details of the scenarios[1]

Parameter	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Farmer acceptance	Baseline	5% reduction	15% reduction	25% reduction	40% reduction
Arable restrictions	Baseline	Reduction in autumn applications on sandy soils	Further reduction in autumn applications on sandy/shallow soils	No autumn applications except to oilseeds	No autumn applications except to oilseeds and limits in spring
Grassland restrictions	Baseline	Baseline	Reduction on conventionally treated biosolids to grassland and longer return periods	Severe limit on conventional, limits on autumn applications and longer return periods	No conventionally treated biosolids and increased restrictions for enhanced treated, including no autumn applications
Phosphorus restrictions	Baseline	Increased restrictions at index 3 (c.1 in 2) and 4 (c.1 in 6)	No application at index 4, index 3 consistent with S2 (c.1 in 2)	No application at index 4 and increased return period at index 3 (c.1 in 6)	No application at index 4, long return period at index 3 (c.1 in 7) and increased return period at index 2 (c.1 in 2)
Designated sites/priority habitats	Baseline	5% reduction in land available near sensitive sites and in sensitive catchments and SPZ2	15% reduction in land available near sensitive sites and in sensitive catchments and SPZ2	25% reduction in land available near sensitive sites and in sensitive catchments and SPZ2	No spreading near sensitive sites and in sensitive catchments and SPZ2
Biosolids quantities[2]	2020	2025 predictions	2030 predictions	2040 predictions	2050 predictions
Biosolids quality[2]	Baseline	10% increase in P	20% increase in P	40% increase in P	50% increase in P

[1] Full spreadsheet will be shared detailing all factors considered within the scenarios
[2] Companies have used their predicted date, percentages/set years have only been used where this data was not available

Appendix 6 – WINEP Sludge Update (EA to the Water Industry - 2023)

creating a better place
for people and wildlife

Environment Agency

Information Letter: EA/09/2023
Date: 22 March 2023

To: Regulatory Contacts in Water and Sewerage Companies

Dear Sir/Madam,

Water Industry National Environment Programme - Sludge update

We are writing to inform you of our completion of the option assessment for the sludge drivers (SUiAR_ND and SUiAR_IMP). This has been undertaken by the national sludge driver technical leads and Area colleagues.

In total WaSCS submitted 206 lines under the sludge drivers. There was a diverse range of proposed actions and the number of lines varied from 1 to 64 across the WaSCS. The assessment has resulted in 41 lines being marked as proceed in principle.

Assessment leading to rejection or removal of actions:
Lines that were considered outside the scope of the Sludge Driver were removed. This included if they related to existing regulatory requirements, business as usual and optimisation of existing treatment assets. Examples included, screening improvements, de-gritting, dewatering and thickening. Other lines were removed or rejected due to a risk of double counting with other actions, including population growth, P-removal schemes, Chemical Investigations Programme and Microplastics drivers.

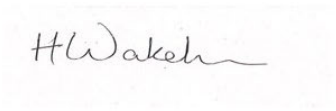
Assessment leading to actions to proceed in principle:
Using the Sludge Driver guidance we have taken a focussed approach to concentrate on actions relating to developing more resilient contingency measures when business as usual is disrupted and the environment is put at risk. We have given an emphasis on effective storage in the sustainable supply and use of sewage sludge. This is seen as the minimum action necessary to deliver improved resilience in the sludge supply chain to agriculture and other relevant use or disposal outlets. Permitted sludge storage would be a new investment as WaSCs currently rely on field storage.

We have not ignored the benefits which can be gained through other actions that deliver improvements in sludge management and handling. We recognise these actions may reduce the mass of sludge intended for use in agriculture and hence may reduce the cost of storage.

If you have any queries regarding this letter, please contact price_review@environment-agency.gov.uk

customer service line 03708 506 506
gov.uk/environment-agency

Yours faithfully,



Helen Wakeham
Deputy Director, Water Industry Regulation, EA

Cc
David Dangerfield - Director, Land, Water and Biodiversity, EA
Malcolm Lythgo - Director, Operations, EA
Richard Thompson - Deputy Director, Water Management and Investment, EA
Leonore Frear - Deputy Director, Water and Land Quality, Environment Agency
Amira Amzour - Deputy Director, Water Quality Policy, Defra
Harry Armstrong - Director, Regulatory Policy, Ofwat
Stuart Colville - Director of Strategy, Water UK