WORSHIPFUL COMPANY OF WATER CONSERVATORS

A THINKPIECE ON THE CURRENT STATE OF AFFAIRS OF BIORESOURCES MANAGEMENT

SEPTEMBER 2025

PROLOGUE

1 The Worshipful Company of Water Conservators (WCWC) is a City of London Livery Company focussed on the long-term health of our water resources and the broader related industries and their regulators, along with others who share our concern for water and the environment. Our experience and knowledge ranges from the complexities of environmental sciences, through the application of engineering to deliver the goals identified by those sciences, and the subsequent management of assets created. The WCWC's purpose is *promoting a diverse and sustainable environment.*

2 The subject of sewage sludge management (now known officially as bioresources) has been one of cyclical interest and in 2025 there is a peak of interest, as part of the focus on water companies. Four recent Guardian articles attest to this:

https://www.theguardian.com/environment/2025/jul/09/environment-agency-insider-alleges-cover-up-sewage-sludge-farmland

https://www.theguardian.com/environment/2025/jul/08/like-fly-tipping-ministers-ignoring-pleas-to-cut-sludge-fertiliser-use

https://www.theguardian.com/environment/2025/jul/07/toxic-sewage-sludge-british-farming-pfas-chemicals

https://www.theguardian.com/environment/2025/jul/14/waste-disposal-practices-are-harming-the-environment

Along with the Greenpeace Petition:

Petition to keep toxic sewage off our farmland

3 It must always be remembered that Society has faecal aversion arising from proper public health training and this is rejuvenated constantly. Water Conservators, in all walks of life, cannot be complacent about public attitudes, however they arise. The current focus on the 'yuck 'factor of sewage discharges has intensified criticisms of current sludge disposal practices. So, the WCWC has prepared this Thinkpiece on the present situation to contribute evidence rather than opinion.

4 In doing so the WCWC updates a Thinkpiece from 2022. This response is structured to aid readers.

Part 1 Summary giving headline observations and recommendations

Part 2 Overview of the issues

Part 3 Gives a Summary of what was said in 2022

Part 4 Gives more detail of what has happened since then

The document is admittedly long, but there does not appear to any other which draws together all the threads and it is important that, any assertion that some of the populist opinions are short on evidence, is backed by some exposure to that evidence.

PART 1 SUMMARY

5 This Thinkpiece seeks to bring together the current evidence on bioresources management and, in particular, biosolids use. It does so because of the decreasing use of evidence in the public debates on the topic. The principal focus is progress since 2021(See Appendix 1 for the position at that time).

6 Headlines

1. **For many decades biosolids (appropriately treated bioresources) have been used successfully in agriculture … now the overwhelming major route for managing bioresources…. with increasingly assured practices. This has been a contribution to the circular economy and to the mitigation of climate change, but big changes are in train. Ofwat now sees that bioresources have much greater market potential to exploit innate resources value than current practices for using biosolids. But there are risks in that the Environment Agency, EA, will restrict times of application to agricultural land and there are concerns about the impact of PFAS and micro plastics on soil and crop quality. And the EA wants to extend already extensive Standard Rules permitting for many aspects of bioresources management to include biosolids use in agriculture, and this is set out in the Strategy for the Safe and Sustainable Use of Sewage Sludge, in August 2023.The WCWC sets out several ideas for the ways forward .**

2. **There is no immediate threat from PFAS and microplastics, but their presence in biosolids could lead to unacceptable accumulation in soils and crops over long periods of time. Contrary to the descriptions in the media there have been, and are, significant efforts to understand the nature and extent of the problems caused by them and the consequent implications for bioresources management. And coupled with the technical impactions of wider market opportunities, the water industry has responded with a UK National Bioresources Strategy in September 2023. This formed a framework for bioresources in Company Plans for PR24 and started to prepare the way for PR29. And developed with Ofwat an extensive innovation programme. Any change of option from biosolids use will inevitably need a transition plan and will not be achieved overnight.**

3. **But the problem has been slow progress in developing the EA strategy and in taking the PR29 Action Plan, for bioresources, forward. And the fact that these two policy development streams do not feel well connected. Communication by the sector has not been as good as it should have been. And the risks elaborated above have been exacerbated by the general distrust by the public on all things to do with sewage treatment .. bioresources are a consequential casualty. And this has given space for ill-informed criticism.**

4. **In making its comments, the WCWC draws on the experiences from the 1980s in laying the foundations for current practices and regulation.**

5. **The WCWC argues that all of the work should be brought together into a single focus, consistent with the aspirations of government for regulatory streamlining and waits to see what the outcome on the implementation of the recommendations of the Water Commission will be.**

7 More details on key points are as follows

Context matters

1. The water companies and predecessors have managed sewage sludge (now known as bioresources) in several ways. They now rely principally on the agricultural use of appropriately treated products, known as biosolids (about 90% of all bioresources are managed in this way). The cost of this is significant, incurring up to 50% of sewage treatment costs. The value of the nutrients to agriculture is substantial, with the principal value being in the addition of organic matter for soil conditioning. This recycling is invaluable as a contribution to climate change mitigation and the circular economy.
2. This strategy is now at risk due to concerns about run off of nutrients applied by biosolids to land during Autumn and Winter, the threat of PFAS and micro plastics to soil and crop quality. It is also a casualty of the general debate about the way in in which sewage is managed. This concern has been compounded by poor communication on policy evolution and slowness of its execution.

Too much complexity and confusion

3. The WCWC observes that there is increasing complexity, professional introspection and diversity of contributors; there is not a single focus for national strategy and progress. Whilst the routes of perception may vary, all are agreed that now is the time for change. The question is to what?
4. The WCWC agrees with the overall conclusion of the Independent Commission on Water and CIWEM (Chartered Institution for Water and Environmental Management) for more focus and an updating of regulations, although not necessarily with their routes to that conclusion.

Poor communication

5. The lack of communication by the sector means that there are some trenchant views flourishing on the immediate abandonment of current practices. This needs sorting out urgently.
6. For example, there is plethora of nomenclature which needs sorting out
7. The effort being made on research and innovation needs much more publicity and extending.

Slow delivery of promises

8. The Water UK National Bioresources Strategy and the Environment Agency (EA) Strategy for the Safe and Sustainable Use of Sewage Sludge were published almost simultaneously in September and August 2023 respectively.
9. The Water UK Strategy followed up the Ofwat strategy for bioresources for PR24 and provided a framework for water companies as part of the PR24 process; but is not now available in the public domain. A second phase was completed, with the aid of AtkinsRealis called the PR29 Action Plan, for bioresources endorsed by Water UK, EA and Ofwat in October 2024. The strategically important elements which will help shape alternative strategic approaches have not been started yet. Information on this is difficult to track down and if progress is being made it is not visible to a wider audience.
10. There is also an apparent lack of progress with EA Strategy which needs better expression of connection to the Ofwat Bioresources strategy.
11. Both strategies promised working groups working in parallel but there is no publicly available evidence of progress, and this is at the heart of some of the reasons for the ill-informed media articles. They were not referred to in the final report of the Independent Water Commission. The ‘blockages’ need removing and the strategies need bringing together as promised, maybe by establishing or re-invigorating joint working groups as a starter. Creating a single focus must be a high priority. This reflects the observations above about communication and complexity
12. The lack of progress on regulatory reform not only causes the media criticisms which triggered this Thinkpiece, they also create uncertainty for water companies and investors.

Learning from the Past

13. Many of the lessons and evidence from the 1980s, which still underpin current regulations, have been forgotten and even paperwork had been lost. However, an archive has been established under the auspices of the Biosolids Assurance Scheme (Appendix 2).
14. Setting aside the rising concerns about microplastics and PFAS (per-and polyfluorinated alkyl substances, also known collectively as ‘forever substances’), there is no evidence that if the processes set out by the Biosolids Assurance Scheme are followed, that there is pollution of water, soil or plants. But there is no place for complacency. The BAS involves the concept of HACCP (hazard analysis and critical control point analysis), and work is continuing on hazards, contrary to the claims of the media.

Focus on future delivery

15. There is some dissonance on the way forward. Is it to maximise the commercial value of the resources content of bioresources or is it to find other ways of disposing / using the resources content due to the presence of PFAS, or is it both? The balance is moving towards finding other ways of treating the bioresources in place of biosolids use. With a need to ‘keep it simple’ A quote from a contributor to this Thinkpiece was ‘deployable, sustainable and resilient’.
16. If change of strategy on agricultural use of biosolids is needed, current practice cannot be stopped overnight. A clear transition plan would be needed which would not be an instant overnight process.
17. The innovation programme is being widened necessarily.
18. Criteria for PFAS and microplastics in soil are needed urgently to plan ahead. This must involve understanding all the sources of these substances The WCWC suggests a framework for understanding the impact of PFAS but recognises that the micro-plastic problem is more challenging. A full understanding of all sources of these substances in soils is needed urgently.

Regulation

19. The Government must take its broader responsibilities more proactively, for example in examining the practicality of regulation of washing machines for microplastics discharge. Regulatory inaction is part of the problem, and all parties would welcome more attention to this to avoid uncertainty, for example when modifying permitting regulations.
20. The WCWC recognises the intention by the EA to move the regulation of the use of bioresources to Standard Rules Permitting and expects that the whole package of several rules will be brought together with ‘areas of deployment’ being a crucial factor. A streamlined ‘fit for purpose’ set of integrated Standard Rules Permits would be an ideal candidate for regulatory streamlining as envisaged by the Government. This should maintain the concept of supplier self-monitoring suitably updated to reflect contemporary quality assurance requirements.
21. The sensible application of the Farming Rules for Water Regulations FRW remains a priority and they could be incorporated into the integrated Standard Rules.
22. In parallel to the concerns of the media, the WCWC is sure that the water services will be pleased to see uncertainty removed provided that it does not introduce draconian administration. Any changes needed for PFAS and microplastics can be added in due course.

Some other specific recommendations relevant to all ways forward

23. In urging the re-creation of a single national focus, the WCWC has included the Standing Committee of Analysts and institutions conducting crop trials. Standard Analytical methods are needed very urgently.
24. The WCWC suggests that whatever the future holds, it may be worth exploring the possibility for land agents to become involved to facilitating

administrative compliance with land-spreading restrictions on biosolids arising from the FRW.

25. The WCWC recognises the urgency of determining the ways forward which take account or PFAS and microplastics and sets out some suggestions. It is of a view that Government must make a more proactive contribution on behalf of the wider community to restrict uses. These are social problems and cannot be 'off loaded' on to the water sector to deal with. The WCWC support current actions being taken by Government of the banning of uses of PFAS.

Finally

26. The long-term way forward will be in the hands of whatever Government decides to implement on the Water Commission report and the WCWC hopes that it will heed the messages of this Thinkpiece. However, the whole topic cannot wait until this happens and some *pro tem* measures will be necessary to avoid more problems.
27. The WCWC observes that the way forward will have to deal with a mosaic of initiatives rather than straight line solutions and to repeat earlier comments… the best way of dealing with this is to create a single focus
28. The WCWC stands ready to help

PART 2 OVERVIEW

Context

The broad picture

8 This Thinkpiece updates a previous version explaining the position up to 2021; much has happened since then. It seeks to summarise progress and set out evidence to counterbalance the populist misconceptions about current regulation and practices. In preparing it, the WCWC observes that the whole subject has become even more complex and there are too many streams of influence not connected properly. The paper makes several observations which may not be popular in the water sector. Even so, the whole professional community must take responsibility for a situation to develop in which expressions like fly tipping, dumping, smearing, toxic waste, panicking are reported in a high-profile way, as views of insiders in the water companies, EA and even Defra. If reported accurately it shows that depth and breadth of understanding about what is happening is sadly lacking.

9 As a reprise to aid readers, the WCWC notes that around 3.6 million tonnes/annum of bioresources is recycled to agricultural land as biosolids in Great Britain, representing about 90% of all bioresources produced – the other 10% is incinerated or used in land restoration projects. Biosolids supply valuable nutrients, which are worth around £60 million/annum to farmers and importantly, in the context of soil function (including health), biosolids provide significant amounts of valuable (stable) organic matter. This has been practiced successfully for many years. But the sector has failed to communicate all the evidence on past experience or on the current situation. And this has been a major cause of the antipathy in the media.

10 To put this into a wider context, intensive agriculture has caused arable soils to lose about 40 to 60% of their organic carbon:

Summary of the state of the environment: soil (2019, updated 2023).

11 This highlights the need to reverse decades of soil organic carbon depletion, particularly in intensively farmed arable land. Organic manures, including biosolids, can play a big part in restoring organic carbon, soil structure and overall soil health.

12 The recently introduced Sustainable Farming Incentive (SFI) standards focus on improving soil organic matter (in arable and grassland settings), but specific measures to promote the use of organic manures (for example focusing on the use of non-fertiliser sources of nutrients on arable land) could help encourage arable farmers to increase organic manure use, which would have a range of soil health benefits (beyond just organic matter), as well as potentially helping to relocate organic manures from being repeatedly applied to the same typically grass-based land.

https://defrafarming.blog.gov.uk/2025/03/11/an-update-on-the-sustainable-farming-incentive/

13 The sustainable use of biowastes like other organic manures (including livestock manures, anaerobic digestate, compost, etc.), should be encouraged as part of a circular economy, given that they do not involve using finite non-renewable resources (e.g. phosphate) or require huge quantities of fossil fuels to produce (e.g. ammonium nitrate); whereas solid manures (like biosolids, farmyard manure, compost etc.) do supply valuable organic matter and improve soil function.

14 However, such products will always need to be used as well as manufactured fertilisers, given that manures have both lower nutrient densities and insufficient quantity of nutrients required to produce our food. That said, better use of organic manures could be made by ensuring they are applied where and when they are needed, in a way that means they do not give rise to a significant risk of diffuse pollution and particularly that the nutrients supplied are accounted for when calculating subsequent fertiliser requirements. And the WCWC observes that there is lack of clarity about the risks of applying liquid biosolids products, as compared to dewatered products, such as cake crumb or pellets (which most biosolids are). Dewatered products supply less nutrients but still supply the valuable organic soil conditioner.

15 Climatic change scenarios in different parts of the country, plus the difference in availability of suitable land in different river catchments, means that the operational challenges to apply treated bioresources (almost all as biosolids) when and where treatment centre production capacity needs, leads to issues in logistics, storage and reliable/efficient environmental application, for sewerage undertakers, as well as livestock farmers.

16 There are several quality assurance schemes in the UK promoting best practice in organic manure management (e.g. the Biosolids Assurance Scheme, Compost Certification Scheme, Biofertiliser Certification Scheme) and other schemes that

similarly encourage best practice on farms including soil health and environmental protection (e.g. Soil Association and LEAF). Encouraging the activities of these schemes through Earned Recognition presents an opportunity to promote better soil health without the need for additional regulatory intervention and at no cost to the Treasury. And this is explored in Appendix 1 and in the proposed future EA approach to permitting which is also explored later

And now

17 A stable past has become an uncertain future for reasons which this Thinkpiece explores later. The entire issue of biosolids use has become, even more, a topic of introspection amongst a community of aficionados within the sector, whilst the wider world is full of misinformation. Contributors use different syntax, do not necessarily agree on the way forward, and promised courses of action have not been followed. This is surely a failure at many levels and certainly in communication with the wider world. It allows ill informed, inaccurate views in the wider world to take precedence. Even the Independent Commission on Water ('The Cunliffe Report') makes its recommendations on limited evidence; and organisations like CIWEM have not necessarily helped to ensure that a wide evidence base is communicated effectively.

https://assets.publishing.service.gov.uk/media/687dfcc4312ee8a5f0806be6/Independent_Water_Commission_-_Final_Report_-_21_July.pdf

Should we be putting sewage sludge on land anymore? - CIWEM

18 The WCWC found that strategies developed by the EA for safe and sustainable sludge use, and by Water UK (aided by CIWEM) for bioresources, published at the same time in August and September 2023 respectively, do not appear to be well connected; they even use different nomenclature. The Ofwat bioresources strategy used for PR24 does not feel connected to the EA strategy; they should be in partnership in seeking solutions to a significant problem. Whilst the Ofwat and Water UK strategies do have a better fit, it would be better still if there was one national focus.

https://www.gov.uk/government/publications/environment-agency-strategy-for-safe-and-sustainable-sludge-use/environment-agency-strategy-for-safe-and-sustainable-sludge-use

Water UK - new report calls for development of National Bioresources Strategy for England

https://www.ofwat.gov.uk/regulated-companies/markets/bioresources-market/

19 The notion put forward in the 2022 paper of a national strategic framework for managing bioresources envisaged a much more integrated approach, a single focus, and, indeed, that is one of the recommendations of the Independent Water Commission. There have been several pressures on the management of sewage sludge, which from now on will be described mostly as bioresources in this Thinkpiece unless reference is being made to other documents; and that embraces

the term biosolids use as one way of exploiting bioresources. The WCWC makes some suggestions how the terms can be better harmonised.

20 The problem with both the Ofwat bioresources strategy and the EA sludge use strategy (more of these later) is that they do not understand the deep roots of current practices. For decades, the water sector has had corporate thinking in regulation and operational practice in which bioresources are a waste byproduct of the principal function of sewage treatment and has to be disposed of as cheaply as possible without causing nuisance or harm, while at the same time recognising that this byproduct contains valuable resources which can be exploited.

21 In psychology, there are many terms for this duality of thinking; ambiguity, cognitive dissonance, and so on, yet the sector managed. The language of dealing with customers of bioresources products, mostly farmers, was somewhat different to the regulatory language. Things have changed in recent years, and the entry of politics and media has meant that confusion occurs.

22 In bygone times, it was often more convenient., particularly for big cities, to dispose of sludge to sea, landfill or incineration. Even then, there was an element of extracting resource value out of the practice. Sewage sludge dispersed at sea was anaerobically digested and electricity generated from the sludge biogas, and incineration was practiced on the basis of the principles of energy from waste.

23 These ideas are well established and not new as some commentators surmise. Since then, quite rightly, the environmental restrictions on landfill and marine dispersal and the cost (environmental and social impact) of incineration has resulted in almost all bioresources being now exploited as biosolids, with some limited exotic uses. It is the gift of nature (for the moment) that the cheapest disposal option is also now one which offers the best opportunity to exploit the resources contained therein, or the Best Practicable Environmental Option (BEPO), and for years this has been government policy.

24 There is very little evidence, if any, that if the practices, as recognised by the Biosolids Assurance Scheme are followed that pollution of water, soil or crops will occur, other than emerging concerns about PFAS and microplastics. A growing focus on wastewater management needs greater re-assurance. As part of the BPEO, biosolids use, recycles valuable organic matter and nutrients and make a positive contribution to climate change mitigation, by reduction of carbon emissions, as was highlighted in COP 26 by Anglian Water.

<u>Biosolids: the greatest story never told at COP26 - CIWEM</u>

25 There are new dynamics as described in Appendix 1 arising from restrictions on land-spreading of dewatered biosolids and concerns about the accumulation of PFAS and microplastics in soil which are challenging this confidence.

26 Up to half the cost of treating sewage is incurred in bioresources management and so it is a significant contribution to overall water pricing. The water companies have vested interests in doing things properly.

Upstream.pdf

https://www.sciencedirect.com/topics/chemical-engineering/sewage-sludge-treatment

The emergence of the notion of bioresources in the front line of management

27 The understanding of bioresources as a marketable resource goes back many decades as the Manuals produced by the IWPC (a forerunner of CIWEM) in the late 1970s attest. One of the recommendations of the previous edition of this Thinkpiece was that an archive should be established to store information and evidence used to create the current regulatory framework. This has been established in Cambridge under the wing of the Biosolids Assurance Scheme and details are given in Appendix 2. This includes information on the drive for alternative outlets and technologies in the 1980s. For example, it shows that contactors have been used for agricultural operations for a long time; it was partnership between Anglian Water and contractors which resulted in the development of sludge injection of liquid anaerobically digested biosolids.

28 The experience of the research programmes in the late 20th Century showed that novel processes and outlets were not serious competitors to the mainstream of agricultural use and plant was installed as demonstration projects, rather than for mainstream use. The advantage in narrowing the options on resource exploitation was that within a water services utility, a common scheme to offer agricultural services and a fairly uniform technology of treatment enabled management focus and kept overheads down. The downside of this, was the risk that if that route of management was compromised, as it happening now, there would be less resilience. On the other hand, if there is a wider miscellany of exotic uses, the overheads for support will be higher. That is a lesson for whatever comes next for bioresources management.

https://www.sciencedirect.com/topics/chemical-engineering/sewage-sludge-treatment

29 As explained in Appendix 1 and outlined in the Ofwat policy paper cited earlier, in 2017 Ofwat established the formal concept of bioresources in which the notion of agricultural use of biosolids use was just one way of exploiting resources, thus shifting the balance. The environmental regulatory regime was unprepared for this, hence the initiative in 2020 by the EA. The drive was to find ways of complementing the agricultural route rather than competing with it, which required new thinking.

30 But this change, the introduction of more restrictions on land spreading of dewatered biosolids (the Farming Rules for Water, FWR) and the rising concerns on PFAS outlined earlier is pushing the balance now even more towards other ways of exploiting bioresources other than by biosolids use.

Rising threats

31 This Thinkpiece is intended to demonstrate that the use of biosolids is far from being unregulated, in contrast with populist views. Everyone recognises that

whatever regulatory system emerges, these new threats must be accommodated by evolutionary change.

Nutrient run off

32 The WCWC observes in the text of this Thinkpiece, that has been little evidence to show that Autumn or Winter application of dewatered biosolids to land causes problem with nutrient run off. The WCWC also observes that there may have been some confusion over the difference of impact of applying liquid as compared to dewatered products. Biosolids are provided as crumb, cake or pellets. Whilst the nutrient content of dewatered products is less, there is less chance of run off and the essence of organic soil conditioning is retained. The latest interpretation of the Farming Rules for Water Regulations is less onerous there are still restrictions and administrative processes to make this a challenge, but it is not insurmountable.

https://www.gov.uk/government/publications/applying-the-farming-rules-for-water/applying-the-farming-rules-for-water

33 This Thinkpiece addresses this and suggests that the role of land agents could explored to become more prominent in the administration process of FRW. However, the number of willing farmers is reducing and hence so is the available landbank and the ill-informed publicity does not help.

Worries about PFAS and Microplastics

34 The wider concerns about PFAS and microplastics are now focussed on their presence in bioresources. These are legitimate concerns which need addressing. These may be sufficient to demand a completely different approach to ultimate use. The original national strategy as expressed in the 1989 Code of Practice on the use of treated sewage sludge (biosolids) in agriculture, and as updated and extended since then, always envisaged that, if and when, there is evidence to show that additional limits need to be added then they will be. Until now no such limits have emerged. The WCWC is disappointed that there is persistent reference to the current practice only having limits for heavy metals; even the Water Commission report made this mistake. In the 1989 Regulations and Code the focus was on a potentially toxic elements in a much wider range than the 1986 Directive.

35 The WCWC observes that concerns about these substances in biosolids has surged in the last four years. The biosolids themselves are not toxic, they contain sufficient traces which will accumulate in soil with repeated applications to levels deemed to be unacceptable. So, this is not an immediate problem requiring instant cessation, which does require urgent attention. That is not complacency on one hand or panic on the other, rather it is prudence. The impact of these vectors is slow so there is time to react and current practices cannot be halted ‘at the drop of a hat’ If the use of biosolids is compromised by evidence projecting unacceptable long-term impacts particularly from PFAS then practices will be altered or stopped. The WCWC sees that there may be a way forward for PFAS but recognises that it will be microplastics which might cause the cause greatest long-term challenge.
These issues are summarised in more detail in Part 4

Responding to the threats and opportunities

Innovation by the water sector

36 A great deal of effort has gone into technical innovation particularly in the Ofwat Innovation programme which started after 2021, and the focus is widening. This Thinkpiece provides a high-level summary of progress in Part 4 but cannot be comprehensive, just indicative. There is a focus on how to cope with the PFAS as well as exploiting the innate resources value.

https://www.ofwat.gov.uk/regulated-companies/innovation-in-the-water-sector/water-innovation-competitions/

UKWIR is also a contributor on behalf of the water companies

https://ukwir.org/response-to-national-bioresources-strategy-prioritisation-of-resource-recovery-opportunities

37 Innovation is more than development of treatment technologies; it is about change. Finding new ways of involving land agents is an example. One of the lessons of the 1980s is the close correlation between treatment and deployment; crop trials played a big part in determining current practices. Several of the innovation projects focus on treatment and have rather glib intentions that the products, such as biochar can be used in agriculture. The WCWC advocates the inclusion of crop trials not only to provide information to customers but to underpin any future legislation.

38 This Thinkpiece sets out some notions as to what is required to provide a 'logic thread' for all aspects of innovation from problem to solution. It is difficult to create an overall picture of what is happening already, because there are so many contributors, which allows the notion of complacency and panic to flourish simultaneously.

39 Different aspects are under the leadership of sundry contributors. What is set out below would really benefit from one integrated leadership on innovation particularly for PFAS and microplastics

- Develop analytical methods. The WCWC advocates bringing the Standing Committee of Analysts to be much more closely involved, with Defra or the EA

- Agree soil and crop targets. The WCWC advocates bringing institutions managing crop trials to be much more closely involved, with the EA

- Establish the effectiveness of sewage and bioresources treatment processes. The Ofwat innovation programme is contributing, but more is needed, with leadership from Ofwat, Water UK and UK Water Industry Research (UKWIR)

- Determine action on control of PFAS and microplastics in sewage. The Government has a big role to play here with the EA

Water Company Leadership

40 To cope with the uncertainty the water sector not only participated in the innovation programmes, but through Water UK, facilitated by CIWEM, produced the UK National Bioresources Strategy in September 2023 which is summarised in this Thinkpiece (see Part 4 and Appendix 4).

Access Water | National Bioresources Strategy for the England

41 It followed up the Ofwat strategy for bioresources for PR24 and provided a framework for water companies as part of the PR24 process ; but this is not now available in the public domain .The second phase was completed , with the aid of AtkinsRealis called the PR29 Action Plan for bioresources, endorsed by Water UK, EA and Ofwat in October 2024 The strategically important elements which will help shape alternative strategic approaches have not be started yet .Information on this is difficult to track down and if progress is being made it is not visible to a wider audience. It does not seem to be connected to the EA Strategy for the Safe and Sustainable Use of Sewage Sludge (which is also languishing, see later in Part 4). This apparent lack of progress on both counts contributed to the perspectives expressed in the media. It was not referred to in the Final Report of the Water Commission. It is discussed in more detail in Part 4 and in Appendix4

https://assets.publishing.service.gov.uk/media/687dfcc4312ee8a5f0806be6/Independent_Water_Commission_-_Final_Report_-_21_July.pdf

which was not even referred to in the recent blog by CIWEM which had facilitated it,

Should we be putting sewage sludge on land anymore? - CIWEM

which also failed to mention the Biosolids Assurance Scheme as well.

42 These issues did feature in the final determination of water prices for 2025-2030 (PR24) with warnings about the uncertainties.

Environmental Policy and Regulatory Leadership by Defra and the EA

Defra Leadership

43 A really effective step by government will be to take the leadership of creating a single focus of policy and practice development. The WCWC observes that the way forward will have to deal with a mosaic of initiatives rather than straight line solutions and the best way of dealing with this is a single focus. Any national plan must be linked to the Circular Economy Task Force to reflect synergies especially with regard to the opportunities for recovery of resources, water itself being the most important.
44 It has been made clear that making the necessary changes to regulations, per se, is not within the gift of the EA or Ofwat. t is the responsibility of Defra, and it is the delay in this transaction which is referred to in the media articles.

45 The control of PFAS and microplastics (‘forever substances’) in sewage rests as much in the responsibility of Government itself. In Part 4 of this Thinkpiece highlights

the actions taken, or planned, by government but suggests that much more needs doing not only for bioresources, but in general for societal protection. There is no doubt that diffuse contributions of 'forever substances' are a difficult problem to solve; they arise from societal practices and the products used, need to change. The question is how much by persuasion and how much by regulation, and the water companies are as eager as any bodies for action to remove uncertainty. The WCWC will support the proposed actions by Government on the use of PFAS.

PFAS in firefighting foam (FFF) restriction proposal - Health and Safety Executive - Citizen Space

46 The way forward is much more clear-cut for point source control. There are some misconceptions, for example, the recent CIWEM blog refers to: *It's up for debate how much water companies are potentially making things worse for themselves by additionally accepting relatively small volumes of commercial effluents (compared to domestic), for which there isn't adequate regulation through the conventional sewage treatment train.*

47 This fails to understand that water companies are obliged to take trade effluents (subject to appeal) and that there is extensive legislation for the control of those effluents. That is how the concentrations of potentially toxic elements were reduced in the 1980s. It would be easy for the government to add PFAS and some microplastics to prescribed processes to the schedules in the Trade Effluents (Prescribed Processes and Substances) Regulations 1989 and that would help.

48 In the 1980s such issues as this would come under one focus within the national umbrella driven by national government; there is nothing like that now. The WCWC recommends creating such a national umbrella, but *pro tem* without waiting for what could be protracted processes the three parties the EA, Ofwat (or whatever comes next) and Water UK could establish a joint working group to bring all the threads together on the threats of PFAS as a starter. This would need the participation of Defra as well (there may be an existing working group which needs reinvigoration). In the meantime, the WCWC sets out a framework for PFAS management, but recognises that it will be microplastics which might pose the greatest long-term challenge.

EA Leadership

49 Even without the threats of FRW and 'forever substances', the growing focus on wastewater management means that bioresources management needs greater re-assurance. This is compounded by a drive for a wider reach of environmental permitting restrictions on biosolids. During the recent five-year period, the EA has issued its strategy for the safe and sustainable use of sewage sludge in August 2023. No progress, at least in public, has been made since then. It does not communicate well with the Ofwat Strategy, and has not progressed

https://www.gov.uk/government/publications/environment-agency-strategy-for-safe-and-sustainable-sludge-use/environment-agency-strategy-for-safe-and-sustainable-sludge-use

50 The WCWC expects that the EA will play its part in the practical way forward such as by ensuring that these are appropriate analytical methods and that new soil criteria are robust.

51 The WCWC interprets this as moving in the direction of Standard Rules Permits; this Thinkpiece explores this in some depth. Any transition needs to avoid any unnecessary extra restrictions on bioresources uses arising from administrative process. The WCWC recognises that there is already a complexity of Standard Rules permits for a range of bioresources activities and this Thinkpiece summarises them. These could be harmonised and biosolids use added, the key will be in the 'areas of deployment'. The sensible application of the FRW Regulations remains a priority and their requirements could be included in a more helpful way.

52 Any future approach to regulation of biosolids must be to support and encourage safe utilisation and not be a restrictive hurdle although it may contain new limits which make biosolids use impracticable. Any new restrictions, such as those arising from PFAS will be added in due course when the evidence is available.

The way forward

53 There is an apparent lack of visible progress with the EA and Water Uk strategies The EA Strategy needs better expression of connection to the Ofwat Bioresources strategy (this is discussed later). Both promised working groups working in parallel but there is no publicly available evidence of progress, and this is at the heart of some of the reasons for the ill-informed media articles. They were not referred to in the Final Report of the Independent Water Commission. The 'blockages' need removing and the strategies need bringing together as promised, maybe by establishing or re-invigorating joint working groups as a starter. And they need explaining better. This reflects the observations about communication and complexity.

54 The lack of progress on regulatory reform not only causes the media criticisms which triggered this Thinkpiece but also creates uncertainty for water companies and investors.

55 Everyone agrees that there needs to be integration of the policy threads. The sooner that matters can be resolved, the better to reduce uncertainty. The way forward must be based on evidence and not prejudice. To avoid repetition the suggestions made by WCWC are brought together in the Summary.

56 The problem is that there are many contributors to the way forward and because there is not a single national focus, no one is giving an alternative narrative with better informed news. The WCWC repeats the need for a single focus, as the Water Commission and CIWEM have done, although not necessarily with all their arguments for doing so. There needs to be a single focus, either by much closer working, or even integration of all the workstreams. These might be two sequential steps, depending on the outcome of the Government response to the Water Commission report will be. This fits in with the Government plans for regulatory streamlining.

PART 3: WHAT WAS SAID IN 2022

57 The previous peak of interest was in 2021, which reflected the debate on the 2018 ‘Farming Rules for Water’ and when the EA was considering implementing a new sludge strategy. Primarily this was a new regime for treated sewage sludge used in accordance with the 1989 Regulations, termed biosolids. As a result, one of our Past Masters was asked to prepare a review for Water UK via CIWEM. This is attached as Appendix 1. This is the paper being updated.

The key recommendations are given below

We need at a national level:

- A return to the benefits of a **national focus of all interested parties** creating the background to future agreement on the best way forward. Such a national consensus served us well in 1981 and could serve us equally well in 2021.
- An integrated national strategy for managing sewage sludge and to reflect the Ofwat terminology, this should be described as the ’**National Strategic Framework for Managing Bioresources’**. The objectives should be to ensure the safe management of all bioresources and, in particular, to ensure the safe, sustainable, assured, desirable use of biosolids in agriculture as the favoured option. In this context the term bioresources is as used by Ofwat and not by ADBA, the Anaerobic Digestion and Bioresources Association. It should contain modules setting out the requirements for each option of management. Existing regulatory and control modules could be slotted in, as now, but kept under review.
- A coherent process for developing the **evidence base and evaluation of emerging risks**.
- A **national archive for sludge management practice** held most probably by the Biosolids Assurance Scheme, to collate knowledge before paper records and memories fade.

We need specifically:

- To take stock of the proposed changes to the control of biosolids in agriculture and consider an update of current practices including the conferred status of an **Earned Recognition Scheme**.
- Within the Strategic Framework, there should be separate modules for the **agricultural use of co-treated products** and uses of **treated sludge in land reclamation and in forestry**.
- The Biosolids Assurance Scheme could be modified to provide separate primary assurance for biosolids use in agriculture, while also applying the principles to the other land management modules, without confusing terminology. It could be renamed the **Bioresources Assurance Scheme**. This essay recognises the different regulatory regimes for those modules. The essay also suggests specific tweaks to make life easier. This widening of assurance, without compromising the concept of biosolids, will give greater comfort to the wider community about Water Company practices.

PART 4: MORE DETAILS ON WHAT HAS HAPPENED SINCE 2022

Naming and not Shaming, and what do the words mean?

Biosolids

58 The one recommendation not addressed - in fact it is getting worse - is what the products are named. In the 1970s and 1980s when the Codes of Practice and Regulations were produced by a national consensus (as described in appendix1) and there was a need for customer-friendly syntax, not a rebranding of an unacceptable practice. There was recognition of the fact that the word sludge is not 'uplifting'. So, the UK, via CIWEM, the European Water Association, WEF in the US and similar organisations in Japan and Australia (in a working network known as Water Associations Worldwide) created the word' biosolids' to describe sewage sludge treated and use properly and safely in agriculture.

59 Unfortunately the word did not translate well in some European languages and so the 1986 Directive used the word 'sludge' in its title and hence that was reflected in the 1989 Code and Regulations. The water sector was used to the concept of the principal route of sewage sludge management being as biosolids in agriculture. So, the working nomenclature was different to regulatory nomenclature and this paradox continued for several years without too much challenge.

60 This left uses of treated sewage sludge on other kinds of land without any special nomenclature and there were no terms which described co-treated products apart from digestate from anaerobic digestion. Unfortunately, this term, digestate, also applied to a majority of the products supplied as biosolids and to digested farmyard manures under the heading of biowaste, another term which emerged from the Waste Framework Directive.

https://www.gov.uk/guidance/biological-waste-treatment-appropriate-measures-for-permitted-facilities/2-definition-of-biodegradable-and-sewage-sludge

Bioresources vs Sewage Sludge

61 There was also a drive to view sewage sludge as a valuable resource in a wider context. In 2017 Ofwat introduced the term bioresources (or sewage sludge), as the semi-solid by-products of wastewater treatment. Ofwat's view was that the right conditions, promoting the role of markets in relation to bioresources activities will help the sector to meet its potential to create economic and environmental value by enabling and incentivising technological changes, economies of scale, inter-company optimisation and co-digestion of sludge with other organic waste. More of this later as the concept has become embedded in the Price Review processes.

https://www.ofwat.gov.uk/regulated-companies/markets/bioresources-market/

62 While the term 'bioresources' appears to cover the whole spectrum of activities of sewage sludge management, even the definition offered by Ofwat cannot quite bring itself to be clear. In many documents, even official ones there is still the word sludge appearing in parentheses. As an example, in Northumbrian Water (NWL), the terms are not used clearly:

https://www.nwl.co.uk/business/nwgrow/

NWL published a Bioresources Strategy in September 2023 in which the word is only used on the front cover, but then the entire document refers to the sludge strategy:

https://www.nwg.co.uk/globalassets/business-plan-2025-30/nes64.pdf.

63 The term was perpetuated in the Water UK National Bioresources Strategy also published in September 2023:

https://www.accesswater.org/publications/proceedings/-10091945/national-bioresources-strategy-for-the-england

64 The EA has been stuck in the European translation dilemma of 1986. In 2020/21 the EA talked about its Sludge Strategy, which but it was principally about biosolids for agricultural use. With Brexit the UK can create its own syntax. and in August 2023 the EA produced its strategy for the Safe and Sustainable Sludge use, which could be tagged as Biosolids Plus.

https://www.gov.uk/government/publications/environment-agency-strategy-for-safe-and-sustainable-sludge-use/environment-agency-strategy-for-safe-and-sustainable-sludge-use

65 In 2022, CIWEM was commissioned by Water UK to develop a bioresources strategy for England to 2050.

https://www.accesswater.org/publications/proceedings/-10091945/national-bioresources-strategy-for-the-england

And in the cauldron of confusion on nomenclature, even CIWEM reverts to uncertain terminology:

Should we be putting sewage sludge on land anymore? - CIWEM

66 There does not appear to be any helpful cross linkage between the Ofwat and Water UK strategies and the EA Strategy on nomenclature and indeed in the strategies themselves. The system cannot sustain parallel strategic development with different terms; this needs to be sorted out.

67 If it is agreed by all parties that the focus will be to use a sludge as a valuable bioresource, maybe the nomenclature could be:

Sewage Sludge Management which recognises that sewage sludge is a valuable bioresource and hence the preferred method of management is by its safe and sustainable use in agriculture regulated by whatever emerges from the implementation of the 2023 EA strategy.

68 The term bioresources is now deeply embedded, so an alternative could be for the headline to be a truly National Bioresource Strategy, one owned developed and

executed by all parties, incorporating all policy streams in which there is one of definition that bioresources is a term describing sewage sludge and all products derived therefrom.

Part one. A truly national statement that the preferred method of managing bioresources is by exploiting their valuable contents.

Part two. The Best Practicable Environmental Option (BPEO is by using appropriately treated bioresources as a soil conditioner / fertiliser particularly in a safe and sustainable way in agriculture as biosolids.

Part three. The safe and sustainable use of other treated bioresources including products of co-treatment and other kinds of land spreading of all bioresources. This may be set out jointly with part two as envisaged in the current EA Strategy.

Part four. The overall national strategic delivery of the regulated activities by the water companies as set out now in the Water UK strategy and forming part of Ofwat processes, with options for other methods of resource recovery particularly if the agricultural and land spreading options become unviable.

Each of these could be associated with bundles of Standard Rules Permits which this Thinkpiece discusses later.

69 To make matters worse, BioResource has other meanings.

https://www.bioresource.nihr.ac.uk/

The NIHR BioResource is part of the National Institute for Health and Care Research (NIHR). The NIHR funds, enables and delivers world-leading health and social care research that improves people's health and wellbeing and promotes economic growth.

Biosolids Archive

70 Many statements are being made without an understanding of the evidence used to underpin current practices. Unfortunately, most of that evidence was undigitized and has been scattered. The 2022 paper recommended the establishment of an archive. A physical archive has been established under the wing of the Biosolids Assurance Scheme at Cambridge Sewage Treatment Works. See Appendix2 To date, no progress has been made in their digitisation.

https://assuredbiosolids.co.uk/

Economic Regulation, the Evolution of a Bioresources Strategy and Market, and Ofwat's role

71 Much has happened since 2021. The Ofwat approach became dominant for managing sewage sludge as bioresources in the PR24 process for 2025-2030. The WCWC reminds everyone that the of costs bioresources management are up to half the cost of sewage treatment and, therefore, are a significant factor in price setting.

Ofwat developed the notion of a bioresources market, and this was part of the 2024 Price Review process.

https://www.sciencedirect.com/topics/chemical-engineering/sewage-sludge-treatment

https://www.ofwat.gov.uk/consultation/our-proposed-approach-to-funding-bioresources-activities-at-pr24/

https://www.ofwat.gov.uk/regulated-companies/markets/bioresources-market/

https://www.ofwat.gov.uk/wp-content/uploads/2022/12/PR24_final_methodology_Appendix_4_Bioresources.pdf

https://awinnovationhub.co.uk/project/unlocking-bioresource-market-growth/

https://waterinnovation.challenges.org/winners/unlocking-bioresource-market-growth/

72 Ofwat took the view as early as 2020 that *bioresources (or sewage sludge) are the semi-solid by-products of wastewater treatment. With the right conditions, promoting the role of markets in relation to bioresources activities will help the sector to meet its potential to create economic and environmental value by enabling and incentivising technological changes, economies of scale, inter-company optimisation and co-digestion of sludge with other organic waste.*

73 This includes the statement: *to help achieve this, we have taken steps to support the functioning of the bioresources market over recent years, including the introduction of a separate price control for bioresources at PR19. However, after identifying potential issues with the operation of the bioresources market, we launched our 'Review of the bioresources market' on 19 October 2020. We published the draft findings of this review in May 2021. In summary, although there seems to be a reasonable degree of competition for sludge transport and disposal, we found that there are barriers preventing the bioresources market from reaching its potential.*

74 This was driven by the notion that bioresources have innate value estimated at £1.6 billion per year, which can be exploited primarily by fertiliser use but also in activities like cement production. But a great deal more work is needed to understand the viability of opportunities to understand how such a competitive market would work and that is part of the problem. This is explored later in this Thinkpiece

https://www.yorkshirewater.com/environment/bioresources/

Extracting resources from sewage | Water UK
https://www.water.org.uk/waste-water/extracting-resources-sewage

75 The WCWC poses the question about the way forward and indeed this question is relevant to the Water UK 2023 National Bioresources Strategy and in response to the Final Report of the Independent Water Commission.

https://assets.publishing.service.gov.uk/media/687dfcc4312ee8a5f0806be6/Independent_Water_Commission_-_Final_Report_-_21_July.pdf

76 Is the development of a diverse market a way of exploiting the maximum value of bioresources or is it in preparation of the demise of agricultural use of biosolids. The Water UK response to the original Consultation on the Ofwat approach also held some concerns.

It seems most likely that new assets will be required to divert at least part of the sector's biosolids production away from agricultural recycling, and significant capital investment may also be needed to meet revised regulatory standards for bioresources products.

We recognise that these impediments are not in Ofwat's gift to remove, that Ofwat has statutory duties to fulfil and that environmental regulations might change at some point in the future to enable the development of the full bioresources market that we all seek. In this context, we welcome Ofwat's commitment to work collaboratively with other regulators, the industry and key stakeholders in the development of a Long Term Bioresources Strategy, by joining both the Strategic Project Advisory Board and the Technical Project Steering Group for this project.

https://www.water.org.uk/news-views-publications/publications/water-uk-response-ofwat-consultation-proposed-approach-funding

77 It seeks to set out some facts about the long-term understanding that sewage sludges have resources value as bioresources. The problem with both the Ofwat and the EA strategies is that they do not understand the deep roots of current practices.

National Bioresources Strategy and Price Review PR24

78 In the mosaic of initiatives and strategies the water industry took the initiative to develop a consistent approach to responding to the bioresources challenges. It had to meet the requirements of Ofwat, anticipate regulatory changes, cope with the impact of Farming Rules for Water and the consequent reduction of available landbank and anticipate the worst regarding the impact of PFAS. In 2022 CIWEM was commissioned by Water UK to develop a bioresources strategy for England to 2050. As discussed in Part 2 the AtkinsRealis Bioresources team were competitively selected as the Technical Advisor for the development of the strategy. A working group was established.

https://www.ciwem.org/news/aligning-policy-and-priority-on-biosolids

https://www.ciwem.org/assets/pdf/Policy/Reports/Bioresources%20strategy%20-%20Project%20overview.pdf

https://www.ciwem.org/policy-reports/towards-a-long-term-bioresources-strategy-for-england

https://www.accesswater.org/publications/proceedings/-10091945/national-bioresources-strategy-for-the-england

79 This Bioresources Strategy was published in September 2023 and set out a way forward in an uncertain market. Unfortunately access to this report via the internet is now denied. Whilst it provided a framework for Water Company strategies and inclusion in PR24 and in preparation for PR29, little progress seems to have been made as observed earlier.in ‘fleshing this out’

https://www.waterbriefing.org/home/energy-and-carbon/item/21191-water-uk-publishes-national-bioresources-strategy-for-england

https://onunda.com/newsroom/what-is-the-uk-bioresources-strategy#:~:text=The%20UK's%20Bioresources%20Strategy%20focuses,to%20achieving%20net%2Dzero%20emissions.

https://waterbriefing.org/home/bioresources/item/21190-water-uk-publishes-national-bioresources-strategy-for-england

Water UK - new report calls for development of National Bioresources Strategy for England

Access Water | National Bioresources Strategy for the England

Optimising Bioresources: reducing water pollution - Business in the Community

80 This also applied in developing Company Plans for PR24.

https://www.anglianwater.co.uk/siteassets/household/about-us/bioresources-strategy-2025---2050.pd

bioresources-strategy-2025---2050.pdf

https://www.anglianwater.co.uk/siteassets/household/about-us/bioresources-strategy-2025---2050.pdf

https://www.nwg.co.uk/globalassets/business-plan-2025-30/nes64.pdf.

81 However though the matter seems quite complex, it is actually even more complicated The UK has various strategies focused within the Industrial Strategy on different aspects of the use of biological resources, for example, the Bioenergy Strategy,

https://www.gov.uk/government/publications/uk-bioenergy-strategy

which outlines a framework for future bioenergy policy and
the Biomass Strategy which highlights the role of biomass in the green energy transition, as a renewable source for all energy sectors, and its potential for low carbon emissions.

https://www.gov.uk/government/publications/biomass-strategy

the Water UK Bioresources Strategy will have to fit in with these.

82This did not appear to address the crucial issues raised by the plans to introduce a new regulatory regime to replace the 1989 regime. The intention was to create a steering group, with working groups to take these strategic principles forward but it does not appear to have advanced as described earlier. This would have run in parallel with the progression of the EA strategy in a similar, maybe overlapped fashion, yet has not made progress and will have added to the angst expressed by the Guardian and Greenpeace and the Final Report of the Independent Water Commission.

83 The continuing worries over the issues of PFAS, and microplastics (forever substances) and the application of the Farming Rules for Water for water were sufficient for Anglian Water to submit a notified item as part of the PR24 process.

https://www.anglianwater.co.uk/siteassets/household/about-us/pr24/dd/anh_dd_025-bioresources-uncertainty-in-amp8.pdf

20240828_Water UK Position Paper - A Common Framework for Uncertainty Mechanisms at PR24_0.pdf

Innovation

84 All of this uncertainty triggered a fresh wave of bioresources innovation within the sector. Whilst this has focussed on technology deployment, the WCWC reminds the readers of this Thinkpiece that innovation is much more than that. It can range from new ways of working, new analytical methods and understanding the impact of bioresources products on the environment. The water companies and Ofwat have been proactive since 2022 particularly on understanding bioresources markets and treatment technology.

UKWIR

85 UKWIR is now contributing as a leader to the way forward.

https://ukwir.org/response-to-national-bioresources-strategy-prioritisation-of-resource-recovery-opportunities

https://ukwir.org/project-reports?object=382958

https://ukwir.org/sewage-sludge-to-biochar-a-review

86 Following on from its work with CIWEM on the Bioresources Strategy for England for Water UK, AtkinsRéalis was appointed by UKWIR to develop the resource recovery tool and has worked along with Cranfield University and CIWEM in the delivery of the tool. It is also involved in other projects

https://www.atkinsrealis.com/en/media/trade-releases/2024/2024-10-31

Ofwat Innovation

87 Ofwat's £200 million Innovation Fund was launched in 2022 originally for 2022-25 and it aimed to grow the water sector's capacity to innovate, enabling it to better meet the evolving needs of customers, society and the environment. It is encouraging new ways of working that go beyond business-as-usual innovation practices in the water industry increasing and improving collaboration and building partnerships from within and outside the water sector. The fund supports various innovation competitions, encouraging water companies and others to develop and implement solutions aligned with Ofwat's strategic innovation themes. And bioresources management is one such theme. But the WCWC poses the question .. what is the structure behind the programme?

88The Innovation in Water Challenge, Water Breakthrough Challenges 1-4, and Water Discovery Challenge were delivered by challenge prize experts Challenge Works in partnership with Arup and Isle Utilities. Following the first three of these, Ofwat consulted on the future direction of the Fund.

89 In July 2022 Ofwat set out its headline decisions on the approach it will take for the Innovation Fund for 2022-25. It has now set the course for 2025-30 Ofwat consulted on its proposal to extend the Innovation Fund beyond 2025 with doubling the size of the fund to £400million for 2025-30, making a total of £600million. The publication of the decision in in 2025 on this includes useful information on past projects. This Thinkpiece does not seek to give a comprehensive review of all the projects but highlights certain features to emphasise the efforts being made to solve problems contrary to media reports about the water sector attitudes.

https://www.ofwat.gov.uk/regulated-companies/innovation-in-the-water-sector/water-innovation-competitions/

https://waterinnovation.challenges.org/

https://waterinnovation.challenges.org/wp-content/uploads/sites/3/2024/08/Ofwat-Innovation-Fund-Circularity-in-water.pdf

90 An early project led by Anglian water and completed in May 2023 looked at bioresource market growth potential.

https://waterinnovation.challenges.org/winners/unlocking-bioresource-market-growth/

https://awinnovationhub.co.uk/project/unlocking-bioresource-market-growth/

91 Challenge 4 announced in May 2024, amongst 17 winners in the water breakthrough challenge the following projects addressed bioresources:

https://waterinnovation.challenges.org/news-updates/b4-winners/

ALL-Streams HTO, led by Anglian Water (£1,380,591). The project will demonstrate how a treatment method called Hydrothermal Oxidation can transform biowaste

management in the water industry. This could create new and exciting ways to reuse resources by recovering nutrients and energy, all while helping us reach Net Zero emissions and eliminate landfilling biosolids and harmful air pollution.

ALL-Streams HTO - Ofwat Innovation Fund

PFAS – A whole system approach to an impossible problem, Severn Trent Water (£1,781,200). PFAS are synthetic chemical compounds that exist in water. Most PFAS are so durable that they won't break down in the environment for many years, earning them the nickname "forever chemicals." The project will investigate treatment options for removing and destroying concentrations of PFAS from water.

Proving the concept of sewage sludge pyrolysis, Thames Water (£6,205,773). We aim to deliver the first continuously operating, sludge-fed UK-based pyrolysis demonstration plant. Pyrolysis (a high temperature process with no oxygen present) can be used to recycle sludge to maximise the value of biosolids, ensuring a circular economy and reducing the requirement for sludge to be recycled to agricultural land.

Sewage Sludge Gasification (Sustainably addressing sludge-to-land, net-zero and emerging contaminant risks) (formerly known as SENECA), Yorkshire Water (£2,329,332). Our multi-partnership consortium, led by YW, identified Advanced Thermal Conversion (ATC) Gasification as an alternative approach to 'Sludge to land'. This will allow us to prove the technical and economic viability of gasifying 100% sewage sludge and provide the water industry with the confidence to exploit the technology globally.

https://www.ofwat.gov.uk/transforming-treated-sludge-into-green-electricity-ofwat-awards-trailblazing-innovations-in-latest-water-breakthrough-challenge/

Yorkshire Water started that the Advanced Thermal Conversion gasification process will convert treated sewage sludge into usable products such as biochar, vitrified ash 'stones' and a hydrogen-rich synthesis gas (syngas). By operating at a high temperature, the process aims to destroy other chemicals such as 'forever substances ', including PFAS and microplastics.

Transforming Bioresources – the Benefits of Biochar, Severn Trent Water (£694,431). By-products from wastewater treatment are carefully managed. The project will investigate biochar production as an alternative to conventional biosolids management practices. Biochar is a charcoal-like product that can be created from sewage by-products. Biochar has several potential benefits, including improving soil fertility, sequestering carbon, and reducing greenhouse gas emissions.

https://waterinnovation.challenges.org/winners/benefits-of-biochar/

92 There are other innovations:

https://conferences.aquaenviro.co.uk/proceedings/anglian-waters-new-scheme-will-treat-80-000-tds-year-to-produce-enhanced-treated-sludge-for-agricultural-use-and-generate-5-mw-of-renewable-electricity/

And for hydrogen production:

https://www.unitedutilities.com/corporate/newsroom/latest-news/unlocking-a-new-source-of-clean-hydrogen-from-uk-wastewater/

There had been an early feasibility study led by Welsh Water:

https://waterinnovation.challenges.org/wp-content/uploads/sites/3/2024/08/Ofwat-Innovation-Fund-Circularity-in-water.pdf

It must also be remembered that biomethane has been used in vehicles for a long time.

Production and deployment working with crop trials

93 Many of the projects refer almost glibly to the usefulness of the ultimate products of treatment, but the experiences of the 1970s and 1980s must remind all the participants that to demonstrate the value of products to customers there must be evidence. This will be necessary to underpin any changes in future regulation.

94 The 1989 Code of Practice was based on extensive crop trails aimed and the utility and safety of biosolids practices and there were many crop trials (see the Biosolids Archive in Cambridge, Appendix 2). For example, the work emerging from UKWIR and the Ofwat Innovation Fund must tie in with agricultural research such as on the utility of biochar use which has been active since the 2022 paper in Appendix1.

95 Biochar field trials are being conducted across various locations to assess its potential benefits in agriculture and carbon sequestration. Initial results from a grassland trial in Dumfries showed a 16% increase in grass yield and significant increases in soil carbon and nitrogen. Another trial in Gloucestershire is using biochar in highway construction, including landscaping, a green bridge, and runoff treatment. These trials aim to evaluate biochar's impact on soil health, crop productivity, and carbon storage, while also exploring its potential for mitigating environmental issues.

https://www.ceh.ac.uk/news-and-media/news/promising-initial-results-biochar-field-trials

Promising initial results in biochar field trials | UK Centre for Ecology & Hydrology
https://naturalengland.blog.gov.uk/2022/09/30/paludiculture-the-future-of-farming-on-peat-soils/

This is yet another thread to weave into the future picture.

96 It would be helpful if some innovation could be directed at identifying best practice for coping with the latest edition of the application of the Farming Rules for Water and this might involve developing new working practices involving land agents

Managing Emerging Quality Threats

97 Before moving on to the prosed legislative framework, the WCWC summaries the threats to current practices which might become embedded in future legislation. The experience of the previous major round of regulation, policy making and research in the 1970s and 1980s was that there will always be campaigners and researchers seeking funds, providing a constant steam of suggestions of potential threats. The advantage of having a single national focus is that these can be sifted logically together and regulatory adjustments are determined as necessary.

98 In rough terms the protocol used was:

- Agree the analytical method upon which decisions are based, agreement on a so called 'Blue book 'method produced by the Standing Committee of Analysts (SCA) https://standingcommitteeofanalysts.co.uk/.
- Determine tolerable limits in soils and crops; this will involve crop trials, some involving biosolids overseen by soil scientists
- Determine tolerable limits in the biosolids
- Understand the effectiveness of sludge treatment,
- Determine what is tolerable in untreated bioresources
- Understand what is acceptable in sewage
- Understand how diffuse contributions will change and determining the criteria for trade effluent control.

Of course, the relationship between these steps will vary according to the ultimate use of the bioresources

99 This approach was what underpinned the 1989 Regulations and Code of Practice on sludge use in agriculture being more demanding than the 1986 EU Directive, a fact now often forgotten. It was the intention that the Code criteria would be updated as more information became available.

100 Nothing has been judged as needing for formal additional criteria, until possibly now, with the concerns about PFAS and microplastics ('forever substances'). Although numerous other determinands have been referred to, these substances are top of the list. The bioresources are not toxic, but repeated applications of biosolids containing traces of 'forever substances' to farmland could lead to levels in soils and crops, of concern. But unlike the 1980s, resolution of the problems lies principally in the hands of government, in that the sources are widespread societal uses

101Methods for soil and bioresources monitoring are essential for the development of robust criteria but for operational control purposes as well. It is important to bring the SCA back into the team developing the way forward. The last method produced by the SCA was for E.coli in Sewage sludge in November 2024.

https://standingcommitteeofanalysts.co.uk/the-microbiology-of-sewage-sludge-part-3-methods-for-the-isolation-and-enumeration-of-escherichia-coli-including-e-coli-o157h7/

102 The SCA states that it works across a broad range of 'blue book methods', including drinking water, recreational and sludge matrices ;it does not have a sludge working group .In view of the high profile of all matters relating to bioresources , the SCA should be asked to re-establish a specific Working Group to develop standard methods for PFAS and microplastics .The WCWC suggests that as a matter of urgency the SCA should create a temporary statement on preferred methods whilst the long-term standard methods are developed and agreed.

103 PFAS and microplastics have been at the heart of the current debate about biosolids being toxic wastes arising from these materials. There is a tendency to point fingers at water companies, and this is a major risk to current operations. Both are examples of where water companies can exercise control of these materials in trade effluents, although the principal sources are from diffuse sources in wider society.

104 The recent CIWEM blog was wrong in assuming that water companies have choice in receiving trade effluents which must be permitted by water companies. The WCWC suggests that one action which Defra could take is to add PFAS and defined microplastics to the schedules of The Environmental Protection (Prescribed Processes and Substances) Regulations 1991.

https://www.legislation.gov.uk/uksi/1991/472/contents/made

105 Since that wider society is complaining about the presence of these materials in effluents and bioresources, there must be an effort in that wider society to limit the contributions to sewage and this requires national leadership on action in sundry ways, and messaging about behavioural change .The WCWC suggests that Defra could take a lead in these matters along with other relevant government departments. Otherwise, the onus will be on water companies to destroy these materials as part of wastewater operations and that will increase cost.

PFAS

106 There is a major narrative around this topic in general with many papers and reports.

https://assets.publishing.service.gov.uk/media/611e31fbd3bf7f63b19cea2d/Poly-_and_perfluoroalkyl_substances_-sources_pathways_and_environmental_data_-_report.pdf

202411 PFAS PPS - CIWEM.pdf

107 The whole issue is being addressed by the House of Commons Environment Audit Committee To which the WCWC has responded, and it will sharing its further thoughts in this Thinkpiece with it.

https://committees.parliament.uk/committee/62/environmental-audit-committee/news/206385/eac-launches-new-inquiry-to-address-the-risks-of-pfas-forever-chemicals-within-the-uks-regulatory-

approach/#:~:text=In%20a%20new%20inquiry%2C%20the,%2C%20water%2C%20oil%20and%20grease.

109 First there must be agreement on the analytical methods for PFAS to be used. Current analytical methods for PFAS in bioresources, typically involve extraction and concentration of PFAS from the solid matrix, followed by separation and detection using liquid chromatography coupled with tandem mass spectrometry (LC-MS/MS). ASTM Method 7968 is a widely adopted standard for this purpose in soil and solids, including sludge. This would be a start for a' blue book' method, which is needed urgently.

https://knowledge.bsigroup.com/products/standard-test-method-for-determination-of-polyfluorinated-compounds-in-soil-by-liquid-chromatography-tandem-mass-spectrometry-lc-ms-ms-1

110 But there has already been extensive monitoring. UKWIR provided useful data in a £190 million project finishing in 2022.Work is ongoing

Water Chemicals Investigation Programme.

111 Since the sources are widespread societal use, the Government has recognised its role in solving the problem.

https://www.gov.uk/government/publications/interim-position-statement-on-the-approach-to-pmt-concept-to-support-uk-reach-risk-management-of-pfas

The 2023 Defra Plan for Water estimated that it would take 40 years from 2023 to achieve the compliance with the current criteria for chemical status in rivers. This is due partly to the presence of PFOS (a particular subset of PFAS). The uses of PFOS and PFOA (also a PFAS) have been heavily restricted for some time and were banned as from July 2025 for use in firefighting foams. The WCWC supports the initiative by Defra to extend the ban on the use of all PFAS in firefighting foam, as referred to above, but would prefer the consultation period to be swifter and to extend to other uses.

PFAS in firefighting foam (FFF) restriction proposal - Health and Safety Executive - Citizen Space

112 Part of government intervention could be to prescribe PFAS in the Environmental Protection (Prescribed Processes and Substances) Regulations 1991.

https://www.legislation.gov.uk/uksi/1991/472/made

113 The protracted period of compliance arises from a legacy presence in use and from historical presence in the environment, even if bans on sale are brought in quickly. The issue is not immediate toxicity of biosolids, but the unacceptable accumulation in soils arising from repeated applications over many years. The WCWC points out the difference between these long terms and the short-term issues. It cannot answer the question about risks, but the PFAS have been used for

some time and so with the benefit of lowering contributions in future it must be possible to evaluate the impact of the past with reducing uses in the future, contrary to the current media narrative. It would be very helpful if a modelled profile could be developed to predict how the quality of bioresources will change over the predicted 40-year period. Much more information is needed on the role of PFAS in soil so that the appropriate quality criteria can be agreed.

114 If the policy development streams of Ofwat, the EA and Water UK can be brought together in ways which reflected the approaches in the 1970s and 1980s, as outlined earlier it would enable a much better integrated approach. This will mean the government itself, particularly Defra playing its part. Controlling the use of PFAS and in leading on the creation of a single overall policy for bioresources

115 At the moment it seems as if the only way of dealing with the problem in wastewater treatment / bioresources operations is by thermal destruction, hence the focus of research discussed earlier.

116 It appears to the WCWC that a structured plan for remedial action could be developed. There is some information on the fate of PFAS in all processes, but as will be discussed later there tends to be a focus on destructive processes like biochar.

Microplastics

117 Again there are numerous papers on this topic identifying the problems with some suggestions for partial removal:

https://www.sciencedirect.com/science/article/pii/S0048969722008270

https://www.gov.scot/publications/human-health-risk-assessment-potentially-hazardous-agents-land-applied-sewage-sludge/pages/8/

https://www.hutton.ac.uk/new-study-finds-1450-increase-in-microplastic-levels-within-soil-after-four-years-of-sewage-sludge-application/

https://www.gov.scot/publications/human-health-risk-assessment-potentially-hazardous-agents-land-applied-sewage-sludge/pages/8/

https://www.sciencedirect.com/science/article/pii/S2352186423001724

https://www.imperial.ac.uk/molecular-science-engineering/publications-and-outputs/briefing-papers/using-microbes-to-remove-microplastics-from-wastewater-and-sewage-sludge/

118 And in many ways the way forward reflects the approach for PFAS but is less certain. It seems to be a growing problem not a reducing one. There is no analogous plan for reduction of microplastics in sewage. Up to 75% of microplastics in sewage can come from textile fragments

https://www.firstsentier-mufg-sustainability.com/insight/sources-of-microplastics-and-their-distribution-in-the-environment.html

A good step would be to reduce the significant output from washing machines. And as an example of what Government could do , support from Defra for the Microplastics Filters (Washing Machines) Bill, currently awaiting the Second Stage, could enable a structured way forward for a diminishing problem akin to that proposed for PFAS .However, this is not without its criticism , one being that the filter debris must be managed and disposed carefully by members of the community.

Microplastic Filters (Washing Machines) Bill - Parliamentary Bills - UK Parliament

119 Much more information is needed beyond what is cited above on the ubiquitous presence of microplastics in soil and the consequences for soil quality so that appropriate criteria can be agreed There is no official method of analysis which could act as a starting point for the SCA. And a standard method is needed urgently.

120 The opportunities of removing microplastics from bioresources within the context of contemporary process seems limited. In fact, the paradox is that in order to meet target for microplastics in effluents, sewage treatment process should be optimised to remove them from sewage. So, there is an air of acceptance that these might be the cause of demise of existing bioresources practices, with thermal destruction being cited as the way forward as for PFAS. This issue has been a big driver in the Ofwat Innovation Programme

121 This is recognised as a principal option in a study commissioned by Defra, published in January 2025: *Option appraisal for intentionally added microplastics Final report Defra January 2025 Eftec and UK Centre for Ecology and Hydrology*

https://www.fidra.org.uk/news/intentionally-added-microplastics-options/

It says: *Reducing recycling of sewage sludge to land by 95% (RMO 3A) and 50% (RMO 3B) are also relatively cost-effective measures, at £23 per kg and £73 per kg respectively, which falls within the mid to lower range of the cost-effectiveness benchmarks identified in literature. Furthermore, the co-benefits of reducing exposure to other chemicals in sewage sludge (e.g., secondary microplastics, PFAS, and pharmaceuticals), are likely to outweigh the primary benefits of reducing intentionally added microplastics for these measures. Even though these co-benefits cannot be fully quantified, it indicates that RMO 3A-B should be considered in a broader environmental policy context.*
…… Lastly, conducting research into potential impacts from exposure to chemicals contained in biosolids is pertinent to understanding the potential co-benefits of reducing recycling of sludge to land.

PRIMARYMICROPLASTICS_OPTIONAPPRAISAL_FINALREPORT%20(1).PDF

This does not take account of the immediate availability of incineration capacity and experience shows that even if incineration is considered as a feasible option technically and economically, it will take many years deliver, not least to the

enormous public opposition to incinerators, which is even more vocal tant the opposition to biosolids use.

Environmental Regulation

122 For decades, UK policy, practice and legislation has been focussed on supporting the safe, sustainable use of treated sewage sludge in agriculture as the best practicable environmental option. In order to understand the regulatory position as of mid-2025, this article reprises the origins of current practice as set out in Appendix1. The media criticisms and even the Independent Water Commission Final Report show that the detail given in 2021 in Appendix 1 needs updating and elaboration.

123 The 1989 DoE Code of Practice for Agriculture Use of Sewage Sludge (this is archived in Cambridge) underpinned the 1989 Regulations (as amended in 1990). As Appendix 1 sets out, there were several steps to extend and improve the de facto practices and it was always intended to keep the Code updated. A second and last edition of that Code was produced in 1996.

www.hutton.ac.uk/sites/default/files/files/sludge-cop.pdf

https://assets.publishing.service.gov.uk/media/5a7c95c940f0b65b3de09d60/str-p193-e-e.pdf

https://assuredbiosolids.co.uk/wp-content/uploads/2018/05/Recycling-Biosolids-to-Agricultural-Land.pdf

www.bing.com/search?qs=SC&pq=biosolids+assrance+&sk=CSYN1&sc=4-19&q=biosolids+assurance+scheme&cvid=bab21645cb5e4efbbfce2e8effd5de22&gs_lcrp=EgRlZGdlKgYIARAAGEAyBggAEEUYOTIGCAEQABhAMgYIAhAAGEAyBggDEAAYQNIBCTEyMTI2ajBqN6gCCLACAQ&FORM=ANNTA0&PC=U531

The latest version of Guidance was produced in 2018:

https://www.gov.uk/government/publications/sewage-sludge-in-agriculture-code-of-practice/sewage-sludge-in-agriculture-code-of-practice-for-england-wales-and-northern-ireland

124 On refection, this update cannot be framed just as reformatting. The EA updated the Code, in a way which was not as helpful as it could have been. It did not link the Guidance to the 1989 Regulations, it did not withdraw the 1996 Code and failed to spell out some crucial issues, which are relevant to the current media criticism. It refers to examples of effective treatment processes, but fails to spell out, as per the Regulations that sludge must be subjected to biological, chemical or heat treatment, long-term storage or any other appropriate process so as significantly to reduce its fermentability and the health hazards resulting from its use before being used in agriculture. It did not incorporate all the evolution in practice since 1996 as described in a 2010 Water UK document.

https://assuredbiosolids.co.uk/wp-content/uploads/2018/05/Recycling-Biosolids-to-Agricultural-Land.pdf

125 The latest EA strategy published in August 2023 set out what the intentions were to update the regulatory practices. This was the derivative of the work set out in the 2020 proposals. The WCWC does not recall any extensive public consultations.

https://www.gov.uk/government/publications/environment-agency-strategy-for-safe-and-sustainable-sludge-use/environment-agency-strategy-for-safe-and-sustainable-sludge-use

126 The course of planned action is not yet completed, which is behind some of the criticism offered in the Guardian's reports.

The introduction of Standard Rules Permitting

127 The intention is to bring sludge / biosolids use into the 2016 Environmental Permitting Regulation framework. The Appendix 1 paper highlighted a number of issues which had caused problems in regulation, for example:

- Whilst almost all sewage sludge was processed and used as biosolids in agriculture there was still a potential demand for treated sludge to be used elsewhere, such as forests, and under these circumstances, the activity was outside the remit of the 1996 Code of Practice, and the products could not be deemed biosolids
- There was a drive by Ofwat to open the market for commercial opportunities in co-treatment and utilisation of joint streams of farmyard and food processing wastes; once more the products would not be covered by the Code of Practice and could not be called biosolids

.

128 These created some angst and are both examples of the bioresources market, the principles of which were established by Ofwat in 2017

Bioresources: Defra says water sector must create evidence base for co-treatment of sludge with other waste

129 These were part of the driver behind the 2020 proposal for revision and features in the motivation in the current strategy, which is a way forward incorporating more than just a latter day version of the 1996 Code for the use of biosolids, under the aegis of the environmental permitting regulations and seeks to bring in the complexities of the use of other products. The reasons for change are given in the EA document, see Appendix 3. This highlights thinking by the EA which may be obscure to all but the most informed aficionados. It states that Regulatory Position Statement RPS 231 allows common industry practices that are inconsistent with the SUiAR (Sludge (Use in Agriculture) Regulations) to continue. This refers to the 2020 (updated 2024) use of waste codes.

https://www.gov.uk/government/publications/waste-codes-for-sewage-sludge-and-sludge-containing-other-materials-rps-231

Using waste codes for sludge materials: RPS 231 - GOV.UK

130 This RPS applies to some exemptions and permits for the treatment, storage and land-spreading of certain waste types not covered under them. The exemptions and permits this RPS applies to are:

- T21 waste exemption: recover waste at a wastewater treatment works
- S3 waste exemption: storing sludge
- SR2010 No 17: storage of waste to be used in land treatment
- SR2010 No 5: mobile plant for the reclamation, restoration or land improvement
- SR2010 No 6: mobile plant for land-spreading of sewage sludge

131 Appendix 3 gives the framework intended for future regulations and this appears to be in the concept of Standard Rules. It does not spell out what this means and the WCWC observes that much of what is written and published is only understood by a limited group of people and does not chime well with the media interest. Standard Rules were established in 2014 and last updated in March 2025.

https://www.gov.uk/government/collections/standard-rules-environmental-permitting

Even that document would benefit from an explanatory note as to what these are.

https://www.360environmental.co.uk/standardrules/

1. Anaerobic digestion including use of the resultant gas and storing digestate
2. Car and vehicle dismantling
3. Car and vehicle dismantling - unavailable for new applications
4. Composting, sewage or sludge treatment, biogas
5. Composting, sewage or sludge treatment, biogas - unavailable for new applications
6. Deposit for recovery
7. Deposit for recovery - unavailable for new applications
8. Electrical insulating oil storage
9. Flood risk activities
10. Medium combustion plant and specified generators
11. Metal recycling, scrap metal and WEEE - not cars or vehicles
12. Metal recycling, scrap metal and WEEE - not cars or vehicles - unavailable for new applications
13. Mining, oil and gas
14. Mobile plant for land-spreading or treatment
15. Radioactive substances for non-nuclear sites
16. Research and development
17. Storage or treatment of waste - recycling, dredging, clinical, soil, tyre shred or wood treatment
18. Storage or treatment of waste - recycling, dredging, clinical, soil or wood treatment - unavailable for new applications
19. Waste transfer station or amenity site with or without treatment
20. Water discharges

132 As an example, the Standard Rules for land-spreading not covered by the SUiAR, is incorporated into the regulatory framework.

SR2010 No 4 mobile plant for land spreading

Again, of relevance, are the Standard Rules for anaerobic digestion plant

SR2021 No 6: Anaerobic digestion facility, including use of the resultant biogas – installations - GOV.UK

The Environmental Permitting (England & Wales) Regulations 2016 – Chapter 4 Standard rules SR2021 No 6 incorporates SR2012 No 11. This Standard Rules permit is for a Part A installation:

- with an anaerobic digestion treatment capacity of over 100 tonnes of waste, or a combination of waste and non-waste, each day
- accepting no more than 100,000 tonnes each year

It applies to all digesters and is based on a common practice for biowastes

133 However lime stabilisation of sewage sludge is also practiced and in 2020 there was an intention to issue Standard Rules for this process but they had not been issued in the latest update of the set of Rules in March 2025 .And it is not clear how the processes like biochar and high temperature oxidation, highlighted in the Northumbrian Water Innovation Festival in July 2025, and vaunted as technology solutions to the current problems will be permitted; no mention was made of understanding what would be required from these processes if and when they entered the Standard Rules framework. The nearest Standard Rules would need modifying, probably using data obtained from crop trials described later in this paper.

https://www.gov.uk/government/publications/low-risk-waste-positions-landspreading/storing-and-spreading-biochar-to-benefit-land-lrwp-61

Farming Practices

134 This Thinkpiece does not seek to review this topic in depth but observes that these have been driven by the regulatory objective of reducing nutrient run off from land dressed by manures and biosolids. The WCWC observes again that there is some confusion over the impact of liquid products, as compared to solid products (which contemporary biosolids are) .

Farmyard manure spreading on land was controlled by guidance:

https://www.gov.uk/government/publications/spreading-organic-manure-on-agricultural-land-rps-252/spreading-organic-manure-on-agricultural-land-rps-252

This was withdrawn in 2022 and replaced by the Rules for Farmers Rules in 2023 (updated 2024)

https://www.gov.uk/guidance/rules-for-farmers-and-land-managers

with a focus on the Farming Rules for Water. And this is relevant to the use of biosolids and co-treated products

135 The previous government was keen to promote co-digestion, particularly of bioresources and farmyard manures . Its regulation remains obscure and is probably covered by one of the relevant sets of Standard Rules.

https://assets.publishing.service.gov.uk/media/5a7968b4e5274a2acd18c991/anaerobic-digestion-strat-action-plan.pdf

The Permitting Model for the Future

136 For a moment before embracing other issues impacting on the future, the WCWC reflects in this Thinkpiece on the issues raised so far. Its interpretation is that the model for future permitting is that of Standard Rules. In that sense, the WCWC reflects further on what happens now.

137 The EA strategy seems to embrace all that has been developed in terms of good practice since 1996. It is not clear if there is any intention to add new ideas immediately available, beyond incorporation of the Farming Rules for Water. It would be very useful if a 'nest' of sets of Rules could be created around bioresources processes and utilisation practices. It would be helpful if one set of rules could be focussed on the 'pure concept of using treated bioresources as biosolids in agriculture as the principal intention for managing bioresources. It would be for the working groups to advise on how far this concept is stretched. It could include land reclamation and use in forestry, for example, not co-treated products, which would require a separate set of Rules.

138 The WCWC submits that a streamlined 'fit for purpose' set of integrated Standard Rules would be an ideal candidate for the regulatory streamlining review envisaged by the government

Streamlined regulation to power growth and boost British industry - GOV.UK

139 This would require revision of the 'Farming Rules for Water' Regulations (FWR) to take out bioresources and incorporate the principles into the Standard Rules. The arguments about these Rules have ebbed and flowed. They have been a major source of concern to water companies as a compromise to existing operations. The latest position is less onerous, yet it does put a major burden on farmer customers which might discourage them particularly with the current bad press. So FWR is still a threat, and it remains to be seen how the principles are incorporated into the Standard Rules.

https://www.gov.uk/government/publications/applying-the-farming-rules-for-water/applying-the-farming-rules-for-water

https://www.fwi.co.uk/news/environment/air-and-water/defra-launches-snap-review-of-autumn-muckspreading

https://www.fwi.co.uk/news/defra-imposes-tougher-requirements-for-autumn-muck-spreading

140 The ‘devil will be in the detail’. If there is a drive for all activities to be placed under the permitting regime there will be a schism for across the UK on practice. The 1996 Code applied to the UK, the 2018 Code excluded Scotland, the 2023 Strategy applies just to England.

141 Everyone agrees that excessive detail in the administration will add work but little extra benefit for the environment beyond past practices. So, the concept of ‘area of deployment’ a Standard Rules term, will be crucial. It would be most practically beneficial if the Standard Rules permit could apply to all company bioresources practices in its region, but it should go no lower in the hierarchy of management than bioresources treatment centres.

142 It is possible that this Thinkpiece has not captured all the detail, but it serves to highlight the complexity of all the regulations and permitting processes. The WCWC agrees with the Environment Agency and the Water Commission that there needs to be streamlining. Years of constant tweaking of regulation has created a situation only understood by a few, leaving an open space of misunderstanding.

143 The preparation of this Thinkpiece demonstrates that the way forward even for environmental regulation will be in resolving a mosaic rather than pursuing a straight line .and will need address several issues at once.

144 There is very little evidence, if at all, that if the practices, as recognised by the Biosolids Assurance Scheme are followed that pollution of water, soil or crops will occur. The growing focus on wastewater management needs greater re-assurance. Biosolids use will recycle valuable organic matter and nutrients and make a positive contribution to climate change mitigation policy, by reduction of carbon emissions, as was highlighted in COP 26 by Anglian Water. It is one of nature’s gifts that this also the least cost option, as of now.

https://assuredbiosolids.co.uk/

Biosolids: the greatest story never told at COP26 - CIWEM

145 Any future approach to regulation of biosolids must be to support and encourage safe utilisation and not be a restrictive hurdle. This was reflected in the WCWC comments on the Water UK National Bioresources Strategy. Any other regulatory issues must not be a distraction from this simple focus. There are legitimate concerns about bioresources (sludge) quality which need addressing. That may be sufficient to demand a completely different approach. These legitimate concerns have been managed with focus of the innate issues around faecal aversion, while this Thinkpiece is intended to demonstrate that the use of biosolids is far from being unregulated, as suggested by the Guardian articles.

146 For now the basic legal concept must be that using treated bioresources safely as a fertilizer and soil conditioner remains the best practicable environmental option as stated earlier, indeed, as even the EA strategy recognises. Apart from the

emerging concerns about PFAS and microplastics there is no evidence that the current practices needed to be changed however they are expressed in law. If regulatory governance at large decide that limits are needed for these substances, the law and practice will be amended appropriately. It does not mean that the current practices are irresponsible and polluting. If is about how to manage and prepare for emerging threats and there is plenty of work in hand.

147 The WCWC poses the question, is it worth risking this primary focus, by the distractions of uses on other kinds of land and other products such as co-treated digestate unless they are vital to long term management viability.

148 The Strategy sets out a Plan of action with proposed working groups. This will involve legislative change which is within the gift of Defra. It is the lack of progress since September 2023 which is at the heart of the Guardian criticism.

149 The WCWC closes this section by repeating that there are several pieces of legislative reform needed to support safe use of biosolids also within the gift of government which will help the situation, for example on the reduction of PFAS and microplastics in sewage.
150 And to repeat the observation made at the end of Part 2 The lack of progress on regulatory reform not only causes the media criticisms which triggered this Thinkpiece but also creates uncertainty for water companies and investors.

The Final Report of the Independent Water Commission

151 This review cannot be completed without reference to this report issued in July 2025:

https://assets.publishing.service.gov.uk/media/687dfcc4312ee8a5f0806be6/Independent_Water_Commission_-_Final_Report_-_21_July.pdf

505: Sewage sludge is primarily regulated by the EA and NRW through the Sludge (Use in Agriculture) Regulations (SUiAR) 1989.636 In England in 2020, 94% of sludge water companies produce is reused in agriculture as an organic fertiliser.637 However, excessive nutrients running off into water ways can cause environmental damage including eutrophication. Sludge can also contain chemicals and pathogens which may be a risk to human health and the environment. There is also evidence it can contain chemicals including microplastics and forever chemicals (for example, PFAS)

509: For sludge, the regulatory regime also relies on self-reporting. Sludge producers are required to prepare and maintain a register containing the total quantity of sludge produced in any year, as well as the quantity and composition of sludge provided for use in agriculture in any year.

526: The Commission has heard concerns around the limits in regulatory frameworks to adequately oversee sludge activities. The Sludge (Use in Agriculture) Regulations (SUiAR) 1989 were made at a time when pollutants from heavy industry were considered of most concern from the spreading of sludge. Consequently, SUiAR only contains specific limits on heavy metal application to soils, while

chemicals such as PFAS, pharmaceuticals microplastics, are unmonitored. Furthermore, current sludge regulation does not consider modern risk-based regulation and the changes in management of sludge from its treatment through to final use when recycled to benefit land.

527: This is an issue that has started to attract public concern, with stakeholders expressing significant concern regarding the presence of modern chemicals within sludge. We have heard there is concern from water companies that if farmers were to start refusing sludge, on the grounds of sludge containing both chemicals and nutrients in excess of crop and soil need, this could lead to the sludge supply chain starting to break down. Water and sewerage companies may have limited resilience to manage this with an average three months of self-storage across the sector Organisations including The Angling Trust and CIWEM have called for several reforms in this space, including new regulatory limits on chemicals and improved treatment solutions.

Recommendation 27: The UK and Welsh governments should tighten regulatory oversight of sludge activity by moving the treatment, storage and use of sludge into the Environmental Permitting Regulations.

542: The Commission has concluded that the regulatory oversight of sludge practices needs to be tightened. Introducing a permitting approach to sludge should enhance environmental protection and provide greater protection over the spread of modern chemicals contained within sludge by introducing a risk-based approach to regulation. This should enhance trust both within the public and the farming community due to greater confidence that sludge use is being more tightly regulated and controlled. Moving sludge to the Environmental Permitting Regulations should also enable environmental regulators to recover costs for their regulatory activity to fund greater compliance activities.

543: However, an expansion of regulatory activity alone will not be sufficient. The UK and Welsh Government should work with water companies and regulators to develop a long-term strategy for managing sludge, including the trial and adoption of new sludge treatment approaches, such as pyrolysis.

152 The WCWC invites readers to compare the evidence used by the Commission compared to that given in this Thinkpiece. The WCWC shares a common view of the need for regulatory reform, but for different reasons. It submitted a view to the Commission that this was an issue with several contributors and it is a good example of regulatory overlap and in need of streamlining .It will be interesting to see what the proposed new water regulator would make of this and the new overlaps with the residual land use functions of the EA how it will fit in with systemic catchment management.

153 This demonstrates how several issues can be conflated. The Commission raises the issue of self-monitoring, which is more extensive than the what the Report records and it fits in well with operational responsibility. The regulatory activity referred to must surely be in ensuring that the system operates well rather than the EA doing its own bioresources and soil monitoring. The WCWC has submitted

suggestions for a reviewed and reinvigorated effluent quality assurance system, and it might be worth adding bioresources monitoring to this.

Looking ahead

154 At the end of the four years since the original Thinkpiece was produced, there have been considerable advances in knowledge, but not in wisdom. It would be an overreaction to describe the situation as a muddle, but it is overly complex to all but a few aficionados. In spite of this, the management of bioresources being up to half the cost of sewage treatment and that topic being one of the major drivers for the establishment of the Independent Water Commission, the topic was not well informed in its final report. There are assertions published, which are not helping, like that water companies have a choice in taking trade effluents which contribute to the quality of bioresources. The reputation of practices for using bioresources is at its lowest point for many years and better communication by the sector is needed urgently.

155 The WCWC repeats the suggestion for the way forward given in Part 2 Overview that there needs to be a single focus either by much closer working, or even integration of all the workstreams, and these might be two sequential steps. Let us see what the outcome of the Government response to the Water Commission report will be.

APPENDIX 1

LinkedIn post https://www.linkedin.com/in/peter-matthews-043050147

THE FUTURE OF BIOSOLIDS - BLENDING PAST WISDOM WITH FUTURE INNOVATION #biosolidsfuture posted Oct 2021

From sewage sludge in 1971 to biowaste, bioresources and biosolids in 2021: time for a new strategy By Dr Peter Matthews. May 2021

Summary

This essay is an overview of fifty years of evolution of sewage sludge management. Beneficial use of treated sewage sludge on land, particularly agricultural land, has always been a favoured way of managing a very substantial part of effective treatment of urban waste waters; now more than ever. It is a happy alliance of economics and the environment.

We need to develop our thinking that sewage … urban wastewater …. is a sustainable resource. For a long time it, and the products of engineered treatment ,.. sludge …. were treated and used beneficially on land. There are still memories of the 'honey cart' of septage in many places in the countryside. But in recent times, almost all of the sludge produced by sewage treatment in England and Wales has been used safely and beneficially on agricultural land and that created the concept of' biosolids' … in simple terms treated sewage sludge used in agriculture in accordance with agricultural best practice and national regulations. I repeat the lesson that biosolids used on land is an excellent example of how a happy alliance of economics and sustainability can work. The alternative to this would be the use of much more carbon-intensive options with incineration as the default fallback, and farmers only able to use the use of other organic composts, farmyard manures and artificial fertilisers.

However, our senses and public health messaging constantly replenish our angst about anything to do with sewage. Concerns about issues bubble up from time to time… such as microplastics, anti-microbial resistance and PFAS. Management practices have therefore evolved to reflect community concerns and the growing body of research and experience, which has evolved over many decades. The origins of our current control systems were in 1971, so 2021 is a Half Century! But the concerns continue and as a result , the Biosolids Assurance Scheme led by the water industry, demonstrates that careful practice provides the assurance that farmers, regulators and food manufacturers need.

The essay highlights crucial dates - with the origins of national strategies in 1981, and the creation of a regulatory framework in 1989 - and confronts the current proposal for the biggest changes in that framework. Inevitably, as always happens in life with incremental changes, inconsistencies arise, which need resolving without challenging or undermining the solid basis of the current concepts and practices. The Environment Agency is right that it is time for such a review and refreshment, but any changes must meet 'better regulation' principles. This essay looks at these issues.

With the diversification of treatment and utilisation opportunities, the pressures of meeting zero carbon targets, pressures to avoid further erosion of ecological diversity, conservation of resources, and the new agricultural land management framework, it is time to recreate the original national strategy and consensus, which worked so well in 1981, and some suggestions are made.

Our first National Strategy on all aspects of sludge management was established in 1981 after the formation of a national approach to the delivery of water services in 1974 . As far as agricultural use is concerned the next big step was the Sludge (Use in Agriculture) Regulations, and associated Code of Practice in 1989 (supplemented in 1992 by the Safe Sludge Matrix) . There has been a gradual disintegration of the National Strategy since then, as other sludge management routes became subject to different regulatory regimes.

The Environment Agency has proposed a fundamental change in biosolids sludge regulation. Whilst it is called a Sludge Strategy, it focuses on biosolids use which it proposes to bring into the Environmental Permitting Regulations regime, but leaves other routes of sludge management already regulated by the EPR in separate and fragmented ways. There is not, per se, a National Strategy, or regulatory framework. The EA is right that it is time for a review and refreshment - inevitably, as

always happens in life with incremental change over decades, inconsistencies arise which need resolving. But what is proposed departs from what we know works, does not build on the last forty years of experience of sludge management, and falls short of 'better regulation' principles. We have lost the principles of integration. The essay highlights the fact that we have lost this well tested concept of a national framework for managing sewage sludge, including research, and the notion of a national consensus to agree the best way forward.

I offer for debate an alternative way forward.

With the diversification of sludge treatment and utilisation opportunities, the pressures of meeting zero carbon targets, the urgent need to reverse losses in ecological diversity and better conservation of resources as part of a circular economy, plus the new Environmental Land Management framework, it is time to recreate the collaboration and consensus that worked so well in 1981 to underpin the original national strategy and regulations.

The essay provides a critique of the proposals to change the regulatory regime with respect to agricultural use and argues for an evolution of current practice rather than the revolution being advocated. Rather than focus as proposed just on sludge use in agriculture, we need a broader regulatory framework embracing all potential uses.

It recognises that there are changes necessary even within the current context. Not least there remains confusion over the miscellany of terms used incorrectly and interchangeably, which needs sorting! We should rally around the overarching term 'bioresources' and protect the purity of the term 'biosolids' for treated sludge meeting strict standards. The essay raises a question mark over whether the concept of a sludge marketplace, including co-treated products from blended waste streams, is helpful or could amplify public concerns.

We need at a national level:

- A return to the benefits of a **national focus of all interested parties** creating the background to future agreement on the best way forward. Such a national consensus served us well in 1981 and could serve us equally well in 2021.
- An integrated national strategy for managing sewage sludge and to reflect the Ofwat terminology, this should be described as the '**National Strategic Framework for Managing Bioresources'**. The objectives should be to ensure the safe management of all bioresources and, in particular, to ensure the safe, sustainable, assured, desirable use of biosolids in agriculture as the favoured option. In this context the term bioresources is as used by Ofwat and not by ADBA. It should contain modules setting out the requirements for each option of management. Existing regulatory and control modules could be slotted in, as now, but kept under review.
- A coherent process for developing the **evidence base and evaluation of emerging risks**.
- A **national archive for sludge management practice** held most probably by the Biosolids Assurance Scheme, to collate knowledge before paper records and memories fade.

We need specifically:

- To take stock of the proposed changes to the control of biosolids in agriculture and consider an update of current practices including the conferred status of an **Earned Recognition Scheme**.
- Within the Strategic Framework, there should be separate modules for the **agricultural use of co-treated products** and uses of **treated sludge in land reclamation and in forestry**.
- The Biosolids Assurance Scheme could be modified to provide separate primary assurance for biosolids use in agriculture but also applying the principles to the other land management modules, without confusing terminology. It could be renamed the **Bioresources Assurance Scheme**. But the essay recognises the different regulatory regimes for those modules. The essay also suggests specific tweaks to make life easier. This widening of assurance, without compromising the concept of biosolids, will give greater comfort to the wider community about Water Company practices.

My motivation here is to generate informed debate; to make sure the lessons and experience built amongst many people over many decades helps shape and enable the best way forward. The essay

remembers the roles played by members of CIWEM and its predecessors. And these can be reprised in the future.

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on land on land. It should be renamed as the **Bioresources Assurance Scheme** to bring into harmony with the overarching framework, resolves some of the current dilemmas and brings assurance into line with the Ofwat strategies. It also suggests that water treatment sludges discharged to waste water streams should have trade effluent consents: paras 95-102

Final thoughts
Smarter regulation para 103
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Can CIWEM play a role again? paras 107 -109

The Essay

Why celebrate in 2021? The historic origins.

1. In 2020, CIWEM celebrated 125 years, but 2021 has key 40 and 50-year anniversaries for a topic that has always put 'bums on seats' for CIWEM and its predecessors, sludge management. Its magazines and journal articles, and work published by its members, would fill a library, so it is impossible to include everything in this essay. CIWEM has produced some excellent Policy Position Statements over the decades.

2. The concept of sewage, and sewage sludge, goes back a very long way as does the concept of using that sludge as a fertiliser. As a euphemism 'sludge' was nicknamed 'honey' in bygone times and was collected in 'honey wagons or trucks' and taken to the edge of villages and towns and dumped on farmland. There are many places still called Honey Hill or Honey End and in a great irony, I live on the edge of a Cambridgeshire village in an old cottage at the bottom of Honey Hill! But with the introduction of modern concepts of sewage treatment, at the end of the 19th Century, the formal term 'sewage sludge' became current at the same time as the forerunners to CIWEM were also established. But it wasn't until 1971 that we saw the first piece of national guidance on good practice for using sewage sludge in agriculture.

3. Inevitably, in citing examples, I have had to draw on my experiences of 'both sides of the fence' and in terms of practical operations from my time with Anglian Water. I must also confess that the extent, diversity and scatter of reference sources made it impossible to cite all key reports and there will inevitably be criticisms of omissions, but I have tried to capture the essence of what has happened. I have focussed on England and Wales.

4. Treatment of sewage (now described legally as urban wastewater) produces a sludge and that has to be managed by use and disposal. Any description that this is an inconvenience to wastewater treatment operators, as has been the case, is as inappropriate as describing young children being an inconvenience to primary school teachers. Water companies have always treated sludge management as 'part of the job', albeit with attitudes reflecting the wisdom of the day, and with the benefit of hindsight, not always with what we would call now best practice. But life is about learning and improving. Many people speak in hyperbole about passion in their work, but it has been true for sludge disposal with networks of like-minded people from all over the world, and even social societies, like the Select Society of Sanitary Sludge Shovellers.

5. A popular way of managing sludge has been to use it as a nutrient source and soil conditioner, but there was an awakening in the later years of the 20th Century that the practices needed more specific controls beyond general legislation, which by modern standards was very broad. Early leaders from CIWEM's predecessors, including members from the Water Pollution Research Laboratory, were active in this evolution. Now almost all sludge (87%) is treated by acceptable processes such as anaerobic digestion and lime addition to create products, safe to use, in regulated ways, in agriculture, as a valuable nutrient source and soil conditioner.

6. We are now fifty years on from the first steps in modern controls with the publication in 1971 of ADAS Advisory Paper No10 Chumbley C. G. 'Permissible levels of toxic metals in sewage used on agricultural land', by MAFF. This launched the world leading concept of zinc equivalent to control the combined effects of zinc, copper and nickel in sludge on growing crops.

7. And 2021 also celebrates 40 years from the creation of the national sludge management strategies that are the bedrock of what we do now. One of the benefits of regionalisation of water services in 1974, and then privatisation in 1989, was to bring greater efficiency and scale to water and water recycling operations. The management of sludge is a leading example of this.

8. To support the development of regional sludge strategies and operations, a UK DoE/National Water Council *Standing Committee on the Disposal of Sewage Sludge* was established, which brought together all interested parties, including regulators, and customers, to make best use

of the available experience and knowledge. It had subcommittees focussing on each disposal option and one on economics; subcommittees dealt separately with: marine dispersal, incineration, and disposal to land including landfill and agricultural use. Each subcommittee published reports. Again, members of this Institution - many of us still active - played key roles. It published its key reports in 1981, and this included best practice for using sludge in agriculture…more on this later. But finding these reports is now difficult; they are archived by government amongst the files of the DoE *Standing Committee of Analysts* and the Drinking Water Inspectorate. In another example from 2003, the Standing Committee of Analysts, now managed by the National Laboratory Service of the Environment Agency (EA), produced a set of reports on 'The Microbiology of Sewage Sludge' in 'Methods for the Examination of Waters and Associated Materials'. The first part was described as 'An overview of the treatment and use in agriculture of sewage sludge in relation to its impact on the environment and public health'; this was archived by the EA in 2018. This was a key document in the development of thinking on health risks. Maybe the time has come to create a national archive of key documents on sewage sludge in a more accessible way.

9. The Standing Committee on the Disposal of Sewage Sludge focussed on the 'big picture' and overarching strategy of sludge disposal and as explained earlier, separated out the use of land, including landfill (but particularly in agriculture), marine dispersal and incineration as distinct activities and provided advice on best practice on all of these. It managed large research and data programmes and contributed in the very large EC research COST 68 programmes 'Treatment and Use of Sewage Sludge and Liquid Agricultural Wastes' Programme, 1972–90. Even then, the benefits of recycling sludge to land, rather than incineration, were obvious, but the practices of the day were determined by the principles of the Best Practicable Environmental Option (BPEO) in which economy and environment were balanced. The most cost-effective option had to be pursued and managed in accordance with best environmental practice. That principle still applies, but the balance has tilted in favour of the environment.

10. Selection of best local options were achieved by the water authorities using sophisticated computer models such as that later named WISDOM (Water Industry Sludge Optimisation Model). And the Authorities understood the coincidence of economic and environmental benefits in using sewage sludge in agriculture. For example, Anglian Water launched its preferred Award Service to Agriculture, with a Manual of Good Practice and a light blue as the livery of its tankers in the 1970s. The focus was building trust in sustainable sludge management; developing an income stream was an incidental aspiration and the income was low. But the gradual 'productification' of treated sludge, now called 'biosolids', provided demand for the products and, hence, an income stream.

11. In the 1970s, the governments of the day avoided saying what their preferred option for managing sewage sludge might be. The concept was that government (also a regulator at that time) defined the standards for safe practice and then left it to water authorities and the market to choose which option was best on the basis of pure economics. The government was also the 'banker' in controlling water authority finances, particularly through Annual Plans and External Financing Limits.

What are some of the highlights since 1981 in sludge management which affect us today?

Narrowing options for use

12. What was agreed in 1981 provides the bedrock of current practices. The report of the Subcommittee on the Disposal of Sludge to Land included the use of sludge in agriculture and established the first principles of good practice based on chemical risks and criteria (soil, crop yield and quality protection), microbiological risks and criteria (human, animal and plant health protection) and nuisance (particularly odour).

13. It was not until the implementation of the Urban Waste-Water Treatment Regulations (UWWTR) in 1994, implementing the EU UWWT Directive, that agricultural use of sludge was given a specific push and marine dispersal prohibited (which finished in December 1998). Regulations implementing the Landfill Directive phased out disposal to landfill (now incorporated under the Environmental Permitting Regulations (EPR) 2016), leaving the

remaining choices as use on land, particularly agriculture, and incineration (the latter also covered by EPR implementing the requirements of EU legislation). The effect is that over the years, the restrictions concerning use and disposal of sludge have developed along with regulations on incineration and waste management. The net result is that all aspects of sludge management outside of use in agriculture is controlled by the EPR (more on this later).

14. The Waste Reduction and Recycling Act 2011 and consequent regulations contain a suite of measures to reduce waste generation and landfill disposal and encourage recycling. It promotes waste avoidance and reduction and encourages resource recovery and efficiency. These set out the concepts such as the waste hierarchy and Duty of Care. And whilst sewage sludge, per se, is not a regulated waste (unless managed outside of agricultural use) the whole way in which decisions are made on sewage sludge disposal is consistent with the principles of the waste legislation.

15. The modern choice is primarily between the production and use of treated sludge in agriculture, which we now call 'biosolids', and the incineration of sludge for energy recovery. In 2006 there was a flurry of official and NGO supporting statements for biosolids use in agriculture as the 'Best Practicable Environmental Option' (BPEO) summarised in a Water UK report 'Recycling of Biosolids to Land'. Of particular relevance are supporting statements from the Environment Agency and from the government. In a letter sent in March 2006 from the then Minister of State for Climate Change & Environment, Elliot Morley MP, to Water UK:

> "I am pleased to provide a statement outlining Government policy which supports the continued use of treated sewage sludge (biosolids) as a fertilizer on agricultural land.
>
> "The Government considers that recycling of treated sewage sludge to agricultural land is the Best Practicable Environmental Option (BPEO) in most circumstances. The practice aligns with the principles of the waste hierarchy of reduction, re-use, recovery and then disposal.
>
> "Recycling to agricultural land also brings considerable benefits including positive effects for the fertility, workability, structure and the water holding capacity of the soil.
>
> "The Sludge (Use in Agriculture) Regulations 1989 (SI 1263) as amended in 1990 (SI 880) impose controls on the application of sludge to agricultural land to prevent the accumulation of heavy metals in the soil and to prevent bacteriological contamination of crops. These controls are supplemented by a non-statutory Code of Practice and the 'Safe Sludge Matrix' drawn up by Water UK and the British Retail Consortium. On the basis of advice from the independent expert Advisory Committee on the Microbiological Safety of Food, the Food Standards Agency has indicated that it considers the application of sewage sludge to agricultural land should not present unacceptable risks to food safety, provided that it has been carried out in accordance with the requirements currently set out in the regulations, the Code and the Matrix.
>
> "I can confirm that we intend to reflect the tighter standards established by the Matrix to which the industry is working in revised regulations. I am grateful for the contribution Water UK has made to the development of these regulations."

16. I am not aware of any further statement and this was referred to again in a Water UK briefing pack published in January 2010.

Tightening controls over sludge use in agriculture

17. In the later 1980s, the EC decided at the end of its research programmes to enact a Directive on the use of sludge in agriculture in 1986. And the UK, through its various connections, played a substantial role in shaping that Directive with the underlying attitude that the Directive should not be an instrument of impediment, but rather one of enablement.

18. The UK standing committee system, which had evolved, provided a governmental focus for inputs into the draft Directive. It also advised government on the regulations to enact the 1986 Directive on use of sludge in agriculture, which became the 1989 Sludge (Use in Agriculture) Regulations (SUiAR), and also produced the first version of the accompanying DoE Sewage

Sludge in Agriculture: Code of Practice, the latest version being 2018 with only a formatting update, and thus, is out of date. I will discuss the reasons for this later. 'Agriculture' was as defined by the Agriculture Act 1947, which still applies.

19. The Code is non-statutory guidance. It is still held as an official Defra document and available on the government website. The regime was designed to be permissive rather than restrictive; in that it defined good practice, but did not require unswerving compliance, per se. However, departing from the Code would lead to an offence if it resulted in pollution, nuisance or health risk. The Code went well beyond the Regulations and was the water sector standard.

20. This Code was supplemented in 1998 by the ADAS Safe Sludge Matrix; produced Water UK and BRC, and included input from the Environment Agency, Department of Environment Transport and Regions (DETR) and Ministry of Agriculture Fisheries and Food (MAFF). The negotiations were managed by ADAS and included discussions with other interested parties such as the National Farmers Union (NFU), Country Land & Business Association (CLA), food manufacturers and food processors. This anticipated some of the aversion to all matters sewage which I discuss below. The last formal edition in itself was the third edition published in 2001. It has long been anticipated that the Matrix would be incorporated into a revised Code and maybe even revised Regulations, and it is a disappointment that it has not. It would have strengthened them. However, it is good that the objectives of the Matrix have been updated and embedded in the Biosolids Assurance Scheme, which I discuss a little later.

21. The 1980s and 1990s saw a large national research campaign to investigate the potential benefits of using sewage sludges as forest fertilisers. The main outcome of the research was 'A manual of good practice for the use of sewage sludge in forestry' published by the Forestry Commission and the Water Research Centre in 1992 and updated in 2006 (again CIWEM played a role in this). Whilst it was recognised that forestry, per se, lay outside the term 'agriculture', it was exempt from the licencing system (exemption was granted on the basis of being applied at no more than prescribed rates and where application will result in 'ecological improvement'). This manual satisfied the exemption and was an extension of the Sludge Use in Agriculture Code. Later, the use of treated sewage sludge in forestry became subject to permitting under the Environment Permitting Regulations of 2016.

The importance of understanding human behaviour and the evolution of the concept of 'biosolids'

22. One of the findings from the Standing Committee back in the 1980s, in its research programme, was to identify a psychological phenomenon termed the 'faecal aversion barrier'. Public attitudes to sewage are determined by this barrier. Everything we are taught about faeces is that lack of hygiene causes illness. It is an instinctive behavioural response to avoid diseases and is known medically as coprophobia. There is constant regeneration of this aversion message through public health education, quite rightly. We have to embrace this truth, but it provides a communication challenge. Applying sludge to land, even when treated, is at risk from this. There continues to be a risk that, unless there is a clear distinction drawn between safe, treated products (now called 'biosolids'), and raw sludge and septage, the public could reject all such use. Most public complaints arising from real or perceived problems relate to sight and odour.

23. The same problem was identified in other advanced countries with wastewater treatment, and an agreement was reached in the early 1990s, in global discussions, to use the term 'biosolids' as a distinct term for a distinctly different safe product. It is recognised as such by the Oxford dictionary and Wikipedia for example. The US Environment Protection Agency uses the term in its regulations. But the UK Government was reluctant to adopt this term, because the Regulations, and subsequent Code of Practice, were driven by EU directives which use the term 'sludge ', despite the negative connotations of this term. But in 2006 the EA did refer to biosolids in its supporting statements for the practice to Water UK. For too many years the language used by regulators and the water industry has been confusing and inconsistent. 'Biosolids' is not a glib marketing term; it is driven by psychological science to describe a substance that is micro biologically distinct from raw sludge. Not understanding the difference remains a problem now, as I will explain later.

24. With the benefit of hindsight, the industry was too slow in embedding this knowledge into the heart of its operations. We all were too slow in phasing out long-term storage of raw sludge as a suitable method of treatment; too slow in phasing out lagoon storage of liquid treated sludge on farms; too slow to understand the operational and psychological benefits of 'productification' of dewatered biosolids; and indeed we spent too long defending the discharge of screened sewage via long sea outfalls to the marine environment in the 1980s. We relied on the physical sciences more than the psychological sciences. But water companies got there in the end! However, one early decision, certainly in Anglian Water, was to stop using iron salts as a sludge dewatering conditioner – the product looked too much like faeces.

25. And we have to understand that the core aversion remains with us and can drive attitudes in all sectors.

26. After the introduction of the Safe Sludge Matrix, the first strategic response by the water industry to reflect the demand for product assurance was the introduction of HACCP (Hazard Analysis and Critical Control Point), now accepted as an industry standard and embedded in the Biosolids Assurance Scheme. The Food Standards Agency defines this as managing food safety hazards.

    "Food safety management procedures should be based on HACCP principles. It involves:

- looking closely at what you do in your business, what could go wrong and what risks there are to food safety.
- identifying any critical control points the areas a business needs to focus on to ensure those risks are removed or reduced to safe levels.
- deciding what action, you need to take if something goes wrong;
- making sure that your procedures are being followed and are working; and
- keeping records to show your procedures are working."

Biosolids Assurance Scheme

27. In the next systemic response to this insight, the water industry created the Biosolids Assurance Scheme (BAS) to bring meeting the various regulations, codes and best practice together. The scheme is owned and operated by Assured Biosolids Limited - a not-for-profit company set up by 11 UK water and sewerage companies in 2017. An independent UKAS accredited Certification Body audits scheme members annually. The BAS operations and marketing are funded by members based on quantities of biosolids recycled to agricultural land. BAS certification covers all activities from sludge treatment to biosolids use. The scheme is managed by a board of directors appointed by the 11 water companies. This really formalised the use of the term biosolids.

28. The principal reason for creating the BAS was to provide reassurance to food chain stakeholders and the general public, that biosolids recycling is a safe and sustainable process. The water industry sought the views of food chain stakeholders before designing the BAS scheme along the same model lines as that of food assurance schemes (such as LEAF and Red Tractor, more on earned recognition schemes later). It must be remembered that the BAS was never designed as a regulatory tool, although it makes a substantial number of references to the Sludge Use Regulations and Code. This design may change in future (see later).

29. The scheme is an excellent tool in providing assurance to food producers and the general public but does need to be re-examined even in the current context. The scope of the scheme includes treatment of sewage sludge (including source material controls), transport, storage and application to agricultural land. The scheme states that it does not currently include applications to non-agricultural land (e.g. land reclamation). This is a non sequitur in that, by definition, biosolids are not used in land reclamation nor forestry – the definition of biosolids embraces both treatment and use in agriculture. An exclusion is more properly expressed as that …. the scheme only covers food production and excludes use on other productive land.

30. The scope of BAS goes beyond urban wastewater treatment sludges. It includes industrial waste waters as source materials coming into a waste- water treatment works (WWTW), water

treatment sludges coming into a WWTW or sludge treatment centre, and ‘feedstock’ eg green material (other organic wastes) coming into a sludge treatment centre. And there is some ambiguity in the terminology and status of the outputs from these processes. The BAS itself reflected evolution of thinking to include co-treated organic wastes, and this has been given more prominence by the push from Ofwat to create a ‘bioresources market’ (which I discuss a little later) and may well have contributed to the triggers for regulatory change.

31. Co- treated (with ‘feedstock’) products are distinctly different at present as they would appear to require Permits to be used (although this is equivocal if the other organic waste is also exempt from permitting); the product is neither ‘fish nor fowl’. The whole focus of biosolids is the treatment and use of the products derived from urban waste waters, which contain, so called, ‘trade effluents. But as I observed above, the industrial waste waters, defined in the BAS, mixed with domestic sewage, which is treated in the WWTW, appear to be more than trade effluent. There is certainly a need to clarify the terminology and role of industrial waste waters as compared to trade effluents.

32. The point about water treatment sludges is valid because many are managed by delivery to a WWTW for co-treatment. If there is an issue herein, it could be dealt with by the simple step of a water company issuing a trade effluent consent for this practice. Internal consents have been used before. Alternatively, the co- treatment of water treatment sludges as part of water companies’ licenced activities for water supply could become a legitimate part of urban waste-water treatment. This could be reflected in any legislative change.

33. The risks managed by the Safe Sludge Matrix embedded in the BAS are based on knowledge gained from research and practical operations from sludge alone, although subsequent research has included ‘modern day’ products. And some of the other organic wastes co-treated have well known risk profiles such as farm-yard manure, straw, wood chippings and saw dust. I suggest a way out of this dilemma later, after I have discussed economic regulation.

34. And because it was not designed as a regulatory tool, the BAS does not give any specific assurance that the all relevant Regulations and Permitting (which by now have multiplied to include matters such as treatment, storage, transport and diffuse pollution of water), and all the relevant Codes including Good Agricultural Practice will be complied with as a minimum. Nevertheless, in practice, these external requirements are embedded. A further example of this being the Biosolids Nutrient Management Matrix, produced jointly by ADAS with Bangor University, issued in 2014.

35. So, BAS does not cover all uses of biosolids, covers the use of more than biosolids in the production of food, and is not a regulatory tool. There is a difference between saying that all materials covered by BAS are described as biosolids and saying that BAS is designed to cover biosolids. It is offered as an assurance scheme for other similar products containing treated sewage sludge.

36. There is too much elasticity in the use of the term ‘biosolids’. The BAS cites the supporting documents from 2006, but these clearly refer to the concept of biosolids being confined solely to treated sewage sludge.

37. The BAS envisages that third parties will be involved in managing urban waste- water treatment sludges. How far does the water industry anticipate that its urban wastewater treatment sludges will be passed over to independent sludge treatment plant operators and biosolids suppliers to agriculture (agricultural contractors have always been employed by water companies as part of farm supplies)? I think that it is more likely that most co-treatment plants are likely to be run by water companies, with these companies taking in other feedstocks rather than sending urban waste- water treatment sludges to a commercial works, but this could change. However, in practice, it is likely that almost all of the assured operations, so far, have been for treated sewage sludge alone as an integral part of water company operations; and with a permit where there is co-treatment.

38. The changing market opportunities for the commercial treatment of sludge has risen to the fore in the Scheme and might explain remarks by EA in its Draft Sludge Strategy that "SUiAR were designed to control the sludge supply chain. In 1989 this was considered to be short and linear. Water companies produced and treated their own sludge. It was then supplied and spread locally. The supply chain is no longer short and linear. From where the sludge is treated to where it is spread, can now involve long distances and third-party contractors. The contractors, who can also be sludge producers or waste management companies, may handle, treat, store and spread the sludge that is produced by others." But water authorities and water companies have always used agricultural contractors, so it is the concept of other parties getting involved with more than that which appears to have been the concern.

39. BAS is an orphan in the regulatory framework and should be brought in more explicitly into that framework. And the EA recognises that the current legislation is complex and confusing.

Earned Recognition

40. The most likely way of doing so is going to be by Earned Recognition (ER). A Task Force was set up in July 2010 to carry out an independent review into ways of reducing regulatory burdens on farmers and food processors. The Task Force reported its findings to Defra in May 2011, making over 200 recommendations on how regulatory burdens could be reduced. One of the key themes of the Task Force report was the need for government to adopt an 'earned recognition' approach to reduce the burden of inspections. The Task Force explained that this approach: "...is about giving official recognition to the effective efforts made by individuals and businesses in understanding legal requirements and getting things right".

41. There were already some ER schemes, but the Defra commitment rolled forward significantly in 2013 when it said that in considering Earned Recognition we must ensure that:
    - Safety, animal welfare and the environment standards are protected.
    - Where used, recognised third party inspections are demonstrably robust, independent and subject to robust checks and controls.
    - Introducing earned recognition should be fair and proportionate, undertaken in consultation with interested parties.
    - Regulators remain fully responsible for enforcement and sanctions.

42. There are now a number of schemes published in 2018 by the Food Standards Agency, including Red Tractor, in the feed and food sector.

43. As the assurance of compliance with regulations and best practice increases, so the need for regulatory inspections diminishes. And where biosolids use in agriculture is concerned, these inspections are articulated in the government guidance on Environmental Protection Inspections of Farms in 2016. But Assurance does not replace the statutory objectives which are set out separately. Thus, there is a triangular relationship between the regulation, the additional best practice, and the management system, which provides assurance to regulators and the public that these have been complied with. In fact, as I explain later, it could well be a quadrilateral relationship, because the regulation can be split into the content of Regulations and the content of any subsequent Permits. A good example of the triangular relationship is the application of the Drinking Water Regulations and earned recognition of the water company monitoring schemes. Whilst the regulations provide for proper monitoring, the ultimate responsibility is to deliver safe drinking water.

44. And if the BAS is to become an ER scheme, a decision will have to be taken as to what is stipulated where, and it may well be that the BAS reproduces the content of a revised Code. If the current approach ceases, is there a need for Regulations to be the focal point of statutory responsibility, or will these all be contained in Permits? If so, where will the general principles for these be expressed? So whatever course of action is pursued, much work needs doing on the content of the Regulations, Code and BAS. If the BAS is to become an ER scheme, then it might well have to be approved by both the EA and Food Standards Agency for all the uses of biosolids (I repeat that the current definition of agriculture embraces more than food production). The current flexibility of annual updates might not be so easy. It could include co-treated products, or other kinds of sludge, provided that it is made plain that the materials are not biosolids, but are being treated with the same care as biosolids per se. There would have

to be additional underpinning evidence that the technical criteria of the Scheme are valid for these products. The EA has suggested that an ER scheme could form part of its Sludge Strategy.

Changes to regulation, including the introduction of economic regulation

45. Earlier, I referred to the impact of numerous changes arising from European legislation. In 1995, an integrated environmental regulator was created in England and Wales - the Environment Agency. In 2013, Natural Resources Wales was created with an even wider remit. But the really big change for the water industry came with privatisation, the creation of water companies and the introduction of economic regulation in 1989, which has been extended more specifically on sludge in recent years. And this included the new dynamic of an economic regulator, Ofwat.

Environmental regulation

46. The introduction of Waste Regulations in 2011, Controlled Waste Regulations in 2012, and Environmental Permitting Regulations in 2016, has created a permitted environment for all sewage sludge management outside of the concept of biosolids. Permits may be bespoken or issued under Standard Rules. An unexpected consequence of this is that Site Permits are required for all biodegradable wastes in compost and anaerobic digestion plants above a minimum size, which embraces sewage treatment works. But because of this different envelope of regulation, in this instance, a Permit is needed as a 'Biowaste'. This was introduced to implement the Industrial Emissions Regulations of 2013, with some controversy. It would appear that the last round of consultation in the Winter of 2019/20 on Standard Rules for such plants will extend the remit to include treatment with lime. So, yet another term and regulatory silo.

47. The problem with such Rules is that they may be less burdensome administratively, but the 'one size fits all' can often be overly restrictive. An insight into how such an impact may occur is with the introduction of the regulations controlling the diffuse pollution of water from agriculture in 2018 (the so called 'Farming Rules for Water'). These apply to biosolids. One feature is the need to only apply organic manures, including biosolids, to meet the needs of crops. EA is now proposing that this will prohibit autumn application for crops that do not need nutrients until the spring. Whilst it is possible that this might be appropriate for some organic manures, it is not justified by science nor experience for biosolids. That debate continues. But a seasonal ban would have the effect of bringing many biosolids operations, (and, indeed, manure spreading), to a halt with the consequence of more incineration. It does highlight the advantage of having a focused, but flexible, Code of Practice underpinning operations.

48. This essay does not provide sufficient space to go into the full impact of the EU Common Agricultural Policy. But the reform of 2003 led to the concept of the Single Farm Payment and hence to cross compliance. Cross compliance is made up of 'Statutory Management Requirements' (SMRs) and standards for 'Good Agricultural and Environmental Conditions of land' (GAECs). They cover public, animal and plant health, environment, climate change and good agricultural condition of land, animal welfare. Thus, the use of biosolids became part of the inspection regime to facilitate payment. Although biosolids use no longer specifically forms part of any SMRs, adherence to good practice has been a key feature and will continue in the post Brexit regime. The Defra Code of Good Agricultural Practice for farmers, growers and land managers (the 'CoGAP') offers practical interpretation of legislation and provides good advice on best practice. It states that good agricultural practice means a practice that minimises the risk of causing pollution while protecting natural resources and allowing economic agriculture to continue. And hence the BAS ensures that farmers using biosolids will comply with this Code as well, and the single payment can proceed at least from that perspective.

49. But the EA wants to bring agricultural use of biosolids into the Permitting system and in 2020 proposed a new Strategy which I discuss later.

Economic regulation: the dilemma of co-treatment and its unintended consequences

50. In September 2011, following a request from Ofwat, the Office of Fair Trading published a market study on organic waste and sludge treatment. This proved to be seminal and is the origin of some of the current dilemmas. The OFT categorise these wastes into two broad types: sewage sludge which falls within Ofwat's regulatory ambit; and other organic waste such as slurries, manure and food and drink waste, the treatment of which is not directly regulated by Ofwat. The OFT examined the markets for the treatment of organic waste from three distinct angles:
    - competition between statutory water and sewerage companies ("WaSCs") for the treatment of sewage sludge.
    - competition between WaSCs and other waste management companies for the treatment of sewage sludge; and
    - competition between WaSCs and other waste management companies for the treatment of other organic wastes (OOW).

51. The OFT's main recommendation was for
    - Ofwat "*to adopt a system that, within a regulatory framework, better incentivises WaSCs to consider alternative market solutions and a better use of market-based instruments to manage risk*."
      The OFT goes on to state that:
    - "*we advise Ofwat to consider the introduction of a specific regulatory system for sewage sludge only if changes to the regulatory framework resulting from its root and branch review are not deemed to address the specific concerns identified in this market study and after ensuring that the rationale for having a differentiated system is subject to close scrutiny*."

52. The Market Study's recommendations included further alignment and convergence of the legal framework for environmental protection and of relevant quality standards for treatment of sewage sludge and OOW. As regards the planning regime, OFT pointed to the ongoing work in relation to the National Waste Management Plan for England and the formulation of a national waste policy. It also recommended increasing engagement between local communities, local authorities and the waste management industry.

53. Eventually in 2017, Ofwat, the water industry economic regulator, focused on these concepts. Common sense, and an entrepreneurial spirit in the water industry, had identified the opportunity to co-treat sewage sludge and other organic wastes to serve the greater needs of the environment and economy. This triggered Ofwat to change the licence conditions of water companies. To encourage this thinking, it has established the concept of 'bioresources', which covers all aspects of wastewater sludge, transport, treatment, recycling and disposal, and this includes co-treatment. Biosolids will be one product amongst many within the definition of' bioresources'. So, what do we call other products used beneficially, for example in land reclamation? The new syntax of 'bioresources' has created yet more complexity but could be harnessed in an integrated approach.

54. Ofwat's key driver is to create a market in which sludge can be traded between and with third parties, including other water companies. Trading with third parties will be restricted unless co-treatment occurs, as in most cases it will not be possible to keep the two streams separate.

55. The competitive driver in minimising sludge disposal costs has always been a feature of sector economics even before economic regulation. But the new player is the concept of co-treatment with other organic wastes, and this amongst a variety of factors, has had the unintended consequence of catalysing the proposed application of Environmental Permitting to biosolids operations.

56. In theory, bringing different organic wastes (sewage sludge and other organic wastes) together as bioresources offers some benefits. As I said earlier, the water industry has long proposed the co-digestion of sewage sludge with other biomass (primarily food waste and vegetation spoil) in their anaerobic digestion plants. Doing so creates residual value for these other organic wastes and using a careful blend, results in more heat and biogas being produced. Water companies could in theory apply for a co-digestion licence under EPR (as biowaste) but the application process, the time taken for deployment to be granted, and associated

restrictions and storage costs in the meantime, render co-digestion uneconomic in practice. Prolonged regulation will not be able to move swiftly enough to cope with fickle British weather.

57. Anglian Water recently proposed to conduct trials of a strictly controlled 80:20 blend of sludge and food waste to inform implementation of the EA draft Sludge Strategy, which I discuss below. The question that I pose is this: does the economic benefit of creating an income stream from co-treatment in a competitive market create too many regulatory risks for the core biosolids operations? We can already see how such risks can occur in the debate about the application of the so-called Farming Rules for Water 2018 as I explained earlier. The plain truth is that co-treated sewage sludge products are not biosolids.

58. How big is this market likely to be? It is interesting to note that a trade body has been created in 2009, originally as the Anaerobic Digestion and Biogas Association (ADBA); becoming in 2014 the Anaerobic Digestion and Bioresources Association. Renewable Energy Assurance Ltd (REAL) offers a certification scheme.

The importance of safe sludge and biosolids use in the contemporary context of the circular economy, flourishing in the post Brexit economy, and achieving net zero

59. We must keep a focus on the core objective that safe, sustainable and assured use of biosolids in agriculture is an excellent exemplar of the circular economy and a practical contribution to a low carbon economy, which everyone can understand, especially with the UK hosting COP26 later this year. Managing sewage sludge is an excellent example of the waste hierarchy in action, even though the use of biosolids, per se, lies outside of the consequent EPR. But risk-adverse approaches to regulation and enforcement are constraining options and forcing sludge down the waste hierarchy toward less beneficial, more carbon-intensive uses. We must also remember that properly treated sludge can also be used on land for non-agricultural purposes, when it is not deemed biosolids and must be subject to a permit. Even though this is a minor activity, it is valuable and needs protection.

60. Good sewage sludge management is a small part of sustainable land stewardship, but because of the faecal aversion barrier it attracts disproportionate attention. Within the waste hierarchy (avoid, reuse, recycle, dispose with energy recovery, and lastly, dispose) sewage sludge cannot be avoided or reused but it can be safely recycled (used) within a supportive regulatory regime and with the tacit approval of those in the food chain. Agricultural use of sludge is a happy alliance that reduces water bills for customers whilst benefitting soils and the environment.

61. Recycling sludge to land as biosolids means maximising the amount of carbon retained in solid form and sequestered in soil structures. The only realistic alternative would be to dispose through incineration, which would be wasteful and much more expensive for water customers even with energy recovery, with all the carbon content of sludge lost to the atmosphere. Building the new incinerators needed would be an expensive, locally contentious, lengthy endeavour. A return to incineration would not only breach government's policies and aspirations, but it would also be very unpopular. I remember that, as an Environment Agency Board Member, the only Board meeting which was disrupted (maybe the only such disruption ever), was by public protest over proposals for an incinerator.

    Safe, sustainable, assured and desirable use of biosolids should be part of the government's new post-Brexit farming and environmental land management strategy. The regulation of sewage sludge should therefore be risk-based and not risk-adverse; based on a presumption in favour of recycling to land given the more damaging alternatives.

National Sewage Sludge Management Strategies

62. It is regrettable that the lessons of forty years ago seem to have been forgotten. In the current system, there is no overarching strategy or central co-ordinated focus. It appears that there are parallel, rather than convergent, economic and environmental regulations. For example, there is no consistency of syntax usage between any of the parties concerned. There is confusion over whether, or when, to use the term 'sewage sludge' or 'wastewater treatment sludge' or 'bio

resources'; that 'sewage sludge' and 'biosolids' are used interchangeably; and whether the concept of 'bioresources' exists outside of Ofwat regulation. The water industry and ADAS talk about 'biosolids '. Ofwat talks about 'bioresources', but in a different way to ADBA and possibly the EA in its sludge working groups. EA avoids both terms in the body of the 2020 draft Strategy but does refer to 'biowaste' regarding site permits and in the working groups. EA did use the term 'biosolids' in its 2006 supporting statement. There is an air of perversity or siloism in the lack of consensus. And all parties get confused. For example, the description of the management of biosolids by agricultural use or for land reclamation or incineration, undermines the clarity of the term 'biosolids. And the impression, given by an overview of the system, is complexity leading to confusion.

63. There are several committees and working groups, but it would appear that they operate in silos and they need to be brought together and given an overarching focus, in which consensus can be achieved on what is best for post Brexit England and Wales, and in which any conflicts in evidence or opinion can be aired and resolved.

64. If one applies the government mantra that government decides overarching policies and the regulators flesh these out with detail, and then execute them, then it may well be that the initiative ought to be taken by Defra, possibly in the context of the 25 Year Environment Plan and Agriculture Act, to create a central focus. And does the regulatory landscape I have described satisfy the principles of better regulation in the Regulators' Code of 2014?

65. I have explored Ofwat strategy's regarding economic regulation, but what is EA's strategy? Inevitably, as always happens in life with incremental changes, inconsistencies arise, which need resolving without challenging or undermining the solid basis of the current concepts and practices. The Environment Agency is right: it is time to review the regulation of sludge. But any new approach needs to comply with the principles of better regulation.

The Environment Agency's new Sludge Strategy

66. EA's Strategy for Safe and Sustainable Sludge Use was published in March 2020 with the aim of implementing by 2023. It is a clear example of 'strategy in a silo'. It considers a single set of issues when the whole business of sewage sludge management needs to be looked at afresh. It is a strategy for changing the controls that apply to biosolids but without placing this within a broader framework. It does not use the water industry syntax of 'biosolids' or even Ofwat 's 'bioresources' in its terminology. The strategy focuses on the regulation of 'sustainable sludge uses on land' and not its other uses, because they are regulated separately. Instead of a strategy, it is narrowly about the process of migrating the Sludge Use in Agriculture Regulations into the Environmental Permitting Regulations. Amongst its highlights, it:
    - Proposes to bring sludge manufacture, treatment and use under the EPR regime, so that sludge and biosolids are regulated along with other "organic manures".
    - Means the Sludge (Use in Agriculture) Regulations (SUiAR) will be revoked, although some aspects could be retained.
    - The Waste Codes for sewage sludge and sludge containing other materials (RPS231) will also be withdrawn.

67. It sets out four options and proposes Option 4: Evolve EPR Regulatory Tools. I agree that Do Nothing is not viable. Option 4 is more flexible than Option 3 but is still an additional set of rigid controls. Option 2 for the revision of the SUiAR is rejected. It is worth understanding why and I hope that it is not too late to reconsider EA says that "*The advantages of revising SUiAR are that it would:*
    - *provide improved regulatory controls*
    - *provide an opportunity to ensure protection of human health and the environment*
    - *provide a charging scheme*
    - *create a more modern framework*
    - *prevent spreading or disposal of untreated sludge*
    - *combine spreading and storage and harmonise regulatory responsibility*
    - *enable more confidence in the use of sludge on land.*

"Disadvantages are:

- *it is not within our remit to change SUiAR*

- *maintains regulation inequality in the bioresources sector*
- *does not allow consistent regulation with the waste management sector*
- *does not allow for the co-treatment of sludge and other waste*
- *Major revisions to SUiAR could provide the necessary environmental and regulatory improvements. However, this would not enable the co-treatment of wastes or clarify issues over the definition of a sludge producer. Revision of SUiAR to incorporate these changes would create a parallel regime to the existing EPR. It would still result in complex regulation*."

68. The inclusion of septic wastes make sense, not only because of the regulatory bracketing with sewage sludge in the Controlled Waste Regulations, but because there is the potential for these to be treated with equal merit in plant not located on sewage treatment works. Significant quantities of septic tank emptyings are transported to sewage treatment centres and hence join the appropriate exemptions and regulations applying to the host centre.

69. In making these observations the EA does not demonstrate any empathy with the idea of an overarching framework, or how any revisions could also have major implications for the Code of Practice (in fact the assumption is that if the SUiAR goes then so does the Code). However, there is a hint that BAS might be accepted as an Earned Recognition scheme. And there is a working group on the subject of assurance, but without a Code what would the scheme focus on? It may be of value to look at the experiences of self-monitoring of effluents (see EA guidance of June 2020); such monitoring is to determine compliance with consents to discharge, and in the case of urban waste waters compliance with the relevant Regulations. I also referred to a similar approach to drinking water monitoring in para 44.

70. As I wrote earlier, there is a triangular relationship between legal responsibility, the assurance scheme which gives comfort to regulators and the public, and best practice. The comfort given to regulators enables them to adopt a lighter touch in the execution of regulations and the terms of any permit. There needs to be a consensus on the balance between points on this triangle and the value of maintaining a separate code, even if its content is replicated in the BAS. If the legal responsibilities are expressed only in a Permit rather than backing regulations, there could well be challenges and I discuss these later. The optimum way forward, maybe, is to split the regulations and permitting, thus creating a quadrilateral relationship.

71. It does, however, provide an insight that the introduction of a bioresources market has triggered a wish to change the entire regulatory regime for biosolids, which affirms my question about the risk/benefit balance of co-treatment.

72. EA's strategy says one reason for rejecting option 2 is that it does not have the power to amend the SUiAR. But it has the power to recommend to ministers that the SUiAR be amended, just as it will recommend to Defra that the SUiAR be revoked.

73. It is worth explaining why the SUiAR might not have been revised before. It might well be the use of the Safe Sludge Matrix, HACCP and the introduction of the Biosolids Assurance Scheme made this unnecessary. And the Regulations were tied to a particular Directive. The maxim of 'sleeping dogs' comes to mind! But the introduction of the bioresources market, EU-exit and gaining control of retained EU legislation, coupled with a number of pressures on the EA, might have been the trigger for change. Revised Regulations could be tucked in under the Environment Bill or the Agriculture Act with specific provision for a Code of Practice and maybe even a formal version of the BAS without the need for permitting.

74. Revoking SUiAR will also render obsolete the associated Code of Practice. There would still need to be set of practical operational criteria for an assurance scheme to comply with. Without the protection of the Code and Safe Sludge Matrix, it means that the current permissive approach to regulation would be in jeopardy and could be replaced by a more restrictive approach through the EPR. At the moment biosolids producers and users can operate as long as the Code of Practice is followed with assurance under the BAS. Instead, under the EPR regime, the operations will need a Permit, in extremis, for each site, but preferably for a regional operation. And following the lead of the FRfW, and indeed the Nitrate Vulnerable Zones and cross-compliance regulations, if it is site based, it will be land managers

who will need a Permit, which will surely be a disincentive for farmers to continue to use biosolids. There is a potential contrast, in which it appears that it is producer responsibility defined in Permits issued for other treated organic wastes applied to agricultural land. Under such circumstances there would be a complex relationship between the assurance provide by the supplier and the responsibilities of the land manager.

75. The aspiration is that a revised BAS would have 'Earned Recognition' status and allow a light touch permitting regime. But I repeat that it would still need separate regulatory definition of criteria against which assurance is assessed. And in my opinion, the experience with the Farming Rules for Water, so far, does not set a good precedent for light touch permitting.

76. The strategy fails to recognise that if sludge is not used on land, as biosolids, it would have severe economic consequences for farmers and water companies. It would have to be incinerated instead; at massive cost to the climate, and would be replaced with alternatives, which could have greater impact on the environment. ADAS and Cranfield University are investigating the consequences of this that have already emerged, following EA's new interpretation of the FRfW regarding the allowable timing of biosolids application to land.

77. The strategy does not adequately explain why there is a need to migrate to the more restrictive approach for biosolids. It does not draw on the 40 years of experience. There are hints of the need for some of the issues I have raised to be investigated. It proposes four working groups:

- *EPR and SUiAR review and revise group:* This group will review the EPR framework and SUiAR. It would also need to lead on the revision of the Controlled Waste Regulations. It will create a new EPR based regulatory framework. Membership will also include Water UK – industry technical experts, and the Biowaste Regulatory Forum – a trade group from the bioresources sector. Will this be the place where the Regulations and Code will be modified because they will be needed as the 'coat peg' on which the Assurance Scheme hangs, even with EPR? Will this be the place in which a decision is made to rekindle Option2? And once more there is confusion in terminology. 'Biowastes' by virtue of EPR site permits are any anaerobically digested organic waste (above a certain small size). So is the intention that the Sludge Strategy will include co-treated or even sole food and farm waste? If so, then the science and experience behind the understanding of risk will have to be extended to ensure that there is no more risk than the baseline understanding of treated sewage sludge alone, and the term biosolids will have become less certain unless that can be demonstrated. And is the term 'bioresources' used in the context of ADBA or Ofwat? If ADBA it will include other organic wastes as sole materials, whereas Ofwat's definition includes sludge treated with other organic waste and sludge alone. This is trying to do too many things at once.

- *Legislative change group:* EA will work with Defra on the required legislative changes to support the strategy and this could include a revision of Regulations and Code and not just the repeal of the SUiAR.

- *Assurance scheme group:* This group will produce recommendations for an assurance scheme to support the regulation of sludge treatment, storage and use. Membership will also include Assured Biosolids Limited and other relevant groups. As I have explained, any transformation of the scheme will require a revisit to the focus of the BAS. If it is intended to cover all of the variations above, it cannot be based on the existing criteria of BAS because all the risk analysis is based on experience and research on sludge alone; it would need to add new criteria. It will need to focus primarily on what we have called 'biosolids' for some time but offer the same assurance framework to co-treated products, whilst not calling these biosolids. Not to do so would disrupt the existing scheme. In fact, it would destroy the unique value of the word 'biosolids'and the brand value that it has. I suggest a way forward from this dilemma below.

- *Septic tank group:* This group will look at current industry practices for septic tank sludge spreading direct to land. It will characterise the potential environmental risks and propose new requirements for treatment and spreading. Membership will also include the waste industry and Water UK.

78. And very importantly where is the NFU who played a key role 40 years ago, or the CLA, in any group?

79. All of the details I have laid out and how the strategy has been developed suggests we need a rethink of where we are going. From the perspective of the EA, it is helpful to group similar things together, like the use of all anaerobic digestates. But from the water industry's point of view there is confusing overlap, which could compromise the core objective of safe, sustainable, assured, desirable use of treated sewage sludge. The EA has tried to create too many level playing fields at the same time.

80. I advocate, therefore with new insight, that if it is not too late, Option 2 should be revisited and re-evaluated and placed in a broader framework.

Principles for a Sludge Management Strategic Framework for the future

An overarching framework

81. The lesson of forty years ago is that it is essential to bring all aspects of sludge and septage regulation under a single strategic framework, but with some common principles particularly those arising from the Waste Hierarchy applying to every option, such as the Duty of Care applying to producers, contractors and customers. It must be demonstrably compliant with the 2014 Regulators Code.

82. This Code says that regulators should avoid imposing unnecessary regulatory burdens through their regulatory activities and should assess whether similar social, environmental and economic outcomes could be achieved by less burdensome means. Regulators should choose proportionate approaches to those they regulate, based on relevant factors including, for example, business size and capacity. And when designing and reviewing policies, operational procedures and practices, regulators should consider how they might support or enable economic growth for compliant businesses and other regulated entities, for example, by considering how they can best:
    - understand and minimise negative economic impacts of their regulatory activities.
    - minimise the costs of compliance for those they regulate;
    - improve confidence in compliance for those they regulate, by providing greater certainty; and
    - encourage and promote compliance.

83. This proposed framework should be driven collectively, and past initiatives should be revisited. The regulation of sludge does not sit in a vacuum. There must be a principle of equity; for example, incineration of sludge should be regulated the same as that of municipal solid waste, and biosolids should have equity with farmyard manures and chemical fertilisers in agronomic principles. And there should be consistency of syntax.

84. Such a framework should have a clear purpose to help achieve net zero greenhouse gas emissions by 2050, the long-term goals within the 25 Year Environment Plan and to come under the Environment Bill, for example, and to develop a resource-efficient circular sewage sludge economy in accordance with the waste hierarchy.

85. To reflect the Ofwat terminology, this should be described as the '**National Strategic Framework for Managing Bioresources'**. The objectives should be to ensure the safe management of all bioresources and, in particular, to ensure the safe, sustainable, assured, desirable use of biosolids in agriculture. In this context the term bioresources is as used by Ofwat and not by ADBA.

86. Within the framework there should separate modules for each option defining best practice and regulation recognising their different properties, benefits and risks; for example, a biosolids module.

87. A ‘biosolids use on land’ module would incorporate updated Regulations, Code of Practice and the Biosolids Assurance Scheme. BAS could be extended to provide assurance to other sewage sludge-based products and non-agricultural beneficial uses on land, such as those below, without these being deemed biosolids:
    - A land reclamation module
    - A forestry module
    - A septage module
    - A co-digestion module, and subsequent agricultural use, could unlock the additional benefits of mixing waste streams, but will need a more research.

88. The Framework and its constituent modules should be ‘owned’ by all interested parties (policy makers, regulators, academics, water companies, farmers/land managers and contractors) through joint working and co-creation, and supported by the latest science, so that decisions are driven by evidence and experience and not by faecal aversion. This needs to be national initiative driven by Defra.

89. The terms sludge, septage, bioresources, biowaste and biosolids should be clearly defined and used consistently rather than interchangeably and/or differently.

90. In this way, by collective creation of a new regulatory framework which learns from past experience, supported by the science, the full potential of these important bioresources can be realised. And rather than wait until 2023, we could begin to transition toward it now, by building on the permissive codes of practice we already have.

91. Thus, if the only way forward for biosolids use (by far and away the most widely used option for sludge management) is to be by EA‘s Option 4, it needs to have a clear rationale. A regulatory Impact Assessment should compare the transaction and other costs involved against current practice. Any additional regulatory burden on biosolids to land needs to be justified in the context of this remaining the Best Practicable Environmental Option for sludge management and satisfy the Regulators Code.

***How can we resolve the issues identified*?**

92. We need to bring all of the components into greater harmony:
    - This could be achieved by establishing a national focus in which all of the relevant parties, including customers, are represented. It would appear that Defra is best placed to catalyse this. The EA could still retain a focus on each of the options, but this would require a reconfiguration of the current working groups.

93. The national focus could have oversight of:
    - A national archive of publications supporting a national strategy - maybe BAS could be commissioned.
    - Creating a consensus on syntax.
    - Providing a forum for conflict resolution, on such matters as the FRfW and the juxtaposition between Ofwat and EA regulations.
    - Developing the National Strategic Framework which can be rolled forward as knowledge and experience evolves.
    - Providing a national focus on evaluating risks and co-ordinating research as concerns emerge.
    - Under overarching principles, there would be modules on good practice and regulations for clearly defined activities, some examples being biosolids use, co-treatment, use of treated sludge in land reclamation and forestry, incineration, other industrial uses of sludge such as constituent recovery, and septage management. Further modules could be developed. The great advantage would be that the complexity and miscellany of regulation which impacts on all sludge management would be located and connected in one place.
    - If it is not too late, revising the 1989 SUiAR, associated 2018 Code and the relationship to any assurance scheme like a revised BAS particularly as Earned Recognition. And I address this especially below.

What the Biosolids Module could look like

94. There are a number of ways forward each with benefits and risks. In fact, I have commented extensively during this essay, but it is worth a reprise:
    - An unequivocal statement from government on biosolids to land as the BPEO, to replace that issued in 2006.
    - If it is not too late, review and modify the Regulations (which could be relocated in the Environmental Bill) incorporating all the changes since 1989. This will be necessary no matter which option is accepted as a 'central coat hook' for agreed compliance criteria and applies in Options 2 and 4. This is clear cut.
    - Similarly review the Code of Practice to play the same role as now in fleshing out the bare bones of the Regulations. Again, this would be essential in any regulation of biosolids use in agriculture and could replace Standard Rules in a permitting system.

95. Dealing with the practical criteria, in any other way, is risky or more restrictive. If the SUiAR are repealed and sludge use is brought in under the EPR without the core strength of the SUiAR and the associated code, it will be left to the nature of Permits to define what happens in practice. Either these will be defined in Standard Rules which will have to be as detailed as a revised Code of Practice and with the risks of draconian approaches, like those proposed for the Farming Rules for Water, or with the burden of bespoke Permits, with an understanding that these would be based on criteria as detailed, which would be included in a revised Code and would be more of an administrative burden. And all of this will involve land managers, who should not carry the administrative burden.

96. Which leaves the revision and use of the BAS as an Earned Recognition scheme. First the revision needs a reprise of its foci and syntax. The dilemmas identified earlier could be resolved if BAS was renamed the **Bioresources Assurance Scheme** – that would bring it into line with the Ofwat requirements and the title of my proposed National Strategic Framework. Then, upfront, it could say that the principal focus would be to provide assurance for the use of biosolids in agriculture; and by that, I mean the strict use of those words. As I said earlier there is a difference between saying that all materials covered by BAS are described as biosolids and saying that BAS is designed to cover biosolids but offered as an assurance scheme for other similar products containing treated sewage sludge. Thus, it could maintain its principal purpose of assuring biosolids use in agriculture and then go on and say that the Scheme is offered in separate sections for other beneficial uses of treated sewage sludges on land (in other strategic modules – so there would be cross referencing) without calling them biosolids. Another section would cover the use of co-treated products on land, again without calling them biosolids (again referring to a separate module in the National Strategic Framework).

97. Of course, if the aspiration is to keep the biosolids module regulated by the current principles is maintained, then all the other modules would have to recognise the additional need to reflect Permitting. But if that aspiration is not successful, then all modules would include permitting as well.

98. It would also help if the concept of trade effluent consents for water treatment sludges discharged into the urban wastewater stream was introduced

99. If the ultimate destination is permitting, there is an aspiration that a revised BAS as ER could be coupled with a very light touch permit. But this would still to have to have defined regulatory targets, which determine when a criminal offence is caused. The Standard Rules and bespoke Permits would both sit more comfortably if there were a set of independent criteria which can be used under the EPR to determine when an offence occurs. The BAS, as an Earned Recognition Scheme, would ensure light touch inspections and so on. Although an analogy can be drawn with the earned recognition of effluent and drinking water monitoring (para 90), a lesson is that, in spite of some long-term aspirations, it appears that it has not yet been possible to agree an ER Scheme for water abstractions. The good news is that the EA envisages an ER scheme as part of its future Strategy.

100. So, a way forward might be a hybrid of option 2 and 4, with the revised BAS as an Earned Recognition scheme holding the ring. This approach has precedent.

101. As a final speculation - if the destination of all the discussions is for an Environmental Permit applied to biosolids use, then every effort should be made to avoid a farm-by-farm permit system, which would apply if land managers were to be made responsible. If the responsibility is vested in the producer - the water companies - it could be possible to issue a single permit to a water company for each treatment centre source with a schedule of farms supplied with an easy access system to keep the schedule contemporary. Permits for individual farms would be burdensome and expensive. The alternative could be combined in some way with the permit issued for the treatment plant under the Industrial Emission Regulations, as a combined Bioresources Permit. This would simplify the role of an ER scheme.

Final thoughts

102. The beneficial use of treated sewage sludge on land has a good track record of success and has evolved to reflect the best practice of the day. It is still the right approach for the world we live in, reinforced by the climate emergency and the UK regaining control over agricultural and environmental policy. That does not mean that it cannot be improved. But nor does it mean there should be more demanding regulation; it means 'smart regulation' which serves the greater goal of sustainable use. Even though agricultural use is likely to have the very dominant role in wastewater management, it must be recognised that there are other opportunities and there is a pressing need for an overarching framework. At the moment, there is overlap and confusion, a lack of a central focus. And in the context of better regulation, there is justification for a fresh look.

103. The focus of this essay has been the strategies and tactics for ensuring that biosolids use in agriculture is sustainable. It has not sought to address any specific technical issues in detail. But I am aware of the continuing angst about chemicals in biosolids. I would like to make some final comments on the way that we deal with that angst.

104. Such concerns have been with us since the whole subject of the biosolids management was placed on a scientific basis, but the nature of the chemicals has constantly changed. So far there is no evidence that substances other than those already catered for have caused problems. But we cannot be complacent. This is borne out by a recent UKWIR report 'Biosolids to Market. I must say that we will always have such angst, which is driven in part, by the faecal aversion barrier. That does not mean that such concerns are invalid or can be dismissed. We must listen and the management processes must be constantly vigilant and be ready to deal with any concern as it arises. This means that as they arise, they need to survey and researched in a methodical fashion and then any consequential evidence incorporated into regulation .. and having a Code of Practice makes this easier. This means creating a national research focus … a working group .. into which all parties contribute, which can act as a hub for co-ordinating research, and maybe even commissioning it. This was at the heart of the success of the 1981 guidelines and 1989 Regulations and was certainly at the heart of the EU Directive. Such a focus would be a key part of the National Strategic Framework for Managing Bioresources which I proposed earlier.

105. The banner for CIWEM's 125 years celebration was based on tradition but moving forward with innovation. Bioresources management can reflect that by being based on experience and moving forward with innovation. And CIWEM can play a role in this.

106. In paragraph 1 , I referred to CIWEM Position Statements. In fact, CIWEM produced Handbooks on Sewage Sludge: Utilisation and Disposal in 1978 (as IWPC) and in 1995. In the 1995 edition I am cited at the start with a quote originating in 1991 .. 'Even after decades of interest, sludge disposal is a subject which continues to attract great attention. There will not be any boredom for sludge disposal managers over the next twenty years '. In fact, this year is a thirty-year anniversary of that quote! And the prediction of a lack of boredom is still true. The constant pressure of faecal aversion means that this will continue. But the BBC2 programme 'The Secret Science of Sewage' on the 18th March shows that, with the right communication, sewage can be celebrated as an important sustainable resource.

107. During the essay I refer to the ‘diaspora’ of knowledge arising from the 70s to the 90s and recommended the need for a central archive. The 1995 Handbook has a valuable set of contemporary references which can contribute to that archive.

108. To finish, I am going to take a chance and repeat the prediction.. ‘Even after decades of interest, sludge disposal is a subject which continues to attract great attention. There will not be any boredom for bioresources managers over the next twenty years ‘.

APPENDIX 2

BIOSOLIDS ASSURANCE SCHEME
NATIONAL BIOSOLIDS ARCHIVE

AS AT 7th SEPTEMBER 2022

STORED AT CAMBRIDGE SEWAGE TREATMENT WORKS
FOR ACCESS TO THE DOCUMENTS PLEASE CONTACT
bas@assuredbiosolids.co.uk

This archive is established to preserve the evidence used to underpin the Guidance of 1981 and the Regulations in 1989 in particular. But it does continue thereafter. It is needed because none of the early documents, in particular, were digitised and held on the web After the early 1990s, digitisation started. Some of the early documents have been digitised retrospectively. Unfortunately, with the progress of time, hard copies have been thrown away, but some were retained for reasons of sentimentality. Some of these retained documents have been rescued literally from journeys to disposal, through the Select Society of Sanitary Sludge Shovellers.

The catalogue starts with hard copies of rescued documents; the intention is that key documents will be digitised in due course. More will be added as they are found. The second phase will be to search out digital documents. Inevitably the archive is incomplete, but enough is now catalogued to give some key evidence, but importantly, this gives an insight into the depth and breadth of the effort involved in producing the best guidance, and the enthusiasm by water professionals to share and develop best practice not only within the UK, but throughout the world.

An inspection of the web shows that there are many papers and reports which can be accessed. The first electronic paper is a 2021 Linkedin post which sets out the history of where we were in 2021 (https://www.linkedin.com/posts/peter-matthews-043050147_essay-on-the-future-of-biosolids-management-activity-6833462209230737408-6ukW). The start of the hard archive is with the establishment of DoE Working Party on Sludge Disposal to Land in 1973 ,which was assimilated into the work of the Standing Committee on Sludge Disposal , DSS , in 1975 .The papers include some of the reports of the sub committees of DSS and of the Disposal of Sewage Sludge to Land , DSSL, working parties. After the Guidance was published in 1981, work continued to develop good practice and to underpin the UK leading contribution to the development of the EU Directive on the use of sludge in agriculture (published in 1986), through the COST 68 & 681 programmes and Directive working parties. It also underpinned the UK contribution to the WHO reports on risks 1981- 1984. The continuing work contributed to the DoE Working Party for development of the 1989 Code of Practice and Regulations and subsequent evolution of good practice through the Safe Sludge Matrix and HACCP and eventually to the emergence of the Biosolids Assurance Scheme.

An important element of the work was the development of 'Blue book' methods for analysis, and this archive covers only a fraction of what was produced. But because of the focus on analysis there was a need to understand the environmental dynamics behind the methods and much of the broader issue of utilisation sustainability seem to have passed to the Standing Committee of Analysts, which was tucked in under the Drinking Water Inspectorate. Some of the early papers have been archived by the Environment Agency which is the principal government organ for dealing with these matters at the moment.

CATALOGUE

CONTAINING DOCUMENTS DONATED IN PARTICULAR BY PAUL LOWE, JEREMY HALL, TIM EVANS and PETER MATTHEWS

Catalogue Protocol

1 Prefix H for hard copy (the initial focus); prefix E for electronic copy with hyperlink connection
2 Split contributions as follows

- Code 81 : up to 1981 this includes all reports and papers for the 1981 reports

- Code 81-92: 1981-1992 includes work on current Regulations, Code of Practice, Safe Sludge Matrix
- Code92+ : Anything after 1992
- Code EC 68 : All relevant EC reports up to 1986: 68 Refers to COST 68 the Programme which led to the 1986 Directive.
- Code EC 68+ : All relevant EC reports after 1986
- Code Other : Other documents of tangential relevance
- Code US : Relevant material from EPA etc

3 The catalogue has been designed in Microsoft Word so that it can be searched with the Home Find facility using whatever words the searcher desires, but to help , if the following key words are not used in each entry , they are added to facilitate search .

- Review
- Management
- Strategy
- Policy
- Regulation (which includes formal guidance)
- Guidance Guidelines
- Directive
- Economics
- Perception
- Agricultural value
  Nutrients
  Organic value
- Treatment
- Storage
- Odours
- Chemicals including PTEs
- Pathogenic
- Analysis
- Alternative uses
- Sustainability
- European Commission
- International
- Book
- Handbook

It was difficult to assign key words ;in some cases, meeting reports , conference proceedings, or books cover all aspects , so these have assigned to review or management or policy .But practice with the catalogue may need to these being reassigned .The key word research has been left out as it would bring up a high proportion of the documents.

The initial effort has been invested in getting a catalogue established. So, the number system is not chronological but rather reflects the incoming flow of documents. It may be possible in due course to improve the catalogue protocol.

The catalogue is dated in order to keep track of updates.

No.	Code	Title, author, date	Extra key words
1	H81	Report of Working Party on the Disposal of Sewage Sludge to Land. DoE/NWC Standing Tech Committee Report 5. July 1977	Review, Guidance, Regulation
2	H81	Report of the Sub-Committee on the Disposal of Sewage Sludge to Land. DSSL. DoE/NWC Standing Tech Committee Report 20., July 1980	Review, Guidance, Regulation
3	H81	Report of the Standing Committee on the Disposal of Sewage Sludge DSS DOE/NWC Standing Tech Committee report 21 . July 1981	Review, Guidance, Regulation

4	H81	TR 31 Nitrate Groundwater studies in chalk near Winchester . Young Hall , Oakes . Sept 1976	Nutrients
5	H81	WRC TR69 Nitrate in groundwater. Young, Gray . Jan 1978	Nutrients
6	H81	TR71 Contribution of sewage sludges to the dissemination of pathogenic micro- organisms. Carrington. Feb 1978	Treatment
7	H81	WRC TR123 Design and establishment of field experiment on the agricultural use of sewage sludge. Coker, Oct 1979	Agricultural value
8	H81	WRC TR 128. Fate of pathogenic organisms during wastewater treatment and disposal. Carrington. Mar 1980	Treatment
9	H81	WRC TR129 Isolation and identification of Salmonellae spp in sewage sludges: a comparison of methods and recommendations for a standard technique. Carrington. Mar 1980	Pathogenic, Analysis
10	H81	WRC TR 139 Cadmium in agriculture with special reference to the utilisation of sewage sludge on land. Davis, Coker. June 1980	Chemicals
11	H81	WRC TR 156 Control of contamination problems in the treatment and disposal of sewage sludge. Davis, Dec 1980	Chemicals
12	H81-92	WRC TR166 Sewage sludge disposal; A strategic review and assessment of research needs. Collinge, Bruce. June 1981	Overview
13	H81	WRC TR183 Field experiments on the use of consolidated sewage sludge for land reclamation. Effects on crops yields and composition and soil conditions 1976-1981. Coker, Davis, Hall, Carlton-Smith, Dec 1982	Oher uses
14	H81	WRC TR 140 Crops as indictors of the significance of contamination of soil by heavy metals. Davis, Carlton-Smith, July 1980	Chemicals
15	H81	WRC 146M. Effect of time of application of lagoon matured digested sewage sludge on the yield and composition of winter whea.t Hall, Coker. June 1981	Treatment, Agricultural value
16	H81	DoE/Liverpool School of Tropical Medicine (PECD7/7072) Parasites in sewage sludge. Crewe, Owen. March 1978	Pathogenic
17	H81-92	FWR FR0034 WRC. Effects of sewage sludge application on soil microbial processes and fertility. Smith, Hall., Oct 1989	Agricultural value
18	H81-92	Effective Rhizobium present in 5 soils contaminated with heavy metals from long term applications of sewage sludge or metal mine spoil Smith, Giller, Soil Biol Biochem 24(8) 1992	Chemicals
19	H81	NWC Water Journal articles about Water Authority activities including a review of a presentation by Matthews to RSH conference on those activities. May 1979	Review
20	H81	Anglian Water: Manual of Good Practice for Using Sewage Sludge as a Fertiliser. AWARD March 1979	Management
21	H81	Severn Trent Water: Sludge Utilisation Handbook. April 1979	Management, Guidance
22	H81	Yorkshire Water Sludge Recycling Code. Feb 1980	Management, Guidance
23	H81	YW Updated Code of Practice. Oct 1988	Management, Guidance
24	H92+	WRC Common Interest Research U-0915. Effects of heavy metals in sewage sludge in treated soils on	Chemicals

		nitrogen turnover. I A model system using isotope dilution and sludges of controlled metal content, Smith, Hall. Dec 1993	
25	H92+	WRC Common Interest Research U-0915. Effects of heavy metals in sewage sludge in treated soils on nitrogen turnover. II Field observations on nitrification, Smith, Hall. Jan 1994	Nutrients, Chemicals
26	H92+	WRC/Thames Water Ref 10087/1 Phosphate availability of biosolids from Mogden STW. Smith. Jan 1996	Nutrients, Chemicals
27	H92+	WRC /Thames Water. Field trial demonstration of the agricultural use of Perry Oaks sludge. UC 1975. Reynolds, Hallett, Hall. April 1993	Agricultural value
28	H92+	MAFF Countryside Matters, Soil Code. 1998	Regulation
29	H92+	MAFF Countryside Matters, Air Code. 1998	Regulation
30	H92+	MAFF Countryside Matters, Water Code. 1998	Regulation
31	H92+	DoE/CES UK Sludge Survey. Feb 1993	
32 / 72	H81-92	DoE SI 1989:1263 Sludge Use Regulation and Code of Practice	Regulation
33	ECH 81-92	EC Sludge Use Directive 86/278 EEC 1986	European Commission, Regulation
34	H81-92	WRC Recent UK research into incidence, transmission and control of Salmonellae and ova parasites in sludge. Pike. June 1986	Pathogenic
35	H81-92	WRC Pasteurisation and destruction of pathogens. Yorkshire Water /WRC seminar on Integrated Sludge Treatment at Colburn STW and future trends. Catterick Bridge. June 1986	Pathogenic
36	H81-92	IWEM NW Branch Sewage sludge disinfection using peracetic acid. Fraser, Godfree, Gibson, Jones, Slater. Nov 1983	Pathogenic, Treatment
37	H81-92	WRC Methodology for undertaking BPEO studies of sewage sludge treatment and disposal PRD 2305M/1 Powlesland, Frost., Dec 1990	Economics
38	H81-92	WRC A strategy for cost effective treatment and disposal. Calcutt. Sept 1985	Economics
39	H81-92	Severn Trent Water. A review of existing and emerging sewage sludge treatment technologies, Sept 1991	
40	H92+	Aqua Enviro 2nd European Biosolids and Organic Residuals Conference, Wakefield. Presentation. A global view of biosolids management sustainability. Matthews. Nov 1997	Review
41	H92+	As 40 but Sludge and the UK. Environment Agency, Sweet	Regulation
42	H92+	5th Aqua Enviro Conference Nov 2000 and 14th WEF Annual Residuals and Biosolids Conference Feb 2000 Boston. A Millennium perspective on biosolids management. Matthews	Review
43	H92+	United Utilities. Pathogens in UK biosolids and background to UKWIR pathogen research programme. Godfree. UKWIR /Aqua Enviro Workshop 2001	Pathogenic, Treatment
44	H92+	University of Leeds. Fate of pathogens in sewage sludge processing. Horan in UKWIR / Aqua Enviro workshop 2001	Pathogenic, Treatment
45	H92+	WRC/Environment Agency Sewage Sludge Survey 1996/7 (P2/065/1) Gendebien, Carlton-Smith, Izzo, Hall	

46	H92+	WRC TR 61 Water industry construction cost estimating manual. Beal, Hall, 1991	Economics
47	H81-92	IWEM Tyne and Humber Branch. Operating experience of sludge disinfection and stabilisation at Colburn sewage treatment works. Hudson. YWA/WRC. Oct 1987	Pathogenic, Treatment
48	H81-92	IWPC NE Branch WRC Evaluation of picket fences for assisting consolidation of sewage sludge. Hoyland, Day. March 1985	Treatment
49	H81-92	IWEM SE branch. WRC Review of treatment process options to meet EEC Sludge Directive. Bruce, Pike, Fisher. June 1989	Treatment, European Commission
50	H92+	Combi Conference. A beneficial approach to sewage sludge treatment and management. Edinburgh, Oct 1998	Treatment
51	H92+	CIWEM Symposium. Innovative technologies for sludge treatment and disposal. Chester. Dec 1994	Treatment
52	H81-92	WRC/DoE Full scale comparison of thermophilic aerobic digestion and anaerobic digestion for stabilisation and disinfection of sewage sludge (7/7/261). April 1988	Pathogenic, Treatment
53	H81	WRC TR 42 Economic aspects of sewage sludge disposal. Porch, Bayley, Bruce, May 1977	Economics
54	H81-92	WRC U19 WISDOM sludge treatment and disposal model. Carlton-Smith, Powlesland. Nov 1989	Economics
55	H81-92	WRC Oil from sewage sludge. An interim assessment. Frost, Fisher. Feb 1989	Treatment
56	H81-92	WRC Design procedure for sewage sludge consolidation tanks. Hoyland, Day, Dee. Sept 1985	Storage, Treatment
57	H81-92	WRC /BABA Workshop on prefabricated anaerobic sludge digesters experience to date and the future. Stevenage. Nov 1989	Treatment
58	H81-92	WRC CHP yes or no? Wolinski undated	Treatment
59 /158	H81	DoE /DSSL Sewage sludge survey 1980. August 1983	
60	H81-92	WRC 270-S Project 135L Utilisation of digester gas. Study – power generation at Naburn STW .2nd progress report 1983 Frost, Lee, Foulkes, Andrews	Treatment
61	H92+	SORP Workshop- Bio-aerosols from organic wastes. What's the problem? London. July 2004	Treatment, Pathogenic, Perception, Odours, Public perception
62	H8-92	WRC. The use of sewage sludge in land reclamation and assessment of potential. Hall, Daw Bayes. Oct 1988	Alternative uses
63	H81-92	WRC FRD 1043-M/2 (ME9125 SLD) Liverpool School of Tropical Medicine. Parasites in sewage effluent. Carrington, Crewe, Pike. June 1988	Treatment, Pathogenic
64	H92+	Aquaenviro. Workshop on process requirements for pathogen removal in sewage sludge. Wakefield. April 1999	Treatment, Pathogenic
65	H92+	Aquaenviro / UKWIR Biosolids and Organic Residuals Conference Workshop. Pathogens in biosolids and their significance in beneficial use programmes. Wakefield. Nov 2001	Treatment, Pathogenic
66	H92+	UKWIR 99SL/06/3 Survey of E.Coli in UK sludges. Humphrey. 1999	Treatment, Pathogenic
67	H92+	CIWEM/Aquaenviro. Preconference workshop. Stakeholder views and perceptions in the sustainability and acceptability of recycling organic	Public perception

		residuals .8th European Workshop. Wakefield . Nov 2003	
68	H92+	Aquaenvio/CIWEM 5th European Biosolids and Residuals Conference Workshop. Producer responsibilities and environmental liabilities. Wakefield. Nov 2000	Management, Regulation
69	H92+	Aquaenvio / CIWEM 5th European Biosolids and Residuals Conference Workshop. Biowastes and biosolids within the EU thematic strategy. Nov 2000	European Commission
70	H81-92	WRC PRD 1199-M/2 Infectivity of Taenia eggs after sludge treatment B(ME 9147 SLD) Pike., June 1988	Treatment, Pathogenic
71	H92+	WRC Report to DETR /MAFF and UKWIR. Review of the scientific evidence relating to the controls on the agricultural use of sewage sludge. Part 1 Evidence underlying the 1989 Code of Practice for the Use of Sludge and Sludge Use Regulations. Part 2 Evidence since 1989 relevant to the controls on the agricultural use of sludge. Carrington, Davis, Pike. June 1998	Review, Regulation
72&32	H81-92	Doe Sludge Use Code of Practice 1989	Regulation
72A	H81-92	Water UK / BRC /ADAS Safe sludge Matrix 3rd Edition. April 2001	Regulation
73	H92+	SORP Workshop Partnership on the sustainable use of organic residuals on land. Wadham College. July 2002	Management
74	H92+	Irish Government Dept of Environment & Local Government. Code of Practice for the Use of Biosolids in Agriculture 1999?	Regulation
75	H92+	Aquaenviro workshop. Process requirements for pathogen reduction in sewage sludge Wakefield. April 1999	Treatment, Pathogenic
76	H92+	BICS. Conference. Sewage sludge disposal to meet the 1998 deadline. London . Nov 1993	Management
77	H92+	Aquaenviro Sludge Master Class. Getting to grips with pending changes in regulations and technologies. Feb 2001	Management, Regulation, Treatment
78	H92+	FWR Publications catalogue	Review
79	H92+	Tim Evans for the EC. Guide to the use of wastewater biosolids in agriculture. Jan 2006	Review, Regulation, European Commission
80	H92+	WRC/EC Waste Management. Sewage sludge. Part 1 Survey of sludge production, treatment quality and disposal in the EU. B4-3040/014156/92.EC 3646. Oct 1996	Review, European Commission
81	H92+	As archive no. 80, EC3757 Quality criteria, classification, strategy development. Oct 1994	European Commission
82	H92+	FWR D/0009 The examination of sewage sludges for polychlorinated dibenzo-p-dioxins and polychlorinated dibenzo furans. April 1993	Chemicals
83	H92+	Composting Association. A feasibility study of the introduction of process and quality standards for compost in the UK. Dec 1998	Regulation
84	H81-92	University of Leeds / Yorkshire Water. Survival of faecal indicator micro- organisms in refuse /sludge composting using the accelerated static pile system Pereira-Neto, Stentiford, system Pereiraagement & Res 1986 (4) 387-406	Treatment, Pathogenic
85	H92+	Tim Evans The European Commission's Environmental Liabilities White Paper and	Regulation

		Communication on the Precautionary Principle - how do they affect biosolids management? 2000	
86	H92+	WRC/Thames Water. Effects of sewage sludge application to agricultural land on the size and activity of the soil biomass UC 2703. Feb 1996	Agricultural value, Chemicals
87	H92+	MAFF/DoE Review of the use of sewage sludge in agriculture, soil fertility aspects. Oct 1993	Chemicals
88	H81-92	Severn Trent Water: Sludge Utilisation Handbook 1986	Management, Guidance
89	H81-92	IEHO Guidance notes on the application of sewage and sewage sludges on land. Dec 1987	Regulation
90	H81-92	WRC/Thames Water TR251. Effects of metals in sludges and treated soils on crops. Carlton-Smith. Dec 1987	Chemicals
91	H92+	Two papers setting out advantages of HACCP by Buick of Sothern Water and AMA BOOST. 1999	Regulation
92	H92+	Phenipal (UK) Sewage sludge disposal; Symposium. Warrington. Jan 1995	Review
93	HUS	Water Environment Federation USEPA Plain English Guide to the EPA Part 503 Biosolids Rule	Regulation
94	H92+	Aquaenviro 2nd Biosolids Conference. Paper Further experiences with Southwest Water's thermally dried sludge. Whipps, Wharton from SWW, Pell Trischmann, ADAS. And developing commercial outlets for sludge dried pellets. Nov 1997	Treatment, Economics
95	H92+	FWR more efficient sludge drying 0317 Sivil, Day. Sept 1992	Treatment
96	H92+	University of Leeds /Aquaenviro. Thermal processing of wastewater sludge. January 1993	Treatment
97	H92+	Aquaenviro 1st Biosolids Conference Drying of sewage sludge. Wakefield. Oct 1996	Treatment
98	HEC68	COST 68 Report of Management Committee EU/SP/48/75	Policy, European Commission, Book
99	HEC68	1st Symposium Cadarache France. Feb 1979	Policy, European Commission, Book
100	HEC68	Treatment and use of sewage sludge. Final Report. General Report. May 1981 Covers all aspects of the EC work on what we now deem biosolids and contributed to the proposal for the 1986 Directive	Policy, European Commission, Book
101	HEC68	As archive 100. Scientific Report. May 1981 Covers all aspects of the EC work on what we now deem biosolids and contributed to the proposal for the 1986 Directive	Policy, European Commission, Book
102	HEC68	As archive 100 Technical Annexes. May 1981 Covers all aspects of the EC work on what we now deem biosolids and contributed to the proposal for the 1986 Directive	Policy, European Commission, Book
103	HEC68	2nd Symposium. Vienna, Austria Oct 1980	Policy, European Commission, Book
104	HEC68	Workshop. Phosphorus in sewage sludge and animal waste slurries. Groningen, Netherlands. June1980	Nutrients, European Commission, Book
105	HEC68	Workshop. Disinfection of sewage sludge: Technical, economic and microbiological aspects. Zurich, Switzerland May 1982	Treatment, Pathogenic, Economics, European Commission, Book

106	HEC68	Activity Report SL/70/ 82 Oct 1980-June 1982 This includes all aspects of committee activities and research . Precursor to the 1986 Directive	Policy, Treatment, Pathogenic, Chemicals, Agricultural value, European Commission, Book ,
107	HEC 68	As archive 106 Final Report General Report 1983 SL/94/83. Contributed to the proposal for 1986 Directive	Policy Treatment, Pathogenic, Chemicals, Agricultural value, European Commission, Book
108	HEC68	As archive 107 Scientific Report	Policy Treatment, Pathogenic, Chemicals, Agricultural value, European Commission, Book
109	HEC68	Workshop. Methods of characterisation of sewage sludge. Dublin, Ireland July 1983	Analysis, European Commission, Book
109A	HEC68	3rd Symposium Brighton Sept 1983	Policy, European Commission, Book
110	HEC68	Workshop Utilisation in agriculture of anaerobically digested effluents Demuynck. Brussels. March 1984	Agricultural value, European Commission, Book
111	HEC68	Workshop. Efficient use of sludge and manure Denmark June 1985	Agricultural value, European Commission, Book
111A	HEC68+	4th Symposium Rome, Italy Oct 1985	Agricultural value , European Commiss
112	HEC68+	General Report 1984-1985 SL /109/85	Policy, European Commission, Book
113	HEC68+	Activities 1986-1988 SL/128/85	Policy, European Commission, Book
114	HEC68+	Report 1986-1990 on research	Policy, European Commission, Book
115	HEC68+	Seminar. Anaerobic digestion of sewage sludge and organic wastes. Athens, Greece. May 1984	Treatment, European Commission, Book
116	HEC68+	Seminar. Inactivation of micro-organisms by stabilisation processes. Hohenheim, Germany. Oct 1994	Treatment, pathogenic, European Commission, Book
117	HEC68	Seminar. New developments in processing sludges and slurries. Bilthoven , Netherlands. April 1985	Treatment, European Commission, Book
118	HEC68	Seminar. Odour prevention and control of organic sludge and livestock farming Silsoe, UK April 1985	Treatment, Odours, European Commission, Book
119	HEC68	Seminar. Sampling problems for the chemical analysis of sludges, soils and plants Bordeaux, France Nov 1985	Analysis, European Commission, Book
120	HEC68+	Workshop. Volatile emissions from livestock farming and sewage operations. Uppsala, Sweden. June 1987	Odours, European Commission, Book
121	HEC68+	Seminar. Factors influencing utilisation practices in Europe Liebefeld , Switzerland. May 1985	Review, European Commission, Book
122	HEC68+	Symposium. Compost: Production, quality and use. Udine, Italy. April 1986	Review, European Commission, Book
123	HEC68+	Symposium. Scientific basis for soil protection in Europe. Berlin Germany. Oct 1986	Policy, European Commission, Book
124	HEC68+	EC/NVA/EWPCA Conference. Sewage sludge treatment and use. New developments. Technological aspects and environmental effects. Amsterdam, Netherlands. Sept 1988	Treatment, Sustainability European Commission, Book

125	HEC68+	Workshop. Compost processes in waste management .Neresheim ,Germany . Sept 1988	Treatment, European Commission, Book
126	EC68	Workshop. Anaerobic digestion. Results of research and demonstration projects. Villeneuve d'Ascq France. March 1986	Treatment, European Commission, Book
127	HEC68	Polychlorinated biphenyls. Determination in sewage sludge and related samples. Results of inter-laboratory comparison .SL/.111/85. Langen, France. March 1985	Analysis, European Commission, Book
128	HEC68	Nitrogen and phosphorus value in sewage sludge .SL/82/82 Rev 1985	Nutrients, European Commission, Book
129	HEC68+	Workshop. Hygienic aspects of the treatment and use of organic sludges and liquid organic wastes. Dublin Ireland. Sept 1987	Pathogenic, Treatment, European Commission, Book
130	HEC68+	Survey of sewage sludge disinfection processes SL/121/87 1987	Pathogenic, Treatment, European Commission, Book
131	HEC68+	Meeting. Agricultural use of organic sludge and liquid organic wastes. Valencia, Spain. Nov 1987	Agricultural value, European Commission, Book
132	HEC68+	Same as archive 131 but Lelystad, Netherlands. Sept 1988	Agricultural value, European Commission, Book
133	HEC68+	Workshop. Measurement of odour emissions. Zurich Switzerland. April 1988	Analysis, odours, European Commission, Book
134	HEC68+	Meeting. Safe and efficient slurry utilisation. Liebefeld Switzerland. June 1988	Review, European Commission, Book
135	HEC68+	Workshop. Organic chemicals in wastewater, sludge and sediment; occurrence, fate and disposal. Brussels, Belgium. Oct 1988	Review, European Commission, Book
136	HEC68+	Seminar. Epidemiological studies of risks associated with agricultural use of sewage sludge. Knowledge and needs. Metz, France, May 1985	Pathogenic, European Commission, Book
137	HEC68+	Seminar. Effects of organic chemicals in sewage sludge and soil fertility, plants and animals. Braunschweig, Germany. June 1990	European Commission, Chemicals, Agricultural value, Book
138	HEC68+	Symposium Treatment of sewage Sludge Athens Oct 1990	European Commission, Book
138A	HEC68+	Workshop. Treatment of sewage sludge. Thermophilic aerobic digestion Nancy France. Nov 1987	European Commission, Book
139	HEC68+	Review of COST68/COST681 1972-1990 pub 1992	European Commission, Book
140	HEC68+	Workshop. Composting and compost quality assurance criteria Angers, France. Sept 1991	Regulation, European Commission, Book
141	HEC68+	Workshop. Recent developments in sewage sludge processing. Lappeenranta, Finland. June 1990	Treatment, European Commission, Book
142	HEC68+	Seminar. Odour and ammonia emissions from livestock farming. Silsoe, UK. March 1990	Odours, European Commission, Book
143	HEC68+	Workshop. on problems around sludge. Stresa, Italy Nov 1999	Management, European Commission, Book
144	H81-92	WRC Conference Alternative uses of sewage sludge. York. Dec 1989	Alternative uses, land reclamation
145	H81	WRC Stabilisation, disinfection, and odour control in sewage sludge treatment. Bibliography 1950-1983. Connor, Bruce 1984	Pathogens, odours, European Commission, Book
146	H Other	IWA World Congress on sludge management, Berlin. Oct 2001	Review, Book

147	H Other	IWA Conference on Sludge management. Entering the Third Millennium Taipei, Taiwan . March 2001	Review, Book
148	H Other	IWA Conference on Management, regulation, treatment, utilisation and disposal. Acapulco, Mexico. Oct 2001	Review, Book
149	H Other	IWA Conference on Waste management problems in agro-industries Shiga , Japan. Nov 2001	Review, Book
150	H Other	CIWEM Handbook Introducing treatment and management .1995 Covers all aspects of what we deem good practice	Book
150A	HOther	CIWEM Handbook. Sewage sludge utilization and disposal 1995. There have been Position Statements since then	Book, Management, Review
150B	H Other	IWPC Manual Sewage Sludge 1 Production, Preliminary treatment and digestion 1979	Book, Treatment
151	H Other	IWPC Manual Sewage Sludge II. Conditioning dewatering and thermal drying 1981 &1999	Book, Treatment
152	H Other	IWPC Manual Sewage Sludge III. Utilisation and disposal 1978	Book, Management
153	H Other	IWPC Manual Primary Sedimentation 1980	Book, Treatment
154	H Other	IWPC Manual. Activated Sludge 1987 & 1997	Book, Treatment
155	H81-92	MAFF ADAS The use of sewage sludge on land 1982	Regulation
156	H81	DoE/NWC//DSSL WG3 Inventories of UK research on the land disposal of sewage sludge Technical note 5 1976 Technical note 12 1978 Seminar crop trials 1979 Covers all aspects leading to 1981 Guidance	Policy, Treatment, Agricultural value, Pathogenic, Chemicals, Odours, Regulation
157	H81	DoE/NWC/ DSSL WG3 Research seminars Pathogens in sewage sludge Tech note 7 July 1977 Manurial value of sewage sludge Tech note 9 Oct 1977 Effect of metal chemicals in sewage sludge Tech note 11 July 1978 Leading to the 1981 Guidance	Policy, Agricultural value, Pathogenic, Chemicals Regulation
158	H81	DoE/NWC/DSSL Sewage Sludge Survey 1980 August 1983	
159	H81	Bundle of papers on potato cyst nematode research, particularly in Anglian Water 1976-1982 for DSSL and Standing Committee of Analysts	Analysis, Pathogenic, Treatment
160	H81-92	Sewage sludge disposal and utilisation, the current situation. Water Services July 1982 and Wat Sci Tech 11983, 15 135. Matthews	Review
161	H81-92	Agricultural use of sewage sludge, the current situation. Eff Wat Treat March 1982 Matthews	Review,
162	H81-92	Sludge utilisation in the EEC. Water July 1981 Matthews	Review, European Commission
162A	H81-92	EWPCA Sewage sludge utilisation in the EEC. European views on the Sludge Use Directive. Submitted to the EEC. Sept. 1982	Review European Commission
163	H81	Boron in sewage sludge 2nd report Standing Committee of Analysts Feb 1977-April 1979; Myhill and Matthews, Anglian Water .1981	Analysis, DSSL, Chemicals
163A	H81	Standing Committee of Analysts and DSSL Examination of boron in sewage sludges. Anglian Water, Matthews, Myhill Dec 1979	Analysis, DSSL, Chemicals

164	H81	DSS Economics Sub Committee. DSSE Questionnaire Nov 1977	
165	H81	DSSE Problems of disposal of sludge from rural works. Matthews Nov 1976	Economics Management
166	H81-92	Use of sewage sludge in agriculture. Wat Sci Tech 1983 , 15 , 195 Coker	Review
167	H81	Sewage sludge utilisation as part of water quality control. Envio Tech Letters 1980, 1 ,65 Matthews	Review
168	H81	Effect of municipal wastes in Control of Pollution in Agriculture. University of Newcastle April 1981 Matthews	Review
169	H81	IWPC Sept 1978 Annual Conference Sewage sludge disposal – which option? Matthews, James	Review, Management
170	H81-92	Metals in sewage sludge and their potential effects in agriculture, Wat Sci Tech 1983, 15 209 Coker, Matthews	Chemicals
171	H81	Anglian Water. Report of metals in sludges used in agriculture in Anglian Water April 1979 – March 1980 submitted to DSSL Matthews, Barnden	Chemicals
172	H81	WRC/EEC Conference on Utilisation of sewage sludge on land. Keble College Nov1979.Papers and proceedings. This was a crucial conference in the development of the 1981 guidelines. It has papers on aspects including one on Government policy and the DSS. It has supplementary papers including one on the introduction of injectors to improve public acceptance	Review. Policy, European Commission, Guidance
173	H81	Reports of a 1975 survey of Salmonellae in sewage sludges in Anglian Water. Submitted to DSSL. Part of the world's biggest such survey Dec1975-Jan 1976	Pathogenic
174	H81	Standing Committee Analysts. Method for oil and grease in sewage sludge1978. Note this and many other methods 'blue book methods' are still extant	Analysis
175	H81	Institution of Waste Management. Optimising sewage sludge treatment, disposal and utilisation. The British approach. Waste Management Oct 1985 ,557 Matthews	Review, Management
176	H81	Disposal of sewage sludge I - Environmental issues and planning II - Agricultural utilisation Proc. EIW Conference "Disposal of sewage sludge and its environmental consequences". London. November 1984. Matthews	Review, Regulation, European Commission
177	H81-92	Critical Reviews in Environmental Control. Control of metal application rates from sewage sludge utilisation. Matthews. This is a long document with lots of information and is available from Matthews on slepeymatthews@gmail.com . Matthews, 1984, 14 (3), 199-250.	Chemicals
178	H81	Calculating sludge application rates. Water. Matthews. May 1981	Chemicals
179	H81-92	NWC submission to the House of Lords Subcommittee G on the Proposed EC Directive on the use of sewage sludge in agriculture Feb 1983 prepared by Matthews	Regulation
180	H81-92	Practical application of Guidelines for the management of sewage sludge utilisation in the UK. 1987 Matthews	Management, Guidance

181	H81-92	Standing Committee Analysts. Material extractable by light petroleum from sewage sludge. Blue book method. 1985	Analysis
182	H81-92	European Water Pollution Control Association Sludge Conference. Modern sludge management – the managers choice Matthews, Schenkel. Sept 1988	Review
183	H81-92	Korrespondence Abwasser. Sustainability in European biosolids management. Reference to Global Atlas and network see 187 Sept 1983. Ed Matthews	Sustainability
184	H92+	Sustainability in biosolids management Wat Sci Tech 1998 , 38,97 Matthews	Sustainability
185	H92+	CIWEM E. Anglian branch & WEF Conference. Millennium perspective on biosolids and sludge management March 2000 Matthews see also 42	Management, Sustainability
186	H92+	IAWQ Aquatec Conf Biosolids and residuals. Global view of biosolids management. Matthews. Amsterdam Nov 1997 see 187 for Atlas	Management, International
187	Other	IAWQ, EWPCA, WEF Global atlas of wastewater sludge and disposal pub IAWQ Tech Report 4 1996 Ed Matthews. Updated in 2009 by UN Habitat. Eds LeBlanc, Matthews, Richard	Review, International
188	H81, H81-92, H92+	Compendium of papers by Bob Davis	Review
189	HEC68+	COPA (European Farmers) Position on spreading of sewage sludge on land. July 2000	European Commission
190	HEC68+	CEFIC (European chemical industry) Industry comments to EC on sewage sludge use. Dec 1999	European Commission
191	HEC68+	European Commission working group on sewage sludge management (inc proposed definition of treated sludge aligning with biosolids). Oct 1999	
192	HEC68+	Institute for International and European Environmental Policy. Report on disposal of sewage sludge in Europe. Essen, Germany. August 2001	Review
193	US	EWPCA Biosolids treatment, beneficial use and disposal in the USA European Water Pollution Control 7(2) 1997, 62	Review
194	H92+	IAWQ .UK Sludge Management Post 1998. Lingley Mere. Jan 1999	Review
195	H81-92, H92+	Compendium of papers by Matthews	Review
196	HUS	WEF Municipal sewage sludge management: Reference text. Lue Hing et al Tecnomic Pub 1998	Review, Book
197	HOther	IWA Sludge into biosolids. Processing and utilisation, Eds Spinosa Vesilind 2001	Book
198	H92+	CIWEM Symposium Sewage sludge to land Warrington Dec 1998	Review
199	H81-92	WRC Seminar Unconventional Uses of Sewage Sludge. March 1983	Alternative use.
200	HEC68+	Treatment and use of sewage sludge and liquid agriculture wastes. Review of COST68/68 programme 1972-1990 Hall, L'Hermite,Newman Brussels &Luxembourg. 1992	Review, European Commission, Book

APPENDIX3

EXTRACT FROM THE EA STRATEGY

9. Reasons for change

Details of why change is needed.

9.1 Sludge (Use in Agriculture) Regulations

The SUiAR were introduced in 1989 to enact the European Commission Sludge Directive 1986. They enable the spreading of sewage sludge and septic tank sludge to agricultural land. They are supported by the sewage sludge in agriculture: code of practice.

They do not take into account:

- modern risk-based regulation
- the chemical complexity of current sludge
- the potential environmental impact such as from new hazards
- changes in the management of sludge, from its treatment through to final use when recycled to benefit land

The SUiAR still has many good features but they now struggle to provide a usable regulatory framework.

9.2 Complex regulatory framework

The current regulatory framework for sludge treatment and use is complex. It involves a number of separate pieces of legislation. These include the UWWTD, EPR and SUiAR. They are not necessarily consistent with each other. The SUiAR controls are fixed in legislation. We cannot amend them without a change in the law. They are also limited in scope as they only apply to the supply and use of sludge on certain types of agricultural land.

In 2001, the water industry introduced the voluntary safe sludge matrix which is available on the Biosolids Assurance Scheme website. This placed further pathogen controls on the use of sludge in agriculture. The water industry committed to phase out spreading untreated sludge to agricultural land. This and other water industry initiatives are now included in the BAS.
EPR controls apply to the:

- storage of sludge on agricultural land
- storage or use of sludge on non-agricultural land such as land that is used for energy crops

EPR controls also apply to the storage and use of mixed or co-treated materials that contain sludge. The bioresources sector is now more commercially viable. This has led to:

- different regulatory approaches for the waste and water industries – such as a contrast between the regulation of sludge use and other bioresources
- the previously distinct boundary between the water and waste management sectors becoming less defined
- a lack of regulatory clarity in sludge management controls

To address the level of complexity, we produced a short-term RPS. RPS 231 allows common industry practices that are inconsistent with the SUiAR to continue.

9.3 Changes to the supply chain

The SUiAR were designed to control the sludge supply chain. In 1989 this was considered to be short and linear. Water companies produced and treated their own sludge. It was then supplied and spread

locally. Ofwat provided a simple illustration of this. For details see figure 2 in: Sludge treatment, transport and disposal – supporting evidence and design options.
The supply chain is no longer short and linear.
From where the sludge is treated to where it is spread, can now involve long distances and third-party contractors. The contractors, who can also be sludge producers or waste management companies, may handle, treat, store and spread the sludge that is produced by others.

9.4 Changes to treatment processes

Treatment processes have evolved. There is now a focus on the energy value of sludge via the production of gas through anaerobic digestion.

Water company treatment operations have evolved. Some are incorporating activities that are challenging the SUiAR definitions of residual sludge and treated sludge. The IED also applies to sludge treatment activities carried out by the water industry. This brings in further requirements. Water industry interests include co-treatment of sludge with other waste streams. This can improve gas production or take advantage of commercial opportunities. Third party non-water company operators are also showing increased interest in the sludge market.

9.5 Hazards

The chemical complexity of the incoming sewage has changed, as has our understanding of the emerging risks associated with this complexity. The SUiAR mainly control metals. These are referred to as potentially toxic elements. Metal loadings from industrial sources may have reduced, but there are new hazards. These are:

- organic and inorganic chemicals
- anti-microbial resistance
- micro-plastics

We will continue to work with the water industry and others on how to assess these hazards.
We aim to understand and assess these using the UK water industry research Chemicals Investigation Program. This includes specific investigations which target sludge and the fate of these substances passing through a waste water treatment works. Other hazards include a variety of chemical inputs from domestic and run-off sources. A 2019 European Commission report Digestate and compost as fertilisers: risk assessment and risk management options, highlights some of the potential hazards contained within sludge or sludge containing composts or digestates.
As 96% of UK sludge is recycled to land we must:

- identify and understand these risks
- have management systems in place to mitigate them

9.6 Septic tank sludge

The SUiAR allow the spreading of untreated septic tank sludge to agricultural land.
These controls now appear insufficient to address the complaints we receive. These relate to:

- inappropriate sludge being spread
- poor spreading management

Recent case law has highlighted that septic tank sludge may now be unsuitable to directly spread to land. It can be necessary to do pre-treatment to remove physical chemicals. Some of the hazards from waste water in water company derived sludge are also likely to be found in septic tank sludge via domestic effluent.

Appendix 4 Option for the way forward

7.1 Develop option 4

Our decision is to develop option 4. We will evolve EPR regulatory tools.

See section 10. Other options we considered for details of why we did not select options 1 to 3.
We selected option 4 as it has many advantages. It will use existing frameworks with some revision to the permitting process. This will enable greater flexibility for the operator. It will put sludge regulation in line with how we control other types of organic manures. We will keep the most appropriate parts of the SUiAR and the current EPR mobile plant permit regime. The advantages of option 4 are that it:

- provides an opportunity to make sure human health and the environment are protected
- is modern risk-based regulation
- reduces regulatory costs and burden through development of an assurance scheme – this provides the ability to include the concept of earned recognition as defined in the Farming regulation task force implementation: earned recognition plan
- provides consistency across the bioresources sector
- continues to allow co-treated wastes to be spread under a consistent regime
- removes barriers to co-treatment
- would be charge funded
- prevents the spreading of untreated septic tank sludge
- allows industry innovation
- allows for flexible regulatory intervention along the supply chain, from the sludge producer to the final user
- is within our remit to use the existing EPR framework
- means we do not need a time limited regulatory position statement (RPS) – for example, we can withdraw Waste codes for sewage sludge materials: RPS 231
- combines spreading and storage activities and harmonises regulatory responsibility
- mitigates disruption of the current EPR scheme to the agriculture sector

The disadvantages are that:

- the revision of the mobile plant permitting regime has implications for the wider M2L sector
- it will need time and resource

This option will provide clarity, consistency and simplify the current complex regulatory framework. See section 9.2 Complex regulatory framework.

7.2 How we will evolve EPR regulatory tools

We will develop the existing EPR framework to provide regulatory tools for using sludge and materials containing sludge. We will transfer the regulation of sludge spreading into this evolved EPR framework. Once we have done this, the SUiAR will no longer be needed. These tools, including environmental permits, will provide:

- risk-based and outcome-focused regulation
- consistency across regimes
- the flexibility to adapt and scale the controls on current waste management practices

To evolve these tools we will:

- continue to work with Defra, Water UK, the waste industry and others to develop the strategy
- aim to submit a request for legislative change to revoke the SUiAR
- work with the water and waste industry to explore the principles of earned recognition by developing an industry-led assurance scheme
- continue to protect human health and the environment
- reduce the regulatory burden where possible

We accept concerns that an immediate transfer to the current mobile plant permitting and deployment system would present challenges for the water industry. We will:

- commit to review and evolve the permitting regime to create a more flexible scheme

- account for the operational needs of all operators and provide the required level of control to manage the potential environmental risks
- look at how the assurance scheme can work to support us and limit the increase in costs and regulatory burden to industry

7.3 What a new regulatory framework might look like

Here are the aims of the new regulatory framework.

Achieve environmental improvement
Our aim is to reduce the risks and improve performance for the beneficial use of sludge. This will:

- lead to an improved perception about the use of sludge
- encourage producers and operators to produce and supply treated material that will benefit soil
- encourage best practice spreading activities to maximise nutrient availability and minimise risks to the environment
- create a framework that allows for new and emerging science and technology

Where possible, we will aim to reduce costs and regulatory burden.

Risk-based and outcome-focused regulation

We will use a risk-based, proportionate and outcome-focused approach. This must:

- be appropriate to the level of risk
- be mindful of practicalities
- not result in unnecessary costs to industry

Clear and consistent regulation

The new framework must be clear and consistent. This means it must be definitive and not allow for misinterpretation. It must be within the scope of the regulations. There must be clear links to other regulatory requirements. These include:

- Industrial Emissions Directive (IED)
- Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018, also known as the farming rules for water
- biowaste treatment permitting
- trade effluent controls

Charge funded regulation

The new framework must be appropriately funded. This will enable proper determination of permissions and a robust risk-based compliance scheme.

Retain controls that are still effective

We will take the most effective and useful parts of the SUiAR and EPR mobile plant permitting to develop the new framework.

Provide continued stakeholder assurance

The new framework must be thorough and robust. To do this we will ensure that:

- the risks of using sludge are understood and managed
- sludge use ensures soil health and is supportive of the principles of a circular economy

Flexible regulation

The new regime must be flexible. We will make sure it:

- allows commercial innovation and the exploitation of new markets to satisfy Ofwat
- addresses operational requirements of sludge producers, such as flexibility in the supply and use of treated sludge

Targeted regulation

We will identify appropriate points of regulatory intervention and testing. We will consider:

- upstream sludge treatment such as at the sewage treatment works and through trade effluent controls
- storage and pre-spreading control
- post sludge treatment testing
- soil testing and improved record keeping

8. Plan of action

Our decision is to develop option 4. We will evolve EPR regulatory tools. See section 10. Other options we considered for details of why we did not select options 1 to 3. We selected option 4 as it has many advantages. It will use existing frameworks with some revision to the permitting process. This will enable greater flexibility for the operator. It will put sludge regulation in line with how we control other types of organic manures. We will keep the most appropriate parts of the SUiAR and the current EPR mobile plant permit regime.

The advantages of option 4 are that it:

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The disadvantages are that:

- the revision of the mobile plant permitting regime has implications for the wider M2L sector
- it will need time and resource

APPENDIX 4

SUMMARY OF THE WATER UK BIORESOURCES STRATEGY

The UK's Bioresources Strategy, focused on sustainable resource and waste management, will be a key area of focus for the PR29 (Price Review 2029) process. The strategy aims to support a circular economy, enhance sustainability, and contribute to achieving net-zero emissions. A PR29 action plan for bioresources is being developed to guide innovation and inform the upcoming price review. This plan will involve a collaborative approach with the industry to explore opportunities for diversification of sludge disposal outlets and reduce reliance on existing infrastructure.
Here's a more detailed breakdown:
Key Goals and Objectives:

- **Circular Economy:**
  Promote a circular economy approach to bioresources, maximizing resource recovery and minimizing waste.
- **Sustainability:**
  Enhance the overall sustainability of bioresources management practices.
- **Net-Zero Emissions:**
  Contribute to the UK's net-zero targets by optimizing bioresources for energy recovery and other low-carbon solutions.
- **Diversification of Sludge Disposal:**
  Reduce reliance on single disposal methods (e.g., landbanks) by exploring alternative options like regionalized treatment facilities and non-appointed capacity investment.
- **Innovation:**
  Drive innovation in bioresources management through research and development of new technologies and processes.

Collaborative Approach:

- **Industry Collaboration:**
  The PR29 action plan will be developed through a collaborative effort involving water companies, regulators, and other stakeholders.
- **Shared Capacity:**
  Exploring the potential for shared sludge treatment capacity between water companies to improve efficiency and reduce costs.
- **Market Mechanisms:**
  Investigating how market mechanisms can facilitate the efficient transfer of bioresources between companies and optimize resource utilization.

PR24 and PR29 Context:

- **PR24 (Price Review 2024):**
  The PR24 process has already begun to address bioresources, with a focus on improving the robustness of data collection and modeling for future price reviews.
- **PR29 (Price Review 2029):**
  The PR29 process will build upon the foundations laid in PR24, with a greater emphasis on innovation, market development, and long-term strategic planning for bioresources.
- **Data-Driven Approach:**
  A key aspect of PR29 will be the use of a richer data set collected through Annual Performance Reviews (APRs) and other mechanisms, allowing for more informed decision-making.

Specific Areas of Focus:

- **Industrial Emissions Directive (IED):**
  The PR29 action plan will consider the implications of the IED for water companies and how bioresources management can help them meet their obligations.
- **Nutrient Neutrality:**
  The plan will address the need for nutrient neutrality in wastewater treatment and explore innovative solutions, including nature-based solutions, to meet environmental standards.
- **Storm Overflows:**
  The action plan will consider the role of bioresources in addressing storm overflow issues and reducing environmental harm from high-priority sites.

In essence, the PR29 action plan for bioresources UK will be a strategic roadmap for the future of bioresources management, driving innovation, collaboration, and sustainable practices to support a circular economy and a net-zero future.