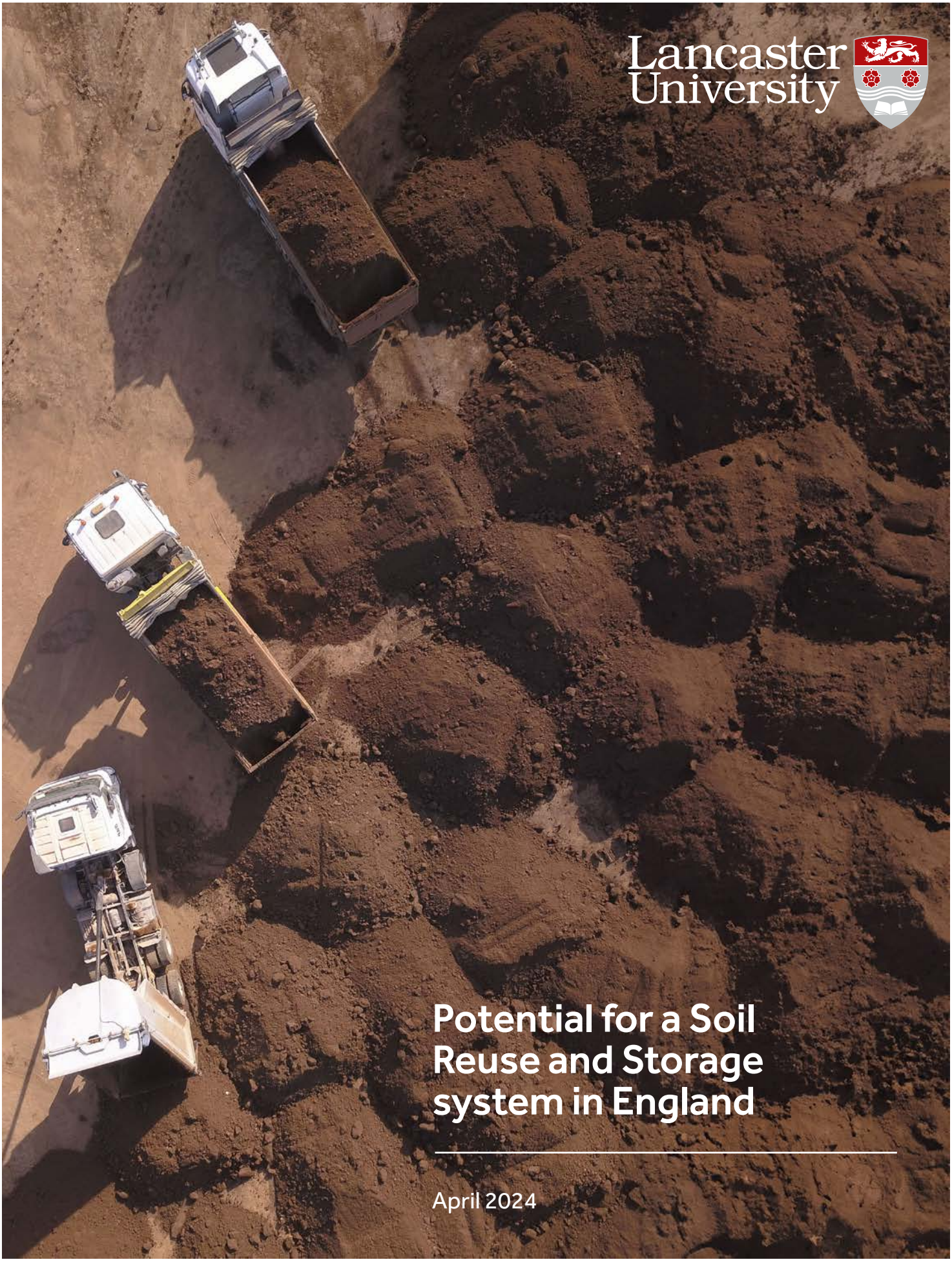

Lancaster University

Potential for a Soil Reuse and Storage system in England

April 2024

Environment Agency

Circular Economy Centre for Mineral-based Construction Materials

CE-HUB
UKRI National Interdisciplinary Circular Economy Research

NICER PROGRAMME

Acknowledgement

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Introduction

In 'The State of the Environment: soil[1]' report the Environment Agency (EA) highlighted the importance of the preservation and management of soil. In both the 25 Year Environment Plan[2] as well as the Environmental Improvement Plan[3] the UK Government committed towards achieving a sustainable soil management in England. In the Environmental Improvement Plan the Government also committed to publishing a revised Code of Practice for the sustainable use of soil in construction sites which it is hoped will continue to reducing the amount of soil sent to landfill. The Government is also committed to developing a pilot Soil Re-Use and Storage Depot scheme by 2026 to help reduce soil that would otherwise be classified as waste going to landfill, and encourage remediation and re-use of soil.

Since the 1950s, the UK has been experiencing the highest urbanization rates across Northern Europe (82%)[4]. Even though the annual urban population growth in the UK has been decreasing since 2015[5], 84% of the total population lives in urban areas[4] and is estimated that this will reach up to 90% by 2050[7]. Specifically in England, although only 8.6% of the land is categorised as developed[8], it is predicted that by 2050 another 0.3 million hectares might be required to be released for housing and infrastructure development, increasing the total area for development uses by 21%[9]. As almost all construction sites have soil removed before construction, millions of tonnes of soil are predicted to be displaced to facilitate the development requirements and if the construction industry follows current practice patterns, then much of this soil will end up in landfills.

One potential mechanism for reducing the amount of soil going to landfill is the introduction of soil banks and this project investigated the potential for introducing a Soil Bank system in England. The objectives of this report are to provide:

- An overview of current soil management
- A preliminary waste data analysis
- A review of the existing systems and examples (nationally and internationally) on soil reuse
- A proposed Soil Reuse and Storage System for England
- Recommendations for policy changes assisting the proposed system's success.

1 www.gov.uk/government/publications/state-of-the-environment/summary-state-of-the-environment-soil
2 www.gov.uk/government/publications/25-year-environment-plan
3 www.gov.uk/government/publications/environmental-improvement-plan
4 ourworldindata.org/urbanization
5 data.worldbank.org/indicator/SP.URB.GROW?locations=GB&most_recent_value_desc=true
6 data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?locations=GB&most_recent_value_desc=true
7 ourworldindata.org/urbanization
8 www.gov.uk/government/statistics/land-use-in-england-2021/land-use-statistics-england-2021-statistical-release
9 www.savills.co.uk/research_articles/229130/274018-0

Methodology

To obtain all the information included in this report, many documents have been reviewed and are cited as footnotes throughout the document. During the three months of the placement, meetings with the core project steering group were held fortnightly as well as weekly meetings with the EA line manager. The data used for the preliminary data analysis is from the ENV23 – UK statistics on waste[10], specifically focusing on the 17 05 sub-chapter of the European Waste Catalogue on soil waste deriving from construction and demolition activities.
In total, 5 interviews (2 international and 3 national) were conducted in order to obtain information about international schemes and gain perspective on the national level. A workshop was held on the 14th of June 2023 to present a review of the international schemes and the proposal of a Soil Reuse system in England. A detailed list of the core project's steering group, corresponding members, interviewees and workshop attendees can be found in Appendix A.

10 www.gov.uk/government/statistical-data-sets/env23-uk-waste-data-and-management

Importance of soil

Soil, is defined as "the layer(s) of generally loose mineral and/or organic material that are affected by physical, chemical and/or biological processes at or near the planetary surface and usually holds liquids, gases and biota and support plants[11]. Although in policy and regulations there is a separation between "topsoil" and "subsoil", following the British Standards definitions, for the purpose of this report when referring to "soil" will be following the former definition. Soil formation is a very slow process, ranging between 0-28.8 mm of soil formed per year[11], while the erosion rates can vary greatly, (0-52.9 mm per year)[13]. Given the great discrepancy between soil formation and soil erosion rates, soil is a limited, non-renewable source.

Soil underpins a plethora of vital ecosystem services and supporting processes[14] by performing multiple functions (e.g. nutrient cycling, climate control, water quantity and quality, etc.). Soils multifunctionality is directly related to the provision of ecosystem services which are essential for the immediate benefits that human societies obtain from soils. Ecosystem services are separated in three categories; provisioning (providing food, wood, fibre, physical support and raw materials), regulating (flood mitigation, nutrients' filtering, biological control of pests and diseases, recycling of waste and detoxification, storing carbon and regulating greenhouse gas emissions) and cultural (spirituality, knowledge, aesthetics and sense of place). Nutrient and water cycling, as well as, soil biological activity are considered supporting processes.

Soils are under multiple stressors and once vital soil functions are lost; they might not be restored entirely. Soil sealing, urbanization, soil erosion, floods and landslides, soil compaction, loss of soil organic matter and biodiversity, desertification, climate change, soil contamination and salinization affects soils globally, threatening soils multifunctionality and resilience[15]. These threats can have significant impacts on food production and security due to decreases in agricultural and forest yields, water quality, runoff of nutrients, climate change due to increased greenhouse gas emissions, additional flood damage associated with additional runoff, additional energy costs.

Soil degradation in England and Wales is estimated to cost up to £1.42 billion annually[16], with over 50% of this cost attributed to greenhouse gas emissions, 20% from flooding and 20% from lost agricultural output. The most prevalent forms of soil degradation are loss of soil organic matter (47% of the total cost), compaction (39% of the total cost) and erosion (12% of the total cost). Thus, safeguarding existing soils, restoring degrading soils as well as utilising soil resources in a more sustainable and circular way should be of high priority[17].

11 van Es H (2017) A New Definition of Soil. CSA News 62:20–21. doi.org/10.2134/csa2017.62.1016

12 Minasny, B., Finke, P., Stockmann, U., Vanwalleghem, T., and Bratney, A. B. (2015) Resolving the integral connection between pedogenesis and landscape evolution, Earth-Sci. Rev., 150, 102–120. doi.org/10.1016/j.earscirev.2015.07.004

13 Montgomery, D. R.: Soil erosion and agricultural sustainability, P. Natl. Acad. Sci. USA, 104, 13268–13272, 2007. doi.org/10.1073/pnas.0611508104

14 Dominati, E., Patterson, M., Mackay, A., 2010. A framework for classifying and quantifying the natural capital and ecosystem services of soils. Ecol. Econ. 69 (9), 1858–1868. doi.org/10.1016/j.ecolecon.2010.05.002

15 www.ukso.org/soil-threats.html

16 www.sciencedirect.com/science/article/pii/S0921800915003171

17 Kourmouli, A and Lesniewska, F, (2023). Losing ground: targeting agricultural land take by enabling a circular economy in construction. Circular Economy and Sustainability

Current policy and regulatory landscape in England

The Waste (England and Wales) Regulations 2011[18] is the legislative framework dictating the appropriate soil (and stones) classification and disposal. Waste soil (and stones) is classified either as hazardous or non-hazardous. Examples of the relevant European Waste Catalogue (EWC) codes for waste soil deriving from construction and demolition activities can be found in Table 1. Facilities (treatment, transfer or disposal) receiving soil waste must be appropriately authorised by a permit or exemption according to the Environment Permitting (England and Wales) Regulations 2016[19].

Table 1: Relevant EWC codes for waste soil deriving from construction and demolition activities.

EWC code	Details	Waste Status
17-05	Soil (including excavated soil from contaminated sites), stones and dredging spoil	
17-05-03	Soil and stones containing dangerous substances	Hazardous
17-05-04	Soil and stones other than those mentioned in 17-05-03	Non-hazardous
17-05-05	Dredging spoil containing hazardous substances	Hazardous
17-05-06	Other dredging spoil	Non-hazardous
17-05-07	Track ballast containing dangerous substances	Hazardous
17-05-08	Track ballast other than those mentioned in 17-05-07	Non-hazardous

Although soils can be classified as hazardous or non-hazardous, when it comes to landfill disposal, for landfill tax purposes HMRC class soil as active (standard rate Landfill tax) or inactive (lower rate Landfill Tax) waste. This causes confusion as these definitions do not match those used in waste regulation. According to the Landfill Tax (Qualifying Material) Order 2011[20] and the Excise Notice LFT1[21], inactive waste is a largely water insoluble and non or very slowly biodegradable and includes sand, subsoil, stones and materials such as concrete and ceramics. Thus, anything not included in the definition is considered active waste, and can include non-hazardous soil waste.

18 www.legislation.gov.uk/uksi/2011/988/contents/made

19 www.legislation.gov.uk/uksi/2016/1154/contents/made

20 www.legislation.gov.uk/uksi/2011/1017/contents/made

21 www.gov.uk/government/publications/excise-notice-lft1-a-general-guide-to-landfill-tax/excise-notice-lft1-a-general-guide-to-landfill-tax

Current situation in soil management in England

For the purpose of this report, the preliminary data analysis was done using only the 17 05 EWC codes (see Table 1 for details) which is soil (including excavated soil from contaminated sites), stones and dredging spoil from construction and demolition wastes from the statistical dataset ENV23 – UK statistics on waste (last updated 28 June 2023; see Methodology section), from the "2021 Waste Removed" spreadsheet.

In total, 55Mt of the 17 05 soil waste were received by permitted facilities[22] in England, with 98.5% (54.3Mt) being inert/construction and demolition waste, while only 1.5% (0.8Mt) being hazardous waste, assuming all waste was classified correctly. This data, suggest that the construction industry is not only a major contributor of soil waste but also soil waste is almost entirely described as inert thus implying that it poses no threat to humans or the environment.

Over 50% of inert/construction and demolition soil waste (over 25 Mt) was sent to either inert, non-hazardous or restricted landfills (Figure 1). This is approximately 8 times greater than the amount of soil estimated to be lost due to erosion across the whole of England and Wales combined (2.9 Mt), annually[23]. Although there is a slight decrease in the amount of soil (29.5 Mt) sent to landfill compared to previous years[24], the latest recovery rates (2020) available for non-hazardous construction and demolition waste in England are over 90%[25].

Figure 1: Inert construction and demolition soil waste (in Mt; 17 05 codes, see Methodology and current section) received in permitted facilities in England per facility type.

22 Facilities type: Anaerobic digestion, Animal and Food waste, Anima

23 www.sciencedirect.com/science/article/abs/pii/S0921800915003171

24 Defra (2021) ENV23 – UK statistics on waste data

25 www.gov.uk/government/statistics/uk-waste-data/uk-statistics-on-waste#recovery-rate-from-non-hazardous-construction-and-demolition-cd-waste

Interrogating the data, approximately 48 million tonnes of soil waste were sent for treatment, while only 0.3 million tonnes were hazardous. However, it is not possible to calculate exactly the soil waste amounts as the treatment calculations also include recovery amounts. Thus, an accurate soil mass balance is not possible. In Figure 2, recovery was the predominant fate for inert/construction and demolition soil waste in England, amounting to over 30 Mt, however it is not clear, from the available data, what the recovery entails and how that material was reused. Landfill was second as fate of inert/construction and demolition soil waste, with over 20 Mt of soil waste deposited to landfills, while long-term storage of soil waste was the least used option with only 230 tonnes of soil waste being stored long-term. It is interesting, however, that given soil waste was categorised as inert, over 250 kt were recorded as being sent for incineration in 2021.

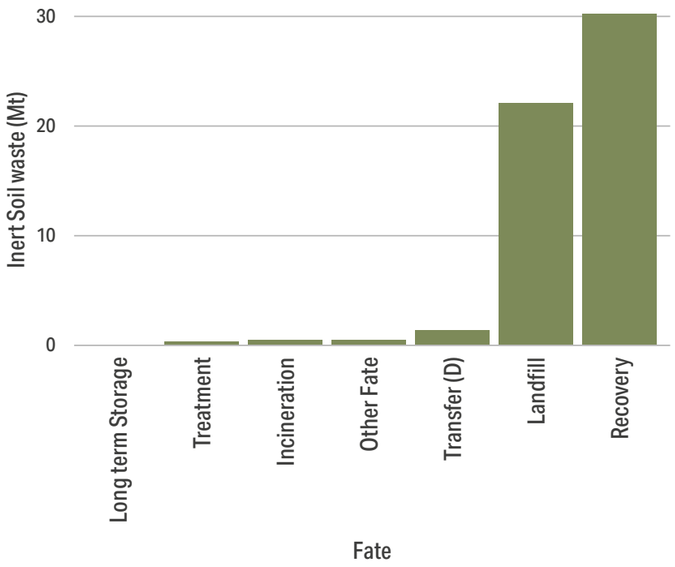

Figure 2: Fate of inert/construction and demolition soil waste in England (17 05 codes, see Methodology and current section)

Figure 3 shows a simplified mind map of the available management pathways of soil "waste" in England. The word waste is in brackets in this occasion as in some management pathways soil is not considered or managed as waste[26]. There are three main management pathways available; on-site, off-site and soil treatment. Soils can be reused on-site without waste controls applying non-waste under the Definition of Waste Code of Practice (DoWCoP) (for further information see National Example section), with certainty of use. However, if the reuse of soil on-site under the DoWCoP exceeds the 12 months storage duration or the conditions of the DoWCoP cannot be met, then a recovery permit must be acquired from the Environment Agency. Soils can be reused on-site as waste which has met the Waste Framework Directive exclusion (Article 2) and if the reuse activity is excluded from waste controls e.g. where the Article 2 criteria are met.

The off-site soil "waste" management pathways offer more options, with some of them serving similar purposes. Soil Excavated from Construction Sites (SECS) moved to one or more sites can be done under the DoWCoP, either under a U1 exemption, an environmental permit, or as by-product or waste that meets the End of Waste criteria (EoW) criteria. Environmental permits for soil recovery can be bespoke, "standard rules" or a landfill permit for restoration of void space. DoWCoP, U1 exemption and environmental permits are alternative pathways for use/deposit of soil, however, there are certain differences. Firstly, DoWCoP allows for assessing on a site-specific basis, whether excavated soil is classified as waste or not, or when treated excavated waste can cease to be waste for a particular use, while under U1 exemption soil is considered waste but the exemption can be acquired only once in the entire duration of the project[27]. Moreover, only minor-hazardous soil waste arising from construction and demolition waste (17 05 waste code) and absolute-non-hazardous soil waste arising from municipal waste (2002)[16] is allowed under a U1 exemption. Lastly, material can be transferred to another site for disposal or sent to landfill. Once in landfill, it can be used as cover material, or for creating cells to minimise the size of the operational area. It can be disposed as waste either in an inert waste, non-hazardous waste landfill or a hazardous waste landfill.

The last available pathway for soil "waste" in England is soil treatment which can be done both on-site or off-site. If soil is transferred at an off-site treatment facility, it can be used recovered if it has achieved EoW criteria. If EoW criteria cannot be met, then the soil remains waste and can be deposited at a permitted facility (for recovery or disposal) or reused under certain criteria, although that is not usually the case[28,29].

Currently the U1 exemption is under review by the Environment Agency and the applications for acquiring an environmental permit can take a long time. In the criteria set out for a U1 exemption, different types of soil waste that can be used are listed as well as the maximum allowed quantities for use. However, there is no requirement to report the actual quantities of waste deposited under each permission. Moreover, there is a digital waste tracking system[30] under development, which will be mandatory to report waste movements and quantities, and could be extremely beneficial to track down soil flows more transparently. The current system can be complicated as the same pathway can be available for both waste and non-waste soil. he lack of digitalised tracking system is a factor hindering the sustainable management of soil.

26 www.gov.uk/guidance/check-if-your-material-is-waste

27 assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1134724/waste_exemptions_government_response_annex.pdf

28 www.gov.uk/government/publications/excavated-waste-from-utilities-installation-and-repair-rps-211/excavated-waste-from-utilities-installation-and-repair-rps-211

29 www.gov.uk/government/publications/deposit-for-recovery-operators-environmental-permits/waste-recovery-plans-and-deposit-for-recovery-permits

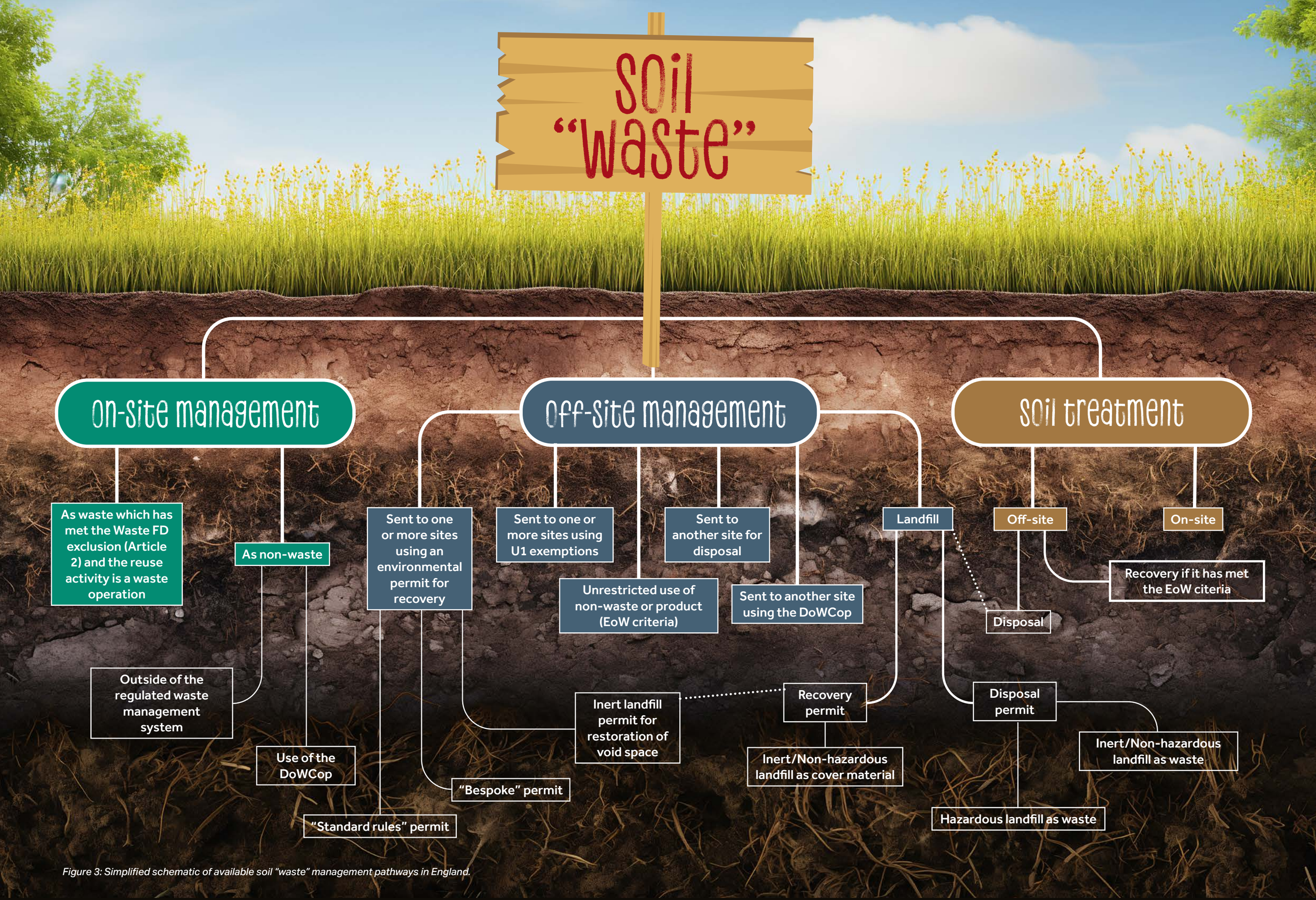

Figure 3: Simplified schematic of available soil "waste" management pathways in England.

Contributing factors and existing barriers to soil reuse

Due to the inherent variability of soil, it is difficult to characterise soil waste appropriately using the basic waste characterisation approach derived by the Waste Framework Directive, the technical guidance WM3 and the Waste Acceptance Criteria determining the acceptance of specific wastes to a particular landfill or recovery operations. The Waste Acceptance Criteria and the required analytical testing were designed for wastes with more homogeneous traits and more stable arising and usage processes through time, thus making them unsuitable for soil waste determination.

Soils are often overlooked when it comes to a construction or development project, and their management is not considered during the early planning stages. Soil handling within development is often mismanaged due to inadequate on-site monitoring and enforcement of existing controls. Moreover, storing soil on-site has been described as a critical obstacle when it comes to soil reuse. Poor planning and greater SECS than predicted lead to surplus of soil without certainty of use, which then becomes waste. Moreover, although there are waste storage exemptions available through the Environment Agency, they are considered restrictive on the storage amount and the timeframe over which they can be applied. In addition, there is no requirement for regulating waste storage pending its collection at the site of its production .

Sampling and testing in order to properly characterise soil, potential soil storage and reuse planning are considered an inconvenience given that they require time and cannot be carried out appropriately once the earthworks have started. The costs (perceived or otherwise) associated with the proper soil management in a development can also disincentivise soil reuse, as disposing to a landfill can be a cheaper and hassle-free option. The landfill tax associated with soil disposal is an insignificant amount (£3.25/tonne the lower rate for inert waste and £102.10 the standard rate for active waste) . Furthermore, recovery waste permits are often considered costly and lengthy to obtain when compared to landfilling soil. Abuse of the U1 exemption has been reported with waste either being misclassified or exceeding the quantity limits.

The misdescription and subsequent misclassification of 'soil-like' waste can have serious environmental and public health impacts and represents a multimillion tax avoidance. Soil waste might be mixed with other materials, such as demolition waste, and misclassified in order to attract the lower rate of the Landfill Tax. This then offers no incentive to segregate materials at the source of origin and makes them unavailable for reuse without degrading their quality. In 2018 in England the cost of waste crime amounted to £600 million, with misclassification and fraud responsible for almost one third of the cost . There have been many occasions where hazardous or active waste has been characterised as inert in order to avoid the standard rate Landfill Tax. For example, in South London a major, mixed-use brownfield site development, contaminated with hydrocarbons and heavy metals35 where, 48,000 tonnes of waste were classified as inert and only 832 tonnes were classified as contaminated.

Waste crime is not only a national issue but an international issue as well: in 2018 Polish authorities required 1,000 tonnes of waste which was illegally described as recycling, from the UK, to be returned. No exporter could be found and the Environment Agency had to bear the cost[35] of dealing with it.

As discussed, the vast majority of the soil sent to landfill is from the construction sector, predominantly due to excavation activities. Thus, SECS is often associated with economic growth, complicating the development of a robust estimate of future supply and demand of soil. This means that instability in the economy will unavoidably affect SECS, making it very elastic in its supply. Although it is inevitable that the land take will continue in order to accommodate the increasing development rate by supporting new-build policies without utilising and refurbishing existing infrastructure, that unavoidably will increase SECS. Additionally, major infrastructure projects, such as road works or major tunnelling, can exacerbate the amount of SECS and shift the offer/demand balance towards specific regions[36].

The big discrepancy between refurbishment and new build VAT disincentivises soil reuse. The refurbishment, repair and maintenance VAT is at 20%, whereas the new build VAT is 0%. This encourages more land take, creating further excavations and more surplus soil, as well as increases the gap in transitioning from a linear to a circular economy (CE). A consistent VAT across all types of construction would provide an incentive for refurbishment of existing properties, assist with meeting the housing targets as well as reduce unnecessary soil disturbance and has been called for by, amongst others, the Architects Journal RetroFirst[37], Architects Direct, Architects' Climate Action Network (ACAN), the London Energy Transformation Initiative (LETI)[38] and the Federation of Master Builders (FMB)[39,40].

31 www.gov.uk/government/publications/waste-classification-technical-guidance

32 www.gov.uk/government/collections/waste-exemptions-storing-waste

33 www.gov.uk/government/publications/landfill-tax-rates-for-2023-to-2024/landfill-tax-increase-in-rates

34 www.gov.uk/government/consultations/reducing-crime-at-sites-handling-waste-and-introducing-fixed-penalties-for-waste-duty-of-care/outcome/supplementary-government-response

35 assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/915937/waste-crime-review-2018-final-report.pdf

36 Capita Symonds (2010) Construction, demolition and excavation waste arisings, use and disposal for England 2008; CON900-001: Final Report, WRAP

37 www.architectsjournal.co.uk/news/introducing-retrofirst-a-new-aj-campaign-championing-reuse-in-the-built-environment

38 www.architectsdeclare.com/uploads/AD_LetterToPM.pdf

39 www.fmb.org.uk/resource/cut-the-vat.html

40www.fmb.org.uk/resource/builders-budget-plea-cut-vat-on-home-repairs-says-fmb-and-rics.html

National example of a soil reuse scheme

In this section, a brief overview of the voluntary framework by CL:AIRE, Definition of Waste Code of Practice (DoWCoP) is presented.

DoWCoP by CL:AIRE

CL:AIRE (Contaminated Land: Applications in Real Environments) is a UK based charity providing a variety of services for those involved in sustainable land reuse. CL:AIRE developed a voluntary framework for allowing the reuse of clean, naturally occurring soil arising from excavations with the active participation of the EA. The DoWCoP provides a framework for excavated material arising from remediation and land development projects, which if followed, will not require waste regulatory controls (except for the hub/cluster scenario[41], which will require an appropriate Environmental Permit under the Environmental Permitting Regulations). During planning stages, a Materials Management Plan (MMP) is drawn-up. This includes the site details, site investigation report, risk assessment results, the expected excavated soil quantities as well as the soil's fate. The properly completed MMPs are verified by a suitable Qualified Person (QP) who then submits all the appropriate paperwork to CL:AIRE and a copy to EA; excavation works can then begin. The key point in the DoWCoP is that the material must have a certainty of use in order for the regulators position to apply.

DoWCoP operates under four different reuse scenarios; reuse on site of origin, direct transfer to one or more sites (only available for clean, excavated material), cluster (soil is transferred for remediation prior to reuse on-site) and lastly, a combination of the aforementioned scenarios. The most widely used scenario is the reuse on site of origin with over 50 million m^3 being reused in 2022, followed by direct transfer to one or more sites[42]. Over 240 million m^3 of soil have been reused since 201643, with the reuse on site of origin being the most preferred scenario, followed by direct transfer, combination and lastly, cluster.

41 This includes "the use in the development of land other than the site from which the material has been excavated, following treatment at an authorised Hub site including a fixed Soil Treatment Facility acting in this capacity" (DoWCoP)

42 www.claire.co.uk/projects-and-initiatives/dow-cop

43 www.claire.co.uk/projects-and-initiatives/dow-cop/28-framework-and-guidance/111-dow-cop-main-document

International examples of soil reuse schemes

Grondbank – Flanders, Belgium

Grondbank is a recognised non-profit organisation in Belgium, an offshoot of the Flemish Construction Confederation (VCB), playing a key role in soils circularity for the past 20 years. Grondbank is responsible for the monitoring and traceability of excavated soil flows across the entire Flemish region as well as overseeing over 160 intermediate storage and soil remediation sites that treat and remarket soil. Through the Grondbank system, 95% of excavated soil in Flanders is reused[44]. In recent years (2018) another affiliated non-profit association was established, Transimat, responsible for tracking construction and demolition waste which distinguishes rubble between 'low' and 'high environmental risk'.

Legislations/Regulations

Grondbank operates under the Decree on soil remediation and soil protection[45], which is a legal framework.

Enforcement

The Flemish Environment Agency (OVAM) is the regulator responsible for enforcement.

What is Grondbank's role?

Although Grondbank is the key link between the stakeholders involved in construction, infrastructure and dredging works they have no active role in regulating the soil flows activities or the market. Grondbank stores all data digitally thus it is easy to track any potential errors or attempted fraudulent activities. If they are not satisfied with the reports provided by the client/contractor prior to an excavation they have the right to withhold the earthmoving permit, although they have neither a regulatory nor an enforcement role. The sampling, analysis and final report submitted to Grondbank are conducted by an external chartered expert, ensuring data integrity as well as creating zero market for projects' final values due to environmental tests. Grondbank is not responsible for finding a receiver site, that is the client/contractor's responsibility.

44 Grondbank - Detail - Circular Construction - Circular Flanders (vlaanderen-circulair.be)

45 navigator.emis.vito.be/detail?wold=304&woLang=en

The client is responsible for covering the costs for the sample analysis, Grondbank's fees and the temporary storage fees, if applicable. Whether the receiver is paying for the soil is up to the agreement between the originator and the receiver and is outside the remit of Grondbank.

How does it work?

Grondbank authorises soil movements in Flanders. They provide quality protocols and advise to all their registered members. Although it is not legally mandated for the clients/contractors to use the Grondbank system, it is strongly supported since it offers transparency and thus trust across the industry. Grondbank operates under 3 scenarios; (1) On-site re-use or re-use to a final destination, (2) Transport to a temporary storage site, soil remediation centre, sludge treatment centre or landfill site and (3) Transport to other regions or other countries.

Simplified steps

Planning stage

Prior to any earthworks, the client is responsible to hire a chartered expert who will perform the sampling and the analysis. Once the final report is complete, the client submits the results to Grondbank. Grondbank has a coded system for the soil quality and once they have authorised the report, they provide the client with associated soil quality code.

Prior to excavation

Once the earthworks are ready to start, the client/ contractor contacts Grondbank to authorise the transport of the soil. Given that the data and the assessment have been completed during the planning stage, the earthmoving permit can be acquired within an hour and the soil can be moved to the receiving site or the temporary storage hub.

After transport is complete

If the soil is transported to a receiving site, the soil can be used immediately. If the soil is transported to a temporary storage hub, it will be transferred to a stockpile with the same soil quality code. The receiver signs the receipt of collection and a copy is sent to Grondbank and a soil management report is drafted. Subsequently, Grondbank provides both the client and the end user with the soil management report.

Is it waste?

Only when transporting contaminated soils or transporting to another region or abroad (also for non-contaminated soil). The transport is accompanied by an identification form for waste.

Is Grondbank applicable only for large-scale projects?

Grondbank is being used for both large- and small-scale projects. For projects smaller than 250 m3 there is no obligation for a technical report however the contractor is still responsible for reporting the soil transport to Grondbank. For such small projects, the contractor does not need to be registered with Grondbank and the reporting is free.

Grondbank members

Membership is mandatory for organisations involved in the execution of works while is optional for other actors. Chartered soil remediation experts, contractors (for both large- and small-scale projects), transporters, temporary storage facilities, soil cleaning and sludge processing facilities, utility companies or local authorities, food processing companies or professional organisations and farmers must be registered with Grondbank.

Are there any incentives for using the system?

No financial incentives were offered to the industry sector to use the system instead of sending soil to landfills. A pivotal moment was when the regulations changed, and the material originator was made responsible for the potential contamination of their material after deposition on the receiving site. Grondbank provided the security and transparency in the industry for soil transport. However, it is important to highlight that Flanders covers a smaller area than England with only 16 operational inert landfills, thus the pressures associated with land and soil material availability are critical.

Is it cost-effective?

The costs of using Grondbank system vary depending on the site, the type and volume of soil, the distance from the temporary storage site (if applicable) and the time of the year. Similarly, the costs of disposing soil to a landfill vary depending on the specific landfill and the type and volume of soil being disposed of. Typically, the cost of using Grondbank is lower than disposing soil to a landfill.

What are the usual reuse activities?

Soil is being reused for landscaping, construction, agriculture, and environmental restoration.

Alberta Soil Reuse Facility (ASRF) – Alberta, Canada

The Alberta Soil Reuse Facility (ASRF) in Canada is a division of the Calgary Aggregate Recycling Inc. and it was established at the end of 2022. Calgary Aggregate Recycling accepts construction and demolition materials as well as contaminated and mixed soils. The facility aims to provide a 90% reduction in soil disposal in landfills with the capacity to process 3,000 tonnes of material per day. The facility will have the capacity to process an additional 600,000 tonnes annually, of contaminated and mixed soil.

Legislations/Regulations

ASRF operates under the Environmental Protection and Enhancement Act (EPEA; 1993)[46], Waste Control Regulation (1996)[47] and Tier 1 and 2 Soil and Groundwater Remediation Guidelines[48,49].

Enforcement

The Ministry of Environment and Protected Areas is responsible for ASRF's compliance with the regulations.

Is it waste?

Soil transferred to ASRF is not necessarily considered waste if it meets certain criteria, as ASRF accepts both excavated and contaminated soils.

Is it cost-effective?

ASRF provides a variety of services. The base rate for clean soil is CA$20 per tonne whereas for contaminated soil with heavy metals and organic pollutants the rate is CA$30 per tonne per ppm of contamination and CA$50 per tonne per ppb of contamination respectively. There is also a tipping fee for CA$10 per tonne of clean soil.

46 open.alberta.ca/dataset/e12/resource/733c4b07-2e4a-4483-bcd3-14a9e0996f26
47 open.alberta.ca/publications/1996_192
48 open.alberta.ca/publications/1926-6243
49 open.alberta.ca/publications/1926-6251

Excess Soil Registry – Ontario, Canada

Excess Soil Registry is a mandated digital reporting service for tracking excavated soils during construction that have to be moved off-site because they cannot or will not be reused in the generating site. The service is provided by the Resource Productivity and Recovery Authority (RPRA) which is the regulator mandated by the Government of Ontario to enforce the laws of CE.

Legislations/Regulations

The Excess Soil Registry was mandated in 2019, after the 2016 Resource Recovery and Circular Economy Act, 2016 (RRCEA)[50], the Waste Diversion Transition Act, 2016 (WDTA)[51], Excess Soil Regulation (2018)[52] and On-Site and Excess Soil Management Regulation (2019)[53].

Enforcement

The Ministry of the Environment, Conservation and Parks is responsible for compliance and enforcement activities for the excess soil registry.

What is the RPRA's role?

The RPRA's role is to develop and operate the Excess Soil Registry programme, manage, analyse and report the registry's information, as well as to carry out certain compliance and enforcement activities.

How does it work?

Project leaders, site reuse owners or operators and residential development soil depot operators are required to file notices to the Excess Soil Registry for certain project areas where the soil is generated, deposited and temporarily placed (project areas, reuse sites and soil depot sites, respectively).

50 www.ontario.ca/laws/statute/16r12
51 www.ontario.ca/laws/statute/16w12
52 www.ontario.ca/page/handling-excess-soil
52 www.ontario.ca/laws/regulation/190406

Simplified steps

Excess soil from project areas notice

The project leader or authorised person needs to file a notice before the soil is removed with the essential information and another notice 30 days post excess soil removal.

Excess soil for residential development soil depots:

The owner, operator or authorised person needs to file a notice before the excess soil is deposited on a residential development soil depot site. The owner or the operator are responsible for ensuring that the quality of the excess soil accepted and managed meets the Excess Soil Quality Standards. Another notice is filed 90 days post depot closure.

Excess soil for reuse sites

The site owner, operator or authorised person files a notice before the excess soil is deposited and another notice is filled 30 days after the final load of the excess soil has been deposited.

Is it cost-effective?

The Excess Soil Registry has two types of fees; flat and tiered fee. The flat fee is $25 for small-scale soil removal projects (<10 m^3), while the tiered fee is $0.02 per tonne of soil removed or received (>10 m^3).

Clean Soil Bank - New York, USA

The NYC Clean Soil Bank (CSB) is a program that aims to reduce the amount of clean soil sent to landfills and deposit it for beneficial reuse to other construction sites, community and school gardens. During 8 years of operation, more than 600,000 tonnes of clean soil have been recycled and reused in projects across NYC and has saved over USD$10 million in disposal costs. Moreover, due to the soil reuse programme there has been a reduction in CO2 emissions (4,800 metric tonnes of CO2) and truck miles (2.2 million miles).

Forbell Street Stockpile is a clean soil stockpile in East New York, Brooklyn and is operated by the Office of Environmental Remediation (OER). The facility receives clean soil from construction sites, stores it and makes it available to the CSB. OER also offers free delivery of clean topsoil to community and school gardens, made from clean excavated soil and compost at the stockpile. OER has another programme, PUREsoil NYC in which deep excavated soil (technically sediment) from the NYC CSB is delivered to community-based organisations to improve the quality of their degraded garden soil or to build new gardens at publicly accessible sites.

Legislations/Regulations

The NYC CSB operates under the NYC Administrative Code Title 43, Chapter 14, Subchapter 4[54], the New York State Department of Environmental Conservation (DEC) Regulations Part 360[55] and the Memorandum of Agreement between the NYC Department of Environmental Protection (DEP) and DEC[56].

Enforcement

The NYC DEP is the regulator of compliance for the CSB.

54 www.nyc.gov/assets/oer/downloads/pdf/authority-nyc-brownfield-cleanup-regulations.pdf

55 www.dec.ny.gov/regulations/118777.html

56 www.nyc.gov/assets/oer/downloads/pdf/authority-memorandum-of-agreement-with-nys-dec-2020.pdf

How does it work?

Clean excavated soil from construction sites moves through CSB either to the City's Forbell stockpile for temporary storage, or to other construction sites (both public and private) and community and school gardens.

The generating site must provide proof that the material is clean, native soil meeting the lower of New York State's soil standard and its protection of groundwater according to the 6 NYCRR Part 375-6.8(b) to the OER. Once OER determines that the soil is meeting the criteria, the soil receives a Beneficial Use Determination (BUD), which allows soil to move in commerce as a commodity.

Is it waste?

After the eligible soil has received the BUD is removed from regulation as solid waste and is moved in commerce as a commodity. Specifically, according to OER's Memorandum of Agreement with DEC (1/10/2020) "DEC … agrees that soils cease being regulated as solid waste pursuant to 6 NYCRR Part 360 when characterized at the site of generation as eligible for the CSB and on arrival at OER-designated soil storage facilities or destinations of beneficial use, provided CSB notification and manifest procedures are followed for all CSB soil transfers…"

Is it cost-effective?

The CSB program operates at minimal cost. The generating site pays for the transport to either the Forbell street stockpile or the final destination, but does not pay for disposal. Similarly, the receiving site pays for the transport of clean soil from the Forbell Street stockpile but does not pay for the soil.

Soil Bank system - Netherlands

The Netherlands has both publicly and privately owned soil banks. The first national policy for soil reuse was released in the 1990s and the Association of Soil Banks (BOG) was established in 1999[57]. The main objective of the Association was to develop quality standards, build trust in the application, share the knowledge and provide certification of all members, both public and private. BOG is the partner for policy makers and assists on policy on soil reuse in large construction works, landfill possibilities (regulations, differentiation of rates, capacity) and permit procedures. By utilising the soil reuse banks, in Rotterdam alone (2011) a total of €12.5 million was saved because of good matchmaking between projects with surplus/demand needs[16] and the total amount of soil being reused was 700,000 tons.

The first regulations and standards for the reuse of excess soil and sludge came into effect in 1998[16]. BOG also assisted in the drafting of the Dutch Soil Decree (2008)[16] and the Soils Protection Act (2013)[16]. The Soil Quality Decree sets out rules and conditions for the permanent reuse of soil, while the Soil Protection Act sets out the overall law, applying amongst others to soil banks, treatment facilities, landfills and reuse locations. According to the Dutch policy to reduce soil landfilling, the landfill rates have been increased and it is neither allowed to landfill contaminated soil which can be treated in a facility nor to landfill lightly contaminated soil which can be reused. The Dutch soil banks are regulated by an enforcement officer from the DCMR (Regional Environment Protection Agency) who checks the soil bank system for registration data. The enforcement is applied throughout the entire chain; from site of origin to final destination, including temporary storage places. In the Netherlands, they have separate authorities for enforcement and organisation for quality assurance.

Specifically for the city of Rotterdam, there are soil quality and soil function maps, and by combining them they produce soil application maps, which are used for decision making in soils permanent relocation[16]. The site-of-origin-destination decision matchmaking follows a hierarchy according to the site of origin state. If the site of origin is a natural site, then the final destination can be a natural, urban or industrial site. If the site of origin is an urban site, then the final destination can be an urban or industrial site. If the site of origin is an industrial site, then the only option available for the final destination is another industrial site. If the site of origin is contaminated and the treatment is possible, then post-treatment can be used only at an

57 rwsenvironment.eu/rws-environment-0/zoeken/?zoeken_term=soil+bank

industrial site. Otherwise, if the contaminated soil cannot be treated, then the soil will be landfilled.

Every soil bank in the city of Rotterdam needs a national licence for batch sampling, a national permit for transportation and a local permit for every temporary storage site16. Every batch has a unique number for the transportation between the site of origin and the final destination and every truck has a transport document, which is registered in the soil bank system. The soil bank is responsible for the registration and the reporting of the soil conditions and volumes, signing the contracts between the parties, advising on policy and legislation in order to make reuse possible and detect excess or demand in their service area. The soil bank is also responsible for checking if the matchmaking is possible by using decision models, intaking the excess soil (verified with legislation and the requirements of the final destination site) and establishing tendering for soil treatment or landfill. The soil bank mediates between the disposer and receiver by a contract; if no match is possible, then the soil bank mediates between the disposer and a temporary storage site by a contract.

Switzerland

Switzerland does not have a soil reuse system on a national level, per se, as it is organised in 26 administrative subdivisions regions and it is the individual's subdivision decision, and currently only two subdivisions operate temporary soil storage sites. However, according to the Art. 18 para. 1 of the Waste Ordinance, (ADWO, SR 814.600)[58], both top- and subsoil must be recovered in full, if possible, provided that it is suitable for the intended recovery owing to its properties, it meets the benchmark values of the Ordinance on the Pollution of Soil (SoilPO)[59], and it does not contain foreign substances or invasive alien organisms. The material is regulated as waste throughout the entire process. The waste and SECS soil arisings from the construction as well as their management plan needs to be declared to the cantons for authorisation prior to any earthworks.

For excavated material, the possibility of reuse follows a hierarchical approach according to the Art. 19 of the Waste Ordinance[17] and the entire amount of the material must be recovered fully, if possible. The unpolluted excavated material that satisfies the top range of the requirements can be reused as construction material on building sites or landfills, as raw material for the manufacture of construction materials, for the refilling of material extraction sites or for permitted landscaping work. The excavated material that satisfies the lower range of the requirements can be reused as a raw material for the manufacture of hydraulic or bituminous bond construction materials, as a construction material for landfills type B-E[60], as a raw material in the manufacture of cement clinker, or on the site where the material is produced, provided any treatment required for the material is carried out on or directly adjacent to the site.

Lastly, if the excavated material does not satisfy the lower range of the requirements, then it may not be recovered. Switzerland also has a national implementation guide for the assessment principles for clarifying the suitability of excavated soil for reuse[61].

58 www.fedlex.admin.ch/eli/cc/2015/891/en#art_18

59 www.fedlex.admin.ch/eli/cc/1998/1854_1854_1854/de

60 www.bafu.admin.ch/bafu/en/home/topics/waste/info-specialists/waste-disposal-methods/deponien.html

61 www.bafu.admin.ch/bafu/de/home/themen/boden/publikationen-studien/publikationen/modul-verwertungseignung-von-boden.html

The comparison of costs of using the international soil reuse systems and the relevant landfills, as well as the DoWCoP nationally, is presented in Table 2. Landfilling soil is more expensive per tonne of soil waste across all countries that have a soil reuse system.

Table 2: Fees comparison (in £; exchange rates EUR/GBP 0.85, CAD/GBP 0.58 and USD/GBP 0.78) between international soil reuse systems and landfills. Please note that the prices are indicative from various online resources and not from the official websites.

	Price (per ton)	
	Soil reuse system	Landfill
Grondbank – Flanders, Belgium	17	26
Alberta Soil Reuse Facility – Alberta, Canada	12-33	23
Excess Soil Registry - Ontario Canada	14.5 flat fee (<10 m^3) 0.012 tiered fee	58
Clean Soil Bank – New York, USA	Only transport costs	47
Soil banks – Rotterdam, The Netherlands	0.34/ton delivered to a demand site Or 1,025/match for matching between 2 projects[62]	28.3/ton[63]
DoWCoP - UK	165 admin fee + 10/1,000 m3 (>5,000m^3) No volume fee for <5,000m^3	3.25 lower rate 102.10 standard rate

Benefits of establishing a Soil Reuse and Storage System in England

The potential benefits of establishing a successful Soil Reuse and Storage System (SRSS) in England are not only environmental but also economic and social. The Government has made a variety of commitments on protecting the environment, safeguarding existing soils and managing them sustainably as well as meeting a net zero target by 2050[64].

- Soil will be valued as a limited, non-renewable resource and thus treated as such.
- Utilising an SRSS means that less and unnecessary disturbance will be caused to the soil.
- Storing and reusing soil contributes to a CE as SECS can be used instead of virgin material, in the sense of acquiring intact sites or locations for covering the development's soil demands and will have financial benefits as this will help mitigate to an extent soil degradation.
- SRSS facilities located appropriately across England would reduce truck miles, landfilling, and the mining of topsoil, thus decreasing fuel use and contributing to achieving net zero.
- Storing and reusing soil could be used to remediate previously contaminated soil removed from a development.
- The SRSS could provide soil for the landfills' operational needs (capping, coverage and backfill) and ensuring that premium quality soil is beneficially reused for other purposes (wildlife habitats creation, green urban spaces, etc).
- The SRSS system could help resolve mismatched timeframes between donor and receiver sites as well as assist with developments that have planned to reuse their SECS on-site but face space constraints.
- The SRSS could provide essential material for building flood defence barriers.
- Storing and reusing soil at a regional level, could also reduce the risk of introducing invasive species to the landscape.
- Old quarries, brownfield sites, or closed landfills can serve as SRSS facilities, if other contributing factors show that those are the most sustainable locations, thus introducing those sites to beneficial reuse.
- The SRSS could assist with the creating of further jobs through the establishment of the soil-reuse sector.

Challenges of establishing an SRSS in England

Whilst implementing an SRSS in England has both environmental and financial benefits, while reducing waste production and implementing a wider CE framework in the construction industry, the implementation under existing frameworks may be challenging.

If SECS is to be stockpiled for long-term with the hope of eventual reuse, rather than certainty of reuse, it may become a burden to the custodian (whether that is a contractor, a planner, a landowner or a fixed facility). Thus, increasing the potential for SECS to become a waste. Long-term storage carries a risk of degrading the soil's value as a resource and causes a high risk for soil storage facilities to effectively become landfill sites.

Lack of appropriate testing indices in policy and regulation can make the viability and success of soil reuse and storage facilities even harder. Without a standard soil testing framework there is a risk of SECS with different characteristics being mixed with other soil while stored, thus potentially causing a deterioration in soil quality. Also, inappropriate soil handling during construction and development activities can result in mixing soil with other materials, leading to either a reduction in soil quality or contamination.

Another challenge associate with establishing a soil reuse and storage system in England is the location of the facilities. If the storage facilities are inappropriately located, requiring more transport miles compared to landfill deposition, then the system's success and viability will be under pressure. Considerably higher transport miles will have both environmental and financial impacts, as the greenhouse gas emissions will increase and industry will find it financially unsustainable compared to landfilling.

62 Data are from 2011
63 Data available for 2021, www.cewep.eu
64 www.gov.uk/government/publications/net-zero-strategy

Proposal of an SRSS in England

In this section, a possible SRSS in England is introduced. The proposed SRSS follows principles and paradigms taken from the international systems presented in previous section as well as trying to adapt to the current policy and regulation landscape, in order to keep the introduction or modification of policy and legislation to a minimum. In that sense, this is neither a perfect nor a single approach on how an SRSS could be introduced in England. The proposed system is predominantly "soil-centric", with all the suggestions based on the best possible approach for ensuring that soil is treated as a non-renewable and valuable resource. The idea of this particular system is not only storing soils for further reuse but also treating contaminated soils and manufacturing soil with improved quality.

Definitions

Actors

All the actors related to an SRSS system are outlined below.

- SRSS Governing Body (see section SRSS Governing Body)
- Regulators
- Developers
- Land owners
- Contractors
- Independent Soil Scientists
- DoWCoP administrator
- Landfill Operators
- Clients (others than those mentioned above, such as, farmers, local council authorities, etc.)

All actors (except the SRSS Governing body and the Regulators) should be registered members with the SRSS governing body and pay a membership fee65.

SRSS Governing Body

The SRSS Governing Body should be an autonomous and independent body in order not to interfere with the market and should not undertake any regulatory activities. The regulators, Environment Agency (EA) should be responsible for regulating the activities of the SRSS and the SRSS should provide all information to the regulators (EA). That is to create division of labour and ensure that the system can operate appropriately without creating extensive delays in the process chain due to understaffed conditions.

The SRSS Governing Body should have a fully digitalised soil flows tracking system and be responsible for its operation and maintenance. They should work collaboratively with DoWCoP administrator, the regulators, the landfill operators and the deposit recovery operators to ensure that all soil flows in England are registered in the SRSS's digital tracking system, to avoid mismatching flows and create full transparency. This will also assist the waste flows.

The SRSS system should establish quality management frameworks for their storage and treatment facilities. As the facilities could be both private and public, they must operate under the same quality management frameworks to ensure the quality of the stored soil or "new products" (e.g., treated contaminated soil and manufactured soil).

All soil movements should be authorised by the SRSS governing body prior to any earthworks taking place and only after all necessary proof (e.g. soil or contaminated land survey results, on-development-site space limitations, etc.) has been submitted to the SRSS body. The SRSS body should be able to prevent earthworks happening if they are dissatisfied with the submitted paperwork. This will assist with the consideration of soil management at the early planning stages of the development project, improve the soil handling on site, reduce illegal and fraudulent activities and create trust across not only the industry sector but across all actors of the soils' quality.

The SRSS system should also provide a digital platform to all its members assisting in finding the appropriate soil or location for their needs. However, the SRSS should not be responsible for the matching soils with sites, that should be the members' responsibility.

Soil Hotels

Soil Hotels are fixed facilities for temporary relocation of clean, natural soils. They should operate under established quality management framework[66,67] on soil handling, storage, soil health and quality indicators by the SRSS. They can be both publicly or privately owned, but must follow the quality management framework established by the SRSS. Soil hotels will only receive clean, natural soil if under the Material Management Plan (MMP; DoWCoP) it has been proven that the reuse on-site and direct transfers are already explored pathways of reuse, but there is still a surplus of soil or there are severe space limitations for temporary storage on-site.

Such facilities can operate under the current policy framework in England and Wales with a permit, however the prescribed storage period associated with the waste permit should be long enough to allow the facility to store and distribute soil.

65 To cost of membership is out of the scope of this report .

66 www.gov.uk/government/publications/code-of-practice-for-the-sustainable-use-of-soils-on-construction-sites

67 www.quarrying.org/soils-guidance

Soil Hospitals

Soil Hospitals are fixed facilities for treatment of contaminated soils as well as manufacturing soil with improved quality. Soil Hospitals follow the same principle as the Soil Hotels (section above) in regard to quality management frameworks and ownership. Different soil hospital facilities could treat soils for different contamination[68] and should only receive soil with the contamination they are able to treat and ensure post-treatment quality.

Such facilities that perform both the treatment of contaminated soils as well as manufacture soil cannot operate without bespoke permits under the current waste policies in England and Wales.

68 This needs further research in order to match the facilities' locations with the industry activities and needs around to avoid increased truck miles and, thus, improve the system's sustainability.

Potential locations of Soil Hotels and Soil Hospitals

One possibility is to locate SRS facilities close to or at existing landfills that receive soil. Figure 4 is a preliminary and exploratory analysis of all inert/non-hazardous landfills in England. They are organised in an ascending order of the amount of soil received, from darker to lighter colour hues and the units are in tonnes. Further research will be needed to assess whether SRSS facilities could be established in landfills or close by. Moreover, old quarries and brownfield sites could be used for establishing SRSS facilities.

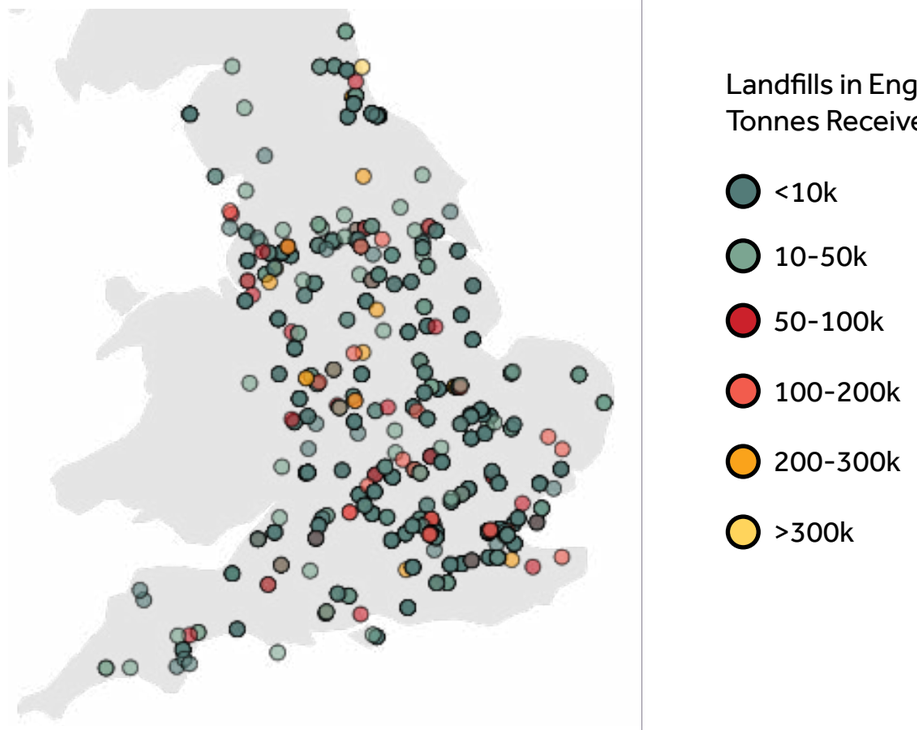

Figure 4: Inert/non-hazardous landfills in England. The locations are denoted with coloured circles and the units are in tonnes of soil received. The colours are signifying the amount of soil received, from darker to lighter hues in an ascending order.

Proposed scenario for Soil Hotel facilities

Figure 5 shows a schematic representation of a Soil Hotel facility scenario prior to any earthworks taking place. During the pre-planning stages of the development project, the planners/developers/designers should consider the expected soil volumes arising from the site. At that stage, an independent chartered soil scientist (as defined in the National Planning Framework[69] and the National Quality Mark Scheme[70]) should be used by the developers/planners/designers to undertake soil sampling and analysis from the site of origin and complete a soil resource survey which will provide all essential information (e.g. BSI standards for topsoil/subsoil). This will aid the drafting of the soil resource plan and MMP (if following DoWCoP). When drafting the soil resource plan, (and MMP if applicable) they should indicate how much soil will be reused on the site of origin, how much soil will be used for direct transfer (if using DoWCoP) and, if there is still surplus soil, how much soil will be transferred to a Soil Hotel facility for temporary relocation. If the soil is to be reused on the site of origin in its entirety, but there are severe space limitations on site for temporary storage, this needs also to be specified in the soil resource plan and MMP.

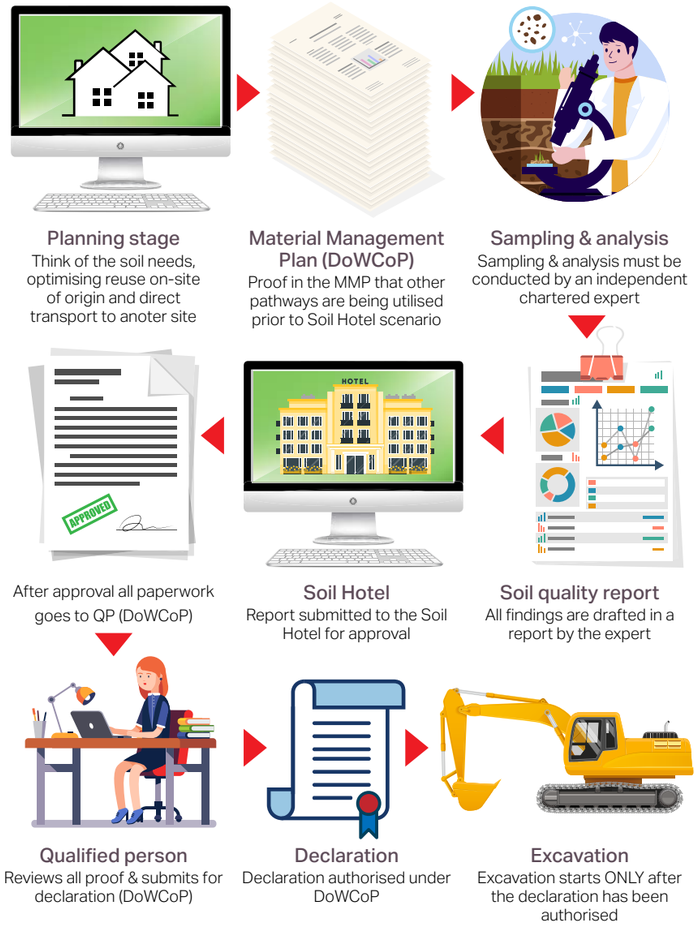

Figure 5: Schematic representation of a Soil Hotel facility scenario prior to any earthworks

69 www.gov.uk/guidance/national-planning-policy-framework/annex-2-glossary

70 www.silc.org.uk/

The report should be submitted to the Soil Hotel facility, in the closest proximity to the site of origin to minimise unnecessary truck miles. If the Soil Hotel facility in the closest proximity is not able to receive the surplus of soil, then the next closest facility should be used.

After the Soil Hotel facility has assessed the soil characterisation and quality report and are happy with the results, they can approve the request and the report, alongside with the rest of the appropriate paperwork will go to the QP for further review and declaration submission to the DoWCoP administrators. Once all requirements have been met, SRSS governing body can authorise the earthworks to start.

Figure 6 shows a schematic representation of a Soil Hotel facility scenario post earthworks in the site of origin. The Soil Hotel facility will receive the agreed surplus soil from the development site and store it temporarily in an appropriate stockpile according to the soil characteristics, until a permanent location is found. Once a receiving site has expressed interest to receive soil from a Soil Hotel facility, according to soil quality and potential reuse activity matchmaking criteria, soil can leave the facility. If there is increased demand for the same soil quality, the decision making should follow a hierarchical model of future beneficial reuse. Firstly, wildlife habitat and green space creations as well as agricultural land improvement should be prioritised, followed by urban and industrial development needs.

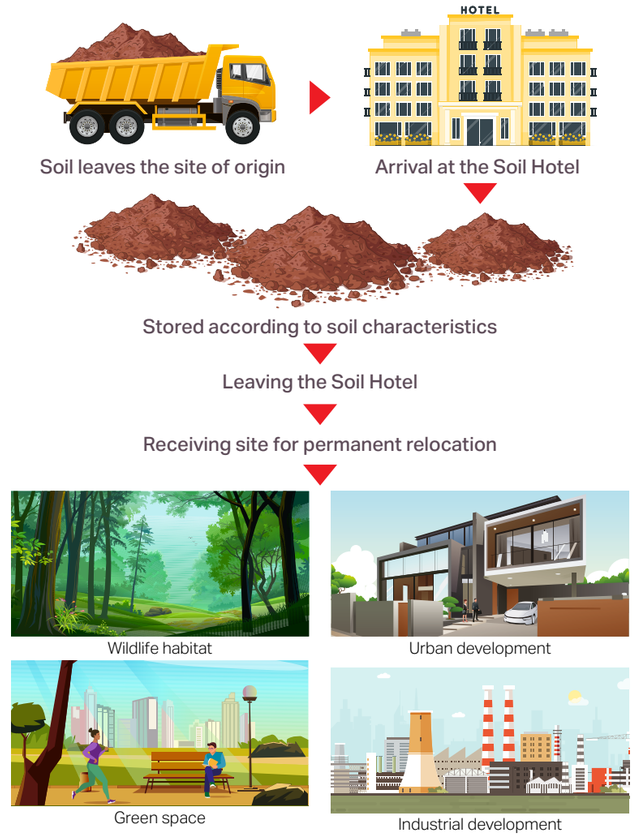

Figure 6: Schematic representation of a Soil Hotel scenario post earthworks in the site of origin.

Proposed scenario for Soil Hospital facilities

Figure 7 shows a schematic representation of a Soil Hospital facility scenario prior to any earthworks taking place. During the early pre-planning stages of the development, the planners/developers/designers should identify the appropriate Soil Hospital facility for sending the SECS for treatment. A soil resource survey as well as a contamination survey will need to be included in the report, following the same principles as in the Soil Hotel scenario mentioned in the previous section.

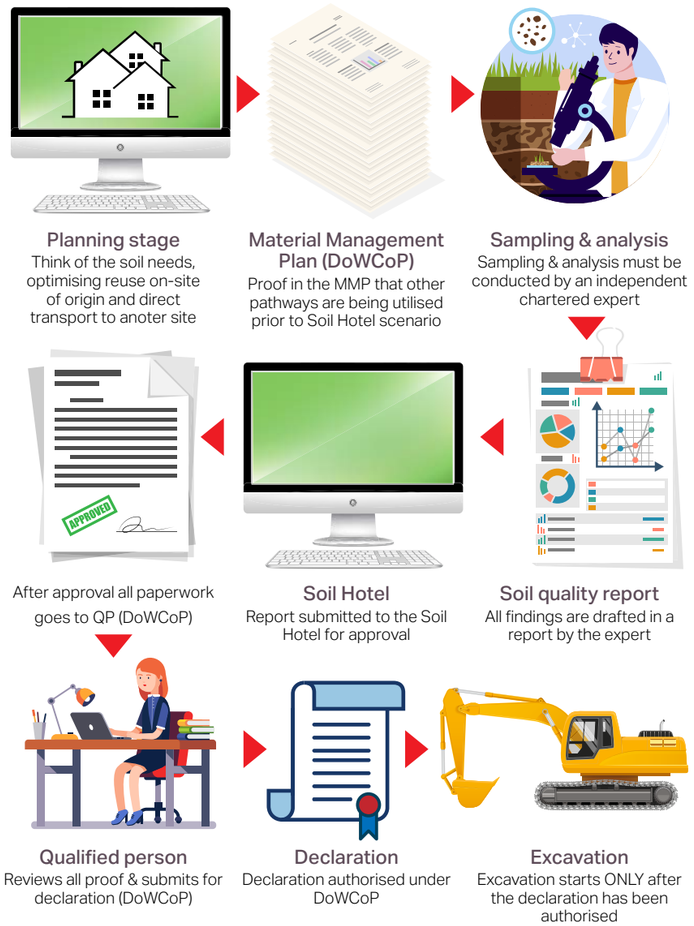

Figure 7: Schematic representation of a Soil Hospital facility scenario prior to any earthworks.

The soil resource survey and contamination survey reports should be submitted to the appropriate Soil Hospital facility, and once the facility is happy with the report and that they can achieve decontamination or immobilisation of the contaminant, post-treatment, they can approve the report. Similar to the Soil Hotel scenario, all appropriate paperwork needs to be sent to the QP who submits everything to the SRSS governing body for authorisation. Once all this is complete, the earthworks can start.

Figure 8 shows a schematic representation of a Soil Hospital facility scenario post earthworks in the site of origin. The Soil Hospital facility will receive the agreed contaminated soil and store it to batches of similar contamination levels, treatment needed and soil characteristics. However, if, when establishing the facility, the available space is limited, the storage of contaminated soils should be per contamination levels and treatment needed. In this case, unavoidably, different soil types will be mixed together and the soil quality achieved post-treatment might be degraded.

Once the treatment is complete, soils should be stored per amended quality. Soil Hospitals could provide low quality treated soils to receiving sites that have similar characteristics needs. If the receiving sites' needs require different characteristics that can be achieved by combining different stockpiles of treated soil or a combination of treated soil and soil improvers/additives, Soil Hotels should be permitted to do this.

Figure 8: Schematic representation of a Soil Hospital scenario post earthworks in the site of origin.

Figure 9 depicts a revised decision tree (Figure 3) of available soil management pathways in England under the proposed SRSS. If the SECS is clean, natural soil then it should not be considered waste and should be able to be reused either on site of origin or off-site to another site (already permitted under DoWCoP) or transferred to a Soil Hotel facility for temporary storage until permanent relocation (as mentioned in the Soil Hotels section, a revised permit or a bespoke permit will be needed to ensure the Soil Hotels longevity and appropriate operation).

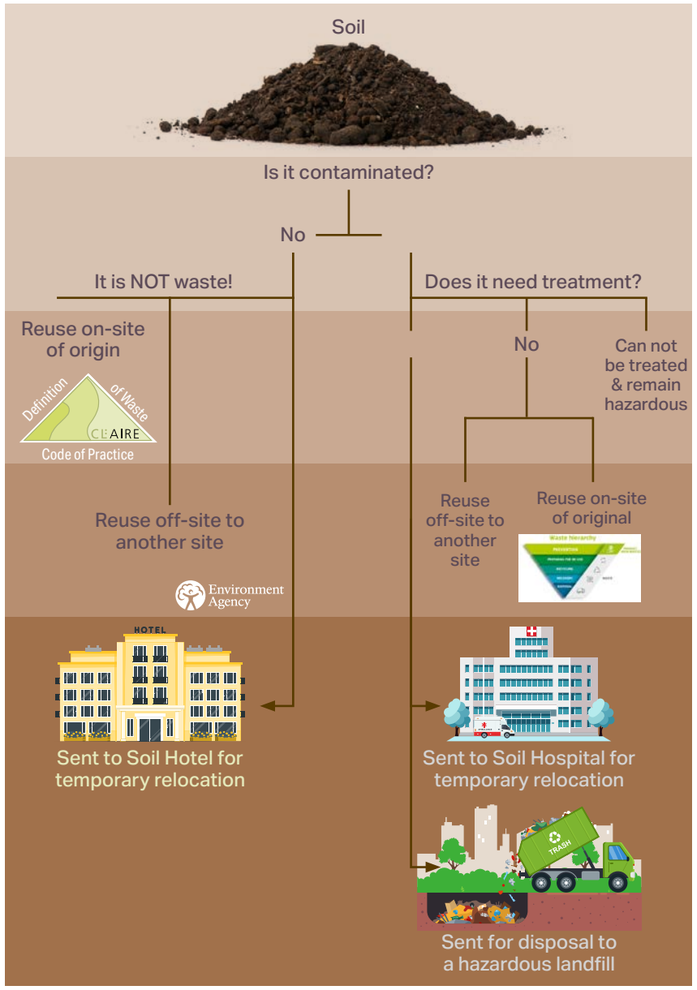

Figure 9: Revised mind map of available soil management pathways in England under SRSS.

If the soil is contaminated but does not need treatment (usually for brownfield sites) it can be reused on-site or off-site to another site (under the Waste Framework Directive Article 2). If it needs treatment and treatment can be achieved, then the SECS should be sent to a Soil Hospital facility for further treatment. If the SECS cannot be treated and thus remain hazardous, they should be sent to a hazardous landfill for disposal.

Recommendations on new policy and policy changes for aiding an SRSS establishment in England

In this section recommendations of introducing new policy as well as updating existing policy in England, for aiding the proposed SRSS establishment are presented. Certain suggestions might be possible to introduce as EA regulatory positions instead of new policy introduction or amendments.

This report considers a crucial and essential step towards a more sustainable and circular future and the need for soils to be considered a valuable and limited resource rather than a waste. With or without an SRSS in England, the definition of waste for soils should be reassessed in its entirety and only soils without the possibility of decontamination or immobilisation should be considered a waste.

The suggestions below, by a combination, could all assist in adopting a no net land take target for England, taking the leap step in CE, net zero, and action against the triple planetary ecological crises (climate change, biodiversity loss and pollution).

New policy and legislation needs

- Soil specific legislative framework to be introduced, with a holistic approach, including forest, peat and urban rather than only agricultural soils. This framework should include standards for assessing soil health and functions[71] and should include the introduction of the SRSS and its quality management frameworks.

OR

- Soil specific legislative framework to be introduced, with a holistic approach, including forest, peat and urban rather than only agricultural soils. This framework should include standards for assessing soil health and functions.

AND

- A CE framework introducing the SRSS and its quality management frameworks.

71 The Agricultural Land Classification (ALC) is completely inappropriate for this assessment and decision making

Amendments in current policy and legislation

- Revisions to Waste regulation to remove all soil following the Soil Hotels' pathway to not be regulated as waste.
- Revisions to Waste Regulation, with appropriate end-of-waste criteria for soils following the Soil Hospitals' pathway, to not be regulated as waste post-treatment.
- Soil resource plan (includes soil reuse and management) could be mandated under Planning policies or Construction regulations.
- Review the Landfill Tax lower rate, and make it less cost appealing for soil disposal.
- Review of the current permitting for storage, beyond the 12-month limit and the tonnage limit, to allow the Soil Hotel facilities successful operations.
- Review of the current amount and storage time allowance of manufactured soils, to allow the Soil Hospital facilities successful operations.
- The refurbishment VAT to be equalised with new build VAT.

Next steps

- Further research and data interrogation on the amount and type of soil currently being disposed of in landfill specifically from construction and excavation, and amounts reused through the current industry best practice guidance (Definition of Waste Code of Practice), permits, and other forms of recovery and backfill.
- Further investigation on how soil is tested, its suitability for verified future uses, and how this impacts its waste classification.
- Further whole life cycle analysis needs to be carried out on the net-zero implications of the policy, particularly truck miles, soil carbon protection and virgin material manufacture.
- Further spatial modelling will need to be undertaken to understand the optimum locations of any SRSS facilities to ensure usage, lessen truck miles and ensure the system's sustainability.
- Further economic analysis needs to be carried out to understand the full costs and benefits of the SRSS establishment in England.

Appendix A

Core project steering group

Name	Company
Karen Andrews	Environment Agency
Theresa Cory	Environment Agency
Peter Elliott	Environment Agency
Eleanor Palmer	Defra
Paul Stevens	Environment Agency
Graham Winter	Environment Agency

Corresponding members

Name	Company
Bob Barnes	Environment Agency
Gisele Bakkenist	Environment Agency
Mat Davis	Environment Agency
Graeme Duggan	Defra
Angela Haslam	Environment Agency
Howard Leberman	Environment Agency
Tommy Lowden	Environment Agency
David Read	Defra
Gareth Watkins	Environment Agency

Interviewees

Name	Company
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Martin Ballard	Wates
Marc Dillen	Grondbank
Corsin Lang	Federal Department of the Environment, Transport, Energy and Communications (DETEC)
Nick Willenbrock	CL:AIRE
Graham Winter	Environment Agency

Workshop Attendees

Name	Company
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Rachel Boulderstone	Defra
Rob Brodie	Environment Agency
Michelle Clarke	Environment Agency
Theresa Cory	Environment Agency
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Mat Davis	Environment Agency
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Angela Haslam	Environment Agency
Cathryn Jones	Environment Agency
Tommy Lowden	Environment Agency
David Read	Defra
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