Greenprint
Process Report

A carbon negative systems model for green infrastructure management

South Gloucestershire Council & West Sussex County Council

27/03/2026

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Contents

Introduction

Purpose of the document

This document summarises how the Live Labs 2 Greenprint project investigated and trialled the introduction of a 'cut and collect' verge management regime across two local highway authorities (LHAs), where previously 'cut and leave' was the existing verge management method.

The document may be used as a point of reference by other LHAs considering changes in verge management and seeking guidance on the approach required.

What it outlines

A narrative is given of the way in which the Greenprint project team considered and tackled the challenges in each area described - to offer guidance to other LHAs, their communities and the wider highways sector seeking to investigate and implement similar verge management changes in their area.

Brief description of the format

Where appropriate a separate description of the experiences encountered by both South Gloucestershire Council and West Sussex County Council is given. Each authority pursued different methods of biomass processing, and many other aspects of delivery were also not the same – such as the cut-and-collect machinery used, the method of data collection, and the characteristics of the plots of grass under trial.

This document draws from the experience of the project team and the existing report documentation to present a concise summary capturing the most significant findings.

More in-depth details on the Greenprint project itself are available separately.

These include but are not limited to:

- Outline Business Case
- Annual project reports
- Vegetation report
- Carbon Baseline report
- Thought Leadership report
- How to Guide

Define the verge management changes to be introduced

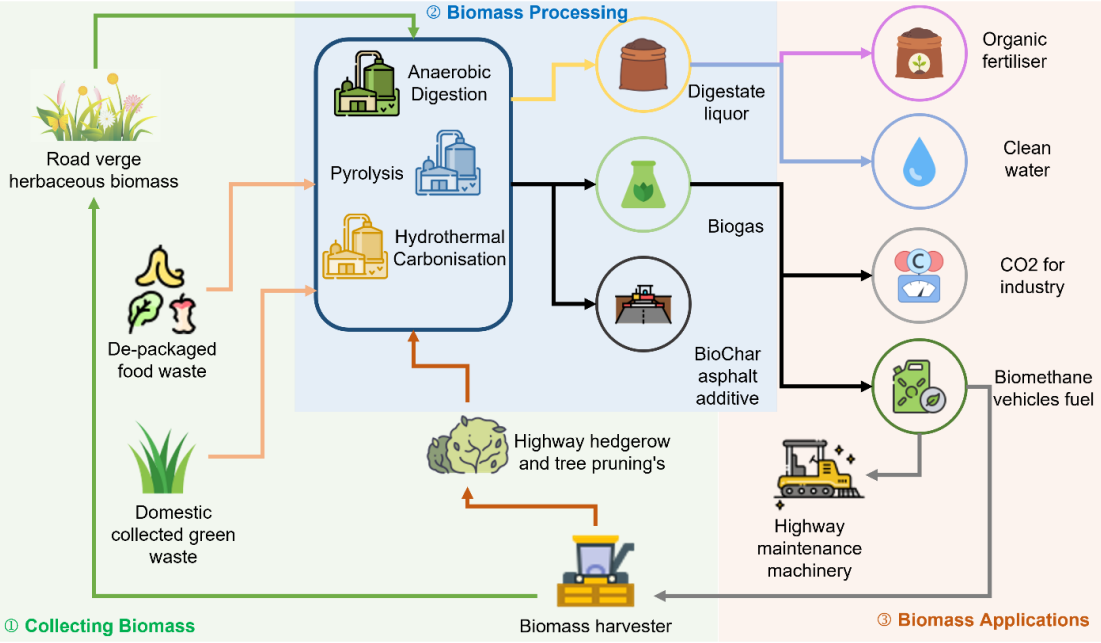
The Greenprint Outline Business Case (OBC) stated the following:

"SGC plans to co-mingle the grass cuttings with food waste using their current waste contractor who will transfer it to a large-scale anaerobic digestion (AD) plant. The project will investigate options and considerations to test, develop and establish operational arrangements, with the aim of formalising an ongoing agreement between SGC and the plant owners.

WSCC plans to work alongside academic and industry partners to test innovative approaches to small-scale biomass processing. WSCC will hire specialist small-scale technology to run AD and hydrothermal carbonisation (HTC) trials. Through Greenprint, WSCC will also be supporting an existing pyrolysis research project".

Working in partnership, both councils had undertaken to investigate innovative ways to redefine the management of grass verges to generate energy and reduce the carbon footprint associated with highways operations. The 'default' approach to verge management of leaving grass cuttings to accumulate on the ground is known to increase the soil nutrient levels – encouraging more robust grasses and other nutrient-demanding vegetation. This does nothing to encourage biodiversity, requires more frequent mowing and generates more operational emissions.

The project aimed to test the adoption of a cut-and-collect operation - rather than the traditional cut-and-leave, a fundamental aspect of which is a phased reduction in cutting frequency. The graphic below captures the essence of the trials under investigation and the processes the cut grass was subject to.



(Source – Greenprint OBC, April 2023)

The Greenprint project partners the charity Plantlife, in partnership with highways agencies, highways managers and conservation organisations, has previously published roadside verge management guidelines that benefit plants, pollinators and other wildlife, stating that reducing mowing frequency to just 2 cuts / year serves to conserve and enhance wildflowers, as it mimics the pattern of traditional meadow management.

The Greenprint project considered the following factors when deciding how to reduce the cutting frequency of Council-maintained grass:

Factor	Issues arising
Safety	Ensuring highway visibility, sightlines, and pedestrian access are not compromised
Legal / Statutory	Compliance with highways, biodiversity, and public safety obligations
Biodiversity & Ecology	Impacts on pollinators, wildflowers, and habitat quality
Public Use & Amenity	Balancing recreational needs, aesthetics, and community expectations
Carbon & Climate Goals	Reduction in fuel use, emissions, and contribution to net zero commitments
Operational Costs & Resources	Potential savings in labour and machinery versus reinvestment in alternative management approaches

Waste & Biomass Management	Handling longer arisings if collected, or potential soil enrichment if left
Community Perception & Engagement	Addressing resident concerns, education, and communication around the purpose of reduced cutting
Weather & Growth Conditions	How seasonal variations affect grass length and maintenance needs
Long-Term Land Management Strategy	Ensuring consistency with wider green estate and open space policies

The cut-and-collect areas trialled in South Gloucestershire were cut 4 times per year throughout the project.

Across West Sussex, several grass-cutting frequencies were trialled during the Greenprint project.

These included:

- 3 cuts per year in Hurstpierpoint - total area 3.7 ha. This was already on a 3 cut-and-collect frequency as part of a previous initiative.
- 4 cuts per year in Horsham – total area 27.7 ha.
- 5 cuts per year in Pagham, Aldwick and Bersted – total area 19.1 ha

In addition, during the final year of the project, a separate trial was undertaken in Crowborough (10.7 ha in East Sussex), where a 2-cut regime was tested.

Whilst the changes under investigation in the Greenprint project were clearly described in the OBC, in any one local highway authority the most viable options for verge management teams to consider, with the greatest potential for minimising cost and maximising carbon emission reduction, will depend upon several factors, as set out below.

Define the areas of grass in scope

Before considering moving to a cut-and-leave model to cut-and-collect it is essential to carry out an audit of all council-maintained plots of grass in order to guide selection. Knowing the status of all the plots, including their characteristics and existing maintenance regimes was essential to identify those areas which most suitable for a cut-and-collect approach.

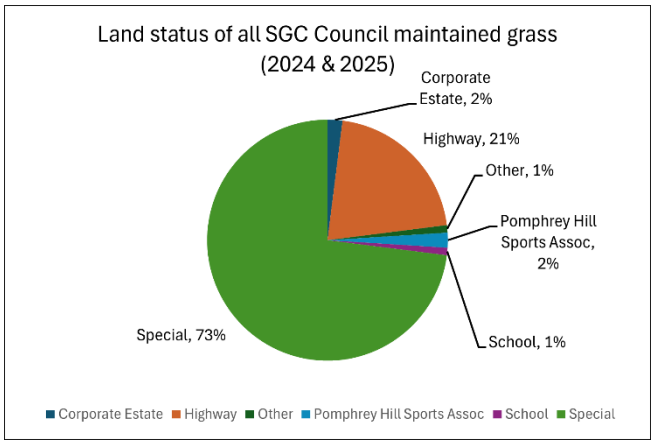
Most councils maintain a detailed Geographic Information Systems (GIS) layer showing the location, size, and boundaries of grassed areas (e.g., highway verges, parks, playing fields, open spaces). Check this data, which is typically compiled from Land Registry

maps, aerial surveys, or GPS-enabled site surveys. Grass areas will be typically categorised by type and maintenance class (e.g., amenity grass, highway verge, conservation area).

1. South Gloucestershire

South Gloucestershire Council (SGC) operates a Grounds Services division of StreetCare as a direct service organisation (or DSO), to maintain grassland within the authority. Within the DSO there is an established Service Level Agreement (SLA), relating to the maintenance of grass. These areas are mapped on the Council's GIS mapping layer as 'Amenity Grass' within the wider 'Council Maintained Grounds' dataset. 'Amenity Grass' is defined as '*all accessible grass areas not dedicated as fine turf or conservation but with generally even surface with defined or loosely defined edges, suitable for mowing with rotary or flail type mowers*'.

The total area of Amenity Grass in South Gloucestershire is 473 hectares. Around 20% of this area is public highway, the majority of the remainder being public open space. All grass cuttings are typically left on the ground.



The land status of the selected Live Labs cut-and-collect plots in 2024 & 2025 was:

- Special – 69%
- Highway – 31%

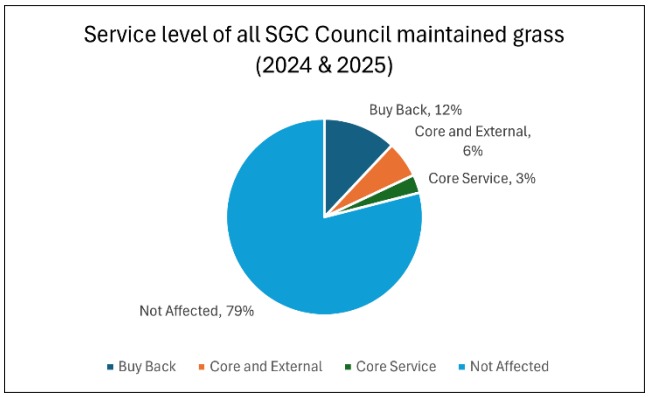
The 'typical' cutting frequency under the SLA is expressed as 8 – 10 cuts per year. However, there are several different models operated under the Localism Act 2011 – in some parishes the parish councils have opted to provide the service themselves using their own contractors, or 'buy back' the service from the Council. Some areas receive a 'core service' from the Council of just 2 cuts per year.

Main service levels – council-maintained grass in South Gloucestershire

- Not Affected – 8 – 10 cuts per year, carried out by SGC (around 79% of the total)
- Core Service – 2 cuts per year, carried out by SGC (around 3%)
- Core and External - 2 cuts per year, carried out by SGC (& additional cuts carried out by external contractor employed by parish – around 6%)

- Buy Back – 8 – 10 cuts per year, carried out by SGC (funded by parish – around 12%)

In addition, and separate to the areas under the SLA, South Gloucestershire Council is responsible for the maintenance of rural grass verges measuring over 975 kilometres in length. These areas are typically cut once a year by an external contractor – usually during August. Occasional additional cuts are applied to selected junctions, as required to protect visibility splays on the highway.



The prior service level of the selected Live Labs cut-and-collect plots in 2024 & 2025 was:

- Not Affected – 36%
- Core Service – 8%
- Buy Back – 38%

2. West Sussex

West Sussex County Council (WSCC) maintains approximately 4 million m^2 of urban highway grass verges, delivered through a fixed lump-sum contract with Grasstex Ltd. The service comprises five cut-and-leave cycles per year.

Delivery is undertaken by six two-person teams, each equipped with a John Deere 1580 ride-on mower, strimmer, blower, 3.5-tonne van, and trailer. Teams typically operate within defined geographic areas to maximise efficiency. Three teams are based at Grasstex's Rudgewick depot and three at the WSCC Drayton depot.

Each team cuts an average of 20,000 m^2 per 8-hour shift, providing a combined daily output of approximately 120,000 m^2. This enables a full county-wide cut to be completed in around 33 working days and allows for the five-cut programme to be completed as a continuous process during the March to November growing season.

The model provides a predictable, high-output service with clear productivity benchmarks and strong cost certainty for both Grasstex and WSCC.

Stakeholder engagement & plot selection

Stakeholder engagement and plot selection are intrinsically linked, with engagement being an essential key aspect of plot selection - this must take into account stakeholder concerns, needs and the existing level of service provision. Asset mapping records categorising the plots must be scrutinised and filtered thoroughly to enable focus on the most suitable plots.

The first task was to identify and map key stakeholders such as local residents, parish / borough councils, ward members, environmental groups, maintenance contractors and operational teams. Early conversations with Council leadership were built in to secure strategic alignment and support, with engagement plans developed for internal and external stakeholder briefings.

1. South Gloucestershire

South Gloucestershire has 50 town and parish councils including 4 new councils created in 2023. Councils are made up of an average of 9 councillors and a clerk depending on the size of the population in the area served. Elections are held once every 4 years. The parish and town councils deal with multiple facilities and services, including public open spaces.

A project Briefing Note was circulated to all parish councils and ward members during February 2023, outlining the Council's imminent involvement in the Live Labs 2 programme, with Yate parish highlighted as the pilot area for year one **(see Appendix 1).** Yate was selected as the pilot area for the cut-and-collect trial, primarily due to its proximity to the Council's operational base (making it easier to control costs and monitor results).

A Greenprint Communications and Engagement Strategy was completed in June 2023 - setting out the stakeholders involved with the project, the messaging and communication channels, plus an indicative timeline of activities and the sign-off process.

A further Briefing Note was issued in August 2023 (following receipt of the project funding), highlighting that the trials would be rolled out beyond Yate into other parishes from 2024.

Prior to Live Labs, South Gloucestershire Council had already started to investigate a change in verge management practice to a cut-and-collect model. A Verges and Public Open Space Grass Management Project was underway, examining how improving

biodiversity on highway verges and public open space could provide carbon benefits to address the ecological emergency and provide resilience to the impacts of climate change. Project consultants Metis had carried out a survey of all Council-maintained grassland from March to May 2022.

Plots were classified and scored under several categories, in the following areas:

- Operational considerations (how easily the plot could be maintained)
- Safety considerations (some areas required visibility cuts)
- Indicators of biodiversity
- Public use of the areas

The Metis survey formed the basis on which plots were to be selected for inclusion in the Greenprint project - only those plots where the survey score for Operational Considerations was 75% or above were to be in scope (75% of the plot area considered suitable for changed maintenance).

There is no one-size-fits-all approach to plot selection and other typical considerations that guided decision making included:

- **Accessibility** – ease of access for collection vehicles and machinery.
- **Size of plot** – larger plots are often more viable for cut-and-collect due to economies of scale.
- **Proximity to processing facilities** – sites closer to processing locations reduce transport time and costs.
- **Traffic and safety considerations** – verges near busy roads may be unsafe or require costly traffic management measures.
- **Ground conditions** – Poor drainage or uneven terrain can make collection difficult or damage machinery.
- **Biodiversity value** – Sites with wildflowers or high ecological value typically benefit more from cut-and-collect to reduce soil fertility.
- **Public use and visibility** – High-visibility areas may be prioritised for aesthetic reasons.
- **Partnership opportunities** – some areas may allow for potential collaboration with parish councils or local environmental groups to manage verges and enhance biodiversity.

Year 1 plot selection – for spring / summer 2023 season

Yate had previously been identified as a suitable pilot area for Greenprint during the earlier Verges and Public Open Space Grass Management Project and had already been subject to trials. In addition, the Council's main StreetCare operational depot is in Yate - making it easier to control costs and monitor the results. Engagement with Yate Town Council began in January 2023 to identify specific plots of amenity grass to be included within the Greenprint project during Year 1. The selected plots were chosen from a wider list of candidate plots identified in the 2022 Metis survey. Maps of the plots were printed off and provided to Yate Town Council.

Several online and face-to-face meetings were held with the town council, until a final selection of plots emerged in June 2023 – totalling 12.4 hectares.

To advise Yate residents of the 2023 pilot scheme the following actions took place:

- A press release was issued to local media, specifically The Yate and Sodbury Voice
- Targeted social media posts were issued using the council's Nextdoor account
- Project information was included in the South Gloucestershire Council weekly residents' newsletter
- A project webpage was created on the SGC public website with a project contact email address
- An A5 flyer was created for Grounds Services staff to hand out to the public if approached.

Years 2 & 3 plot selection – for spring / summer 2024 & 2025 seasons

In South Gloucestershire the Project Manager was directly involved in negotiating with parish councils alongside the Grounds Operations Manager to determine the plots of grass to be included beyond the pilot area of Yate in 2023 for the wider roll-out into other areas from 2024. A series of virtual and face-to-face meetings were arranged to discuss both individual plots and details of any cost implications - as some parishes already paid for a set level of service which would alter when subject to the reduced frequency of cutting required by the project. This engagement ran from October 2023 to March 2024 when the final parish agreed to participate.

From spring 2024, whilst continuing the activity in Yate the cut-and-collect operation was expanded out into the following 7 parishes:

- Bradley Stoke
- Kingswood
- Patchway
- Staple Hill and Mangotsfield
- Stoke Gifford

- Thornbury

Browser maps were sent to all parishes so they could open a link to conveniently view the Live Labs plots operating in their areas. The maps were produced using the Council's GIS software and shared so that parishes could access a simple link that would allow them to view the cut-and-collect grass plots in their area. The same plots selected in 2024 were cut in the final year 3 of the project, 2025 season.

PARISH NAME	HECTARES SUBJECT TO CUT & COLLECT – PER CUT*
Bradley Stoke	3.8
Kingswood Town Council	1.4
Patchway	3.5
Staple Hill and Mangotsfield	2.3
Stoke Gifford	5.3
Thornbury	7.6
Yate	12.9
Grand Total	36.8

Parish cut-and-collect areas 2024 & 2025

**94% of the selected Greenprint plots were in areas previously cut typically 8 to 10 times, with the remaining 6% previously subject to a core service of just 2 annual cuts. All the plots cut using the cut-and-collect Greenprint trial model were subject to 4 cuts in 2024 and 2025.*

Yate	https://maps.southglos.gov.uk/Map2/Map.aspx?mapName=PC_VERGES_MAP_01
Bradley Stoke	https://maps.southglos.gov.uk/Map2/Map.aspx?mapName=PC_VERGES_MAP_08
Patchway	https://maps.southglos.gov.uk/Map2/Map.aspx?mapName=PC_VERGES_MAP_31
Stoke Gifford	https://maps.southglos.gov.uk/Map2/Map.aspx?mapName=PC_VERGES_MAP_39
Thornbury	https://maps.southglos.gov.uk/Map2/Map.aspx?mapName=PC_VERGES_MAP_41
Staple Hill & Mangotsfield	https://maps.southglos.gov.uk/Map2/Map.aspx?mapName=PC_VERGES_MAP_49
Kingswood	https://maps.southglos.gov.uk/Map2/Map.aspx?mapName=PC_VERGES_MAP_50

Browser maps of the cut-and-collect plots in South Gloucestershire

2. West Sussex

West Sussex County Council used its existing Parish Council and Community Engagement Officer, supported by the communications team, to act as the central link between the project and the local community. This dedicated point of contact coordinated public events, shared timely updates, gathered feedback, and quickly resolved issues. By working closely with residents and key stakeholders, the team helped minimise disruption and encouraged collaborative problem-solving.

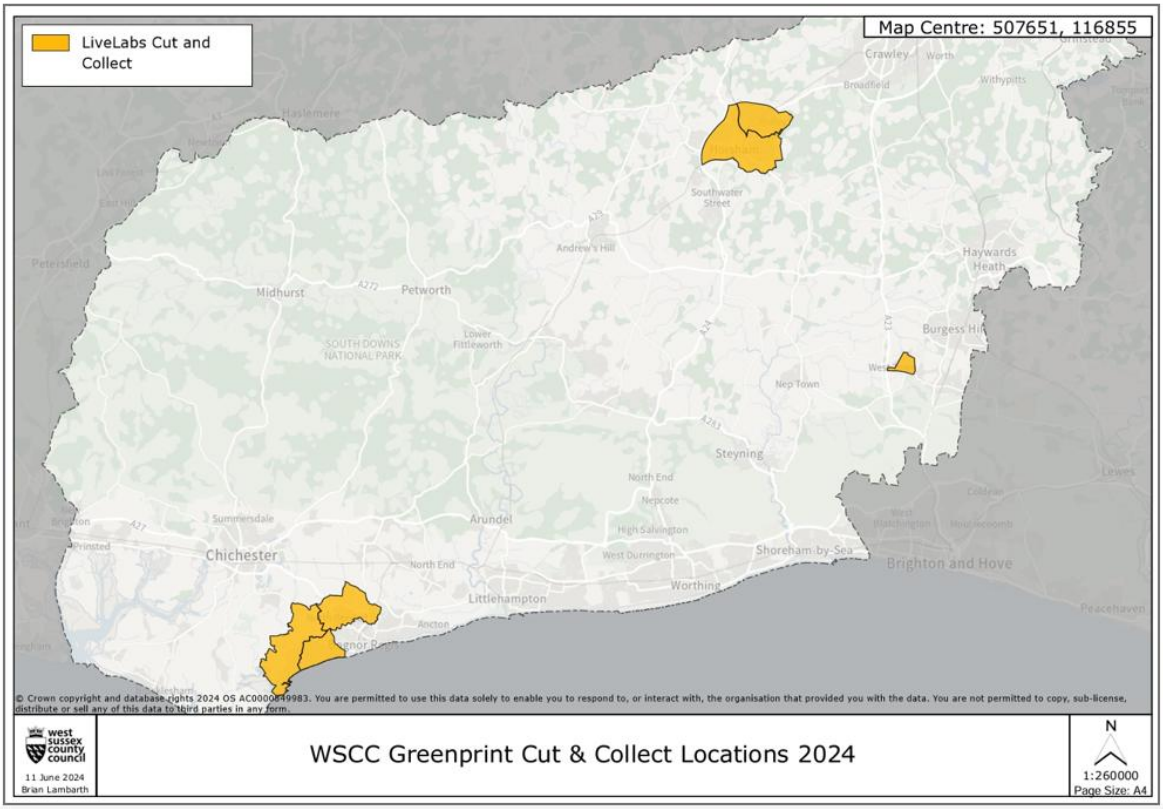
This proactive approach strengthened community relationships, reduced misunderstandings, and provided valuable insights that helped to shape and improve the delivery of the scheme. As there were no significant reductions in cutting frequency within the trial area (Hurstpierpoint already operating under a three cut-and-collect regime from an earlier initiative, and Crowborough following a two cut-and-drop regime), feedback from stakeholders was minimal.

Year 1 plot selection – for spring / summer 2023 season

In year 1 a bespoke grass-cutting round was created selecting larger areas of urban highway grass predominately within the Horsham District area, but also incorporating verges in Hurstpierpoint and Midhurst that were already part of an existing cut-and-collect project - total area cut approximately 20 ha.

Years 2 & 3 plot selection – for spring / summer 2024 & 2025 seasons

To minimise transport time and improve cutting efficiency, the WSCC trial locations were selected as whole Parish areas rather than on an individual verge basis - with selection preference given to those areas closest to council operating bases (Drayton & Rudgwick). With the addition of new equipment, we were able to expand the cut-and-collect operation to allow for an inland area (Horsham), and some coastal areas (Pagham, Bersted & Aldwick) - total area around 50.5 ha. All urban verges were already plotted on the council's asset management system (Confirm), prior to the start of the project.



Define the biomass processing method

1. South Gloucestershire

The Outline Business Case (OBC) submitted in April 2023 stated "SGC plans to co-mingle the grass cuttings with food waste using their current waste contractor who will transfer it to a large-scale anaerobic digestion (AD) plant".

Food waste disposal in South Gloucestershire currently involves weekly kerbside collections from domestic properties via the Council's waste contractor – originally via a 25-year private finance initiative (PFI) contract that started in July 2000 and replaced in August 2025 with a new eight-year contract worth around £120 million, operated by the same contractor, Suez. Domestic food waste is collected from households on a weekly basis and transported to 'Sort It' recycling centres for recycling via anaerobic digestion at the Geneco processing plant in Avonmouth: Home

Discussions with Suez in 2023 cleared the way for using the Yate 'Sort It' recycling centre as the site where all cut grass from the proposed pilot study area in Yate would be taken for co-mingling with food waste and onward disposal at the Geneco plant. Staff from SGC Grounds team were inducted at the site and all relevant driver and vehicle details provided to Suez. Onward disposal of co-mingled food and grass to the Geneco plant was

to be carried out by Suez at no extra cost to the Council – using their regular transport contractors.

It was not possible to dispose of cut grass from the project via the Council's existing food waste disposal contract as intended. This was principally due to:

- the AD plant operators Geneco not having the necessary permit approval from Ofgem to process the co-mingled feedstock
- the plant being taken offline for maintenance due to receipt of a contaminated feedstock load in July 2023.

The efforts made by the project team and Geneco to attempt co-mingling are summarised in **Appendix 2.**

Even with the appropriate permit for co-mingling in place, a mixed feedstock would need to be suitably co-mingled to an appropriate ratio, and in a suitable state to go direct into the digestors without any new pre-treatment, for the permit to not require any change. If the mixed feedstock was not suitably co-mingled in this way, GENeco would need to introduce new equipment at the plant to pre-treat the waste – that would potentially require a further change to the EA permit as it would effectively be a change in operation at the site. The alternative would be for the Council to pre-treat and co-mingle the feedstock in advance of delivery, with similar equipment at a waste transfer facility. Geneco indicated that a suitable ratio would be 80% food to 20% green waste, (maximum).

In 2023 cut grass collected in the Yate pilot area was initially delivered to the Council's existing composting contractor's facility 2.3 miles from the operational depot at Broad Lane in Yate. This arrangement began in August 2023 following two operations of the cut-and-collect process – 21st August to 12th September, followed by 3rd – 31st October - a total of 45.72 tonnes of grass was collected over 12.4 hectares.

This disposal arrangement re-commenced in the 2024 season when 6 further parishes were subject to cut-and-collect from March 2024 – continuing until July 2024. During this period, in April 2024, a decision was made to start delivering grass co-mingled with food to an alternative AD plant following discussions with the plant operators, Geneco. They suggested use of their partner AD plant located near Bridgwater, Somerset - Cannington Bio Energy. The plant is located around 52 miles from the Council's main operational depot in Yate. The plant accepts a co-mingled grass and food waste feedstock because it has secured the necessary regulatory approvals and engineered its process to accommodate varying feedstock types—including grass—while maintaining operational flexibility and readiness. The site had the infrastructure and process controls to effectively integrate multiple organic streams, enabling the economies of scale and feedstock volume stability required to support biomethane production.

A Risk Assessment and Standard Work Procedure for tipping loads was provided to Suez and cut grass was subsequently delivered to the Council-operated Yate Recycling Centre from Wednesday 5th June 2024. This grass was co-mingled at the Yate site with food waste at an approximate ratio of 30% grass to 70% food. The first load taken directly to the Cannington site on 5th June contained no grass (27.06 tonnes). The next load, on 6th June was co-mingled, and weighed 25.94 tonnes. The load on 7th June was also co-mingled and weighed 26.78 tonnes.

The co-mingled load sent on 7th June was rejected by the plant as it contained a high proportion of grass, not adequately mixed with the food. The hammer mills at the plant had been arrested as a result of the load delivered on 6th June and the load delivered on 7th June was taken to landfill instead. Subsequent discussion with the plant operators revealed that the lengthy and fibrous nature of the grass was unsuitable for the food digester, in any quantities, as it would likely block the processing machinery used to strip the non-organics from the food waste - the advice given was that grass could continue to be delivered to the plant but it should be delivered separately into one of the plant's 5 crop digesters instead.

The load rejected at the Cannington AD plant on 7th June 2024 – the ratio of grass to food was too high.

Following rejection of the co-mingled load, grass cuttings were once again diverted to the Council's composting contractor, near Yate. This arrangement continued until 28th June 2024, on which date grass as a single feedstock was delivered directly to the Cannington plant, without prior delivery to Yate Recycling Centre. This arrangement started with the Council initially providing the transport via a diesel powered 6-wheel rigid lorry, with a maximum 16-tonne capacity. This arrangement lasted for 6 trips, after which from 23rd July the Council paid the Cannington plant to send a vehicle to Yate once or twice a week, as required - via diesel-powered, 8-wheel skip lorry with 12-tonne capacity. Grass continued to be disposed of this way for the remainder of the 2024 season, until the final load was taken to Cannington on 22nd October 2024.

Because grass was no longer being co-mingled with food at a Recycling Centre, a storage area was provided at the Council's Broad Lane depot in Yate using 7 x 3m straight edge concrete barriers - installed on Monday 24th June. Following this, concrete blocks were used to create a larger 7m x 7m x 2m storage bunker, that was completed on Wednesday 27th July 2024 – shown below.

Concrete block grass storage bay – South Gloucestershire Council depot, Broad Lane, Yate.

The Greenprint team met again with Geneco in January 2025 to discuss disposal arrangements for the 2025 season. Geneco agreed in principle to arrange to accommodate the receipt and mixing / co-mingling of grass with food at their plant in Avonmouth, as follows:

- five tonne deliveries to be delivered and blended with existing material in the food waste hall
- the co-mingled load to be exported on a bulker to an agreed partner AD plant at a ratio of ~4:1 initially. Geneco to arrange the haulage
- all liabilities to lie with SGC regarding acceptance of material – costs incurred (demurrage, rejection, etc), to be recharged directly
- the proportion of grass to food to slowly increase, at a rate agreed as acceptable by the partner AD plant.

Although Geneco offered to handle the co-mingling process, disposal would have to take place by forward transporting the mixed load to a partner AD plant.

This arrangement never materialised however, as the proposed partner plant, Evercreech AD, operated by Adapt Biogas, informed Geneco that they could not accept loads that were co-mingled due to concerns regarding potential blockages and blinding of the screens –the only option they had was to by-pass the de-packaging process and add direct to the digesters. As it was crucial that there was no contamination contained with any load the risk of this option was considered too high.

The Greenprint team wanted to dispose of the biomass via anaerobic digestion throughout all of 2025, rather than divert back to composting, so a direct arrangement was then agreed between the Greenprint team and Cannington AD plant to continue deliveries of grass as a single feedstock as had taken place from 28th June 2024.

The Council paid the Cannington plant to send a vehicle to Yate once or twice a week, as before – again using diesel-powered 8-wheel skip lorry with 12-tonne capacity, starting from 19th March 2025.

These arrangements continued until 23rd April 2025, when a contaminated delivery of grass caused a blockage at the plant.

Consequently, the operators were unwilling to receive any more deliveries and following discussion with Geneco a new arrangement was established to deliver grass to the Charlton Park Biogas AD plant in Wiltshire – this arrangement continued until the final load of 2025 season was delivered on 7th October 2025. All transport to this plant between the Yate storage depot and the disposal site took place using a biomethane powered lorry operated by Geneco.

2. West Sussex

The majority of grass arisings generated through the trial were sent to a local composting facility. In addition, approximately 3 tonnes of grass were transported to Ricardo's BIOCCUS demonstrator plant in West Sussex to support biochar production trials.

An initial trial involved the processing of approximately 0.5 tonnes of grass, blended with woodchip at an estimated ratio of 10% grass to 90% woodchip on a dry matter basis. While the inclusion of grass resulted in some material handling challenges, the trial was successfully completed and biochar was produced.

Following this initial work, West Sussex County Council (WSCC) commissioned Ricardo to undertake further trials to assess the feasibility of operating the demonstrator plant with a higher proportion of grass within the feedstock mix. The subsequent trials successfully processed a 50:50 grass-to-woodchip blend. However, the higher grass content required significant pre-drying and presented ongoing challenges in terms of material handling and conveyance through the processing equipment.

Further details of the trial methodology, findings, and operational limitations are set out in **Appendix E** to the Thought Leadership Report.

In parallel, a further 40 tonnes of grass cuttings were transported to Invicia Industries' facility in Humberside, where large-scale biochar production trials were undertaken. The grass was blended with locally sourced woody biomass at varying ratios, resulting in the production of approximately 15 tonnes of biochar.

Select the machinery and collection methods

1. South Gloucestershire

Existing Council equipment with the capability to cut-and-collect grass prior to Greenprint included the following:

Equipment type	Make / model	Link	Comments
Ride-on mower	Grillo FD2200 TS	FD 2200TS Stage5 4WD Grillo Spa - Agrigarden Machines (grilloagrigarden.co.uk)	Suitable for lighter rough requiring 4-6 cuts per season
Tractor	Case 125 Maxxum	Maxxum Series | Tractor | Case IH	Smallest tractor in the industry with a six-cylinder engine & 125 to 150hp power output
Tractor	Case 105 Farmall	Discover the Case IH Farmall Series, the versatile front loader	Compact build with tight turning radius

		tractor with year-round capability.	
Trailer	Fleming TR8	8 Ton Tipping Trailer | Fleming Agri Twin Axle Tipping Trailer (fleming-agri.com)	Capacity 8 tonnes / 15 cubic metres of grass
Trailer	Fleming TR6	Drop Side Tipping Trailers Fleming Agri 4T - 6T Single Axle Trailer (fleming-agri.com)	Capacity 6 tonnes / 10 cubic metres of grass


Grillo FD2200 TS ride-on mower in action.

This equipment was used for the entire 2023 cut-and-collect activities in the Yate pilot area. The Council also had several ride-on mowers on the fleet prior to Live Labs, that were not used to collect grass - mainly Ransome 1123cc machines.

Selection and procurement of the cut-and-collect equipment for the Greenprint project was carried out by the Council's Fleet Operations Manager who devised equipment specifications and issued a tender via an existing framework to provide some purchase options in a compliant manner. On receipt of tendered prices, the following equipment was ordered with Live Labs 2 funding for the Greenprint project:

- 3 x Iseki SF5 ride-on mowers – ordered in June 2023 / delivered in December 2023 (£127,050 + VAT) ISEKI Outfront SF5 Mower Range < ISEKI UK & Ireland
- 1 x BigAb B12 hook-lift trailer & 3 x containers - ordered in June 2023 / delivered in December 2023 (£39,000 + VAT) BIGAB B12 Hooklift Trailer - Chippenham Farm Sales

For all items the period between issue of tender, then raising purchase orders and finally delivery was well in excess of six months.

BigAb B12 hook-lift trailer & container

Iseki SF5 ride-on mower

A cut-and-collect team within a parish typically made use of the following equipment:

Cut and collect capital equipment					
Equipment	Purchase Cost / Unit	Quantity	Total Cost (incl VAT)	Useful Life	Cost / Year
Trailer Tandem Axle Hooklift Trailer with 3 Containers	46800	1	£46,800	6	£7,800
Iseki SF5 x 3	50820	3	£152,460	3	£50,820
KubotaFC4-501MOWER - hired not purchased	60000	1	£60,000	3	£20,000
Muthing Flail kit for Iseki SF551 mower	11040	1	£11,040	3	£3,680
Case Maxxum 125 Tractor (WU71 TKA - asset number 43652	74,800	1	£74,800	6	£12,467
Husqvarna 520iRX Brushcutter strimmer	339	2	£678	2	£339
			£345,778		**£95,106**

This contrasts with the traditional cut-and-leave approach, where typically a slightly larger team was used but with lower overall capital equipment costs:

Cut and leave capital equipment					
Equipment	Purchase Cost / Unit	Quantity	Total Cost (incl VAT)	Useful Life	Cost / Year
Ransome HR300	£38,500	1	£38,500	3	£12,833
Ransome HR300	£38,500	1	£38,500	3	£12,833
Ransome HR300	£38,500	1	£38,500	3	£12,833
Ransome HR300	£38,500	1	£38,500	3	£12,833
Kubota F391	£30,925	1	£30,925	3	£10,308
Husqvarna 520iRX Brushcutter strimmer	£339	2	£678	2	£339
Stihl BG86c Handheld blower	£960	4	£3,840	2	£1,920
Husqvarna 525BX Handheld blower	£484	2	£968	2	£484
			£190,411		**£64,383**

A typical day of cut-and-collect involved the following processes:

	Process	**Notes**
1	Tractor driver disposes of full container load of grass from previous day - tips off at main Yate depot (grass storage bay).	
2	The tractor and full / part-full container are stored overnight at the depot nearest to the current cut site	Containers are not left on site overnight in case of fly tipping or vandalism – whether empty or full / part full
3	Tractor driver then drives to cut-and-collect site - with empty container	Tractor driver leaves an empty container at the cut site upon collecting a full container. Normally just 2 containers are rotated
4	Mower drivers arrive separately at the depot nearest to the cut site, to collect mowers	Mowers get delivered to the depots beforehand – combination of beaver tail trailer, or if closer the mowers are driven to the depot(s)
5	Mower drivers drive mowers to cut site to meet tractor driver - travelling in convoy	SGC does not have staff with an appropriate licence or the equipment to transport several mowers to site via trailer on a daily basis during a cut
6	Supervisor briefs the team on the day's plan, including routes, responsibilities, and safety protocols - highlighting potential hazards	
7	Team inspects PPE (Personal Protective Equipment) for all operators	A ladder would be useful to allow the tractor driver access to containers as they fill up, to trample down the grass load
8	Maps of the plots for that day's cut-and-collect are distributed - along with daily worksheets for recording hours / fuel / mileage	Supervisor makes up map books for the team putting them into efficient route order - drivers refer to these every day, carrying them on the mower. They also carry their daily worksheets with them (collected by supervisor on a Monday)
9	Drivers check and prepare the ride-on mowers, tractor, hook lift trailer, (fuel up from	Plan for refuelling to minimise downtime - use fuel-efficient routes and ensure mowers are

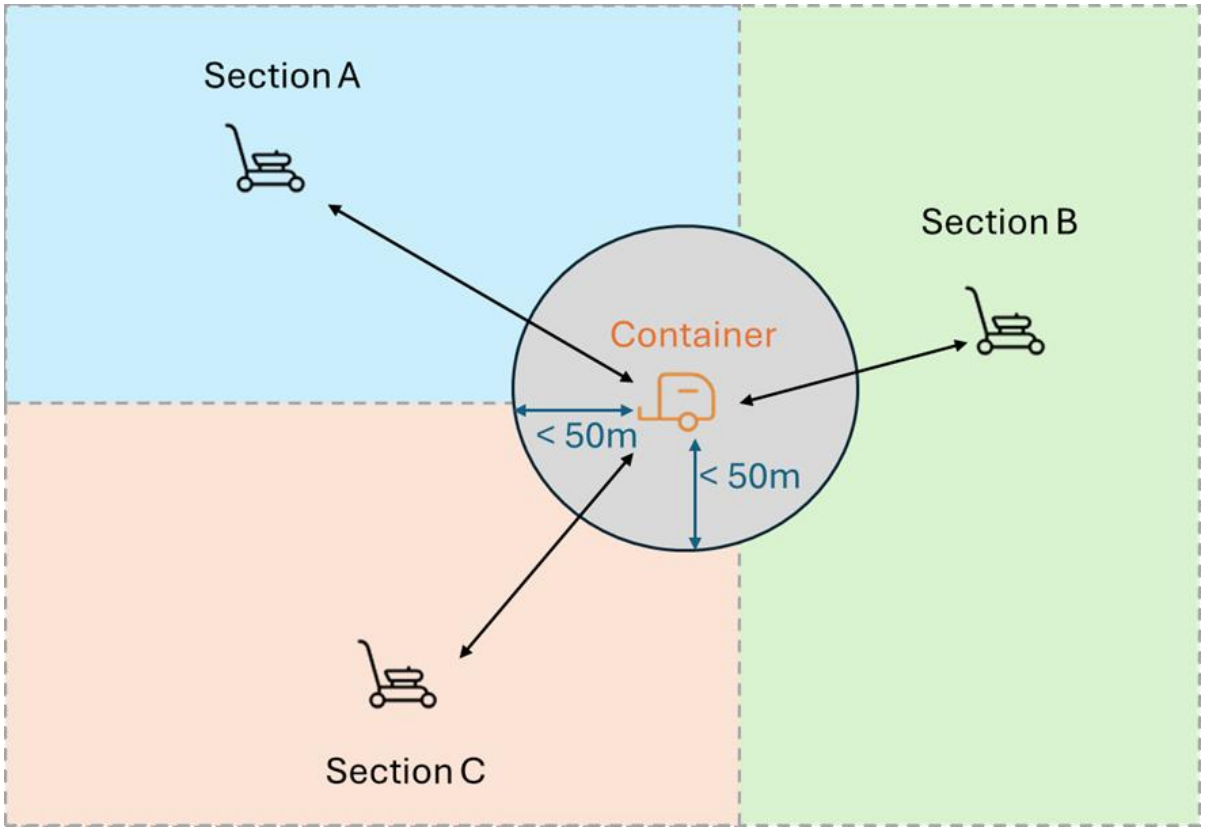
	tanks / pumps, check oil, blades, tyre pressures)	fully refuelled before leaving. Team also regularly greases the mowers.
10	Drivers load and carry any consumable spare parts to site – eg. lubricant	
11	Mower / tractor / van drivers equipped with radios / phones - to coordinate movements and avoid collisions	Currently operatives do not use phones or tablets routinely during the course of a cut
12	Load any necessary tools and supplies onto support vehicles	Grounds use a van dedicated to the project for the strimming team and occasionally use a beavertail van to transport the mowers if required
13	Upon arrival at site, divide the grass area into three equal or optimal sections for each mower, minimising overlap and ensuring no areas are missed. Any visible litter is collected and bagged	Mower drivers have the discretion to arrange this between themselves and agree on which plots each will cut
14	Ensure tractor / container is ready and strategically placed - typically within 50m of the cutting area	Team always aims to have a container within 50m of the cutting area or where is safest to do so – usually needs a sizeable plot to accommodate tractor / container
15	Start mowers at different points to avoid congestion - Mower 1 starts at section A, Mower 2 at section B, and Mower 3 at section C	Mower drivers will each cut smaller plots and the larger plots they will divide into different sections
16	Mow the grass, ensuring even coverage and adjusting speed based on grass thickness and terrain	The greater the blade height, the quicker it will be to cut the plot - although thicker grass or difficult terrain, can mean the time saving might be insignificant
17	Drivers communicate via radios to coordinate and adjust as needed	Drivers communicate by mobile phone when required, typically between cuts and may discuss face to face any issues needing a solution, as required.
18	Monitor mower performance and report any issues immediately - access problems / equipment failures, etc	
19	Mower drivers empty grass collection boxes into container on hook lift trailer - until full	The tractor driver will relocate the container as required during a cut to ensure it is as close to the mowers as possible
20	Complete daily logs and reports detailing the areas mowed, fuel used, any issues encountered, and overall performance	Work sheets are completed during breaks
21	Continuously optimise routes to minimise overlap and missed spots	The team are constantly learning and seeking out improvements whilst noting any new hazards – having consistency in the personnel used is valuable as the team accumulates and retains / shares knowledge
22	Adjust mowing patterns based on real-time observations and feedback	Team reports any issues to the supervisor and jointly discusses them – typically this happens after a whole parish cut has been completed

23	Strimming of hard-to-reach areas carried out	This takes place at some point during the cut – ideally this would be done before the mower drivers arrive to make their task easier
24	Conduct a final sweep of the area to ensure all grass is collected and no spots are missed	A quality control check is carried out by the lead mower driver or supervisor, if present
25	When the areas in easy reach of the container are completed - tractor and mowers drive simultaneously to the next area	The tractor drive or lead mower driver decide where to site the empty container. At the end of a cut, once the strimming and cutting is complete any loose clippings are blown off paths
26	Repeat process until container is full	Minimising having to move the container is key – typically this is necessary no more than 4 times in the process of filling a full load
27	When container is full, tractor driver sets off for Yate depot to store full load overnight	Tractor driver transports full or part-full loads back to the nearest depot at the end of every daily cut – to avoid the risk of fly tipping or vandalism
28	Mower drivers return to depot - either Broad Lane / Hollywood Lane / Brook Road depot	SGC does not have staff with an appropriate licence or the equipment to return several mowers to the depot at once via trailer
29	Drivers clean and maintain all equipment, including mowers and containers	Mowers are regularly cleaned, greased and maintained
30	Perform any necessary minor maintenance (eg. checking belts)	Drivers check bolts and belts – they are not permitted to work on or with the blades
31	Ensure all tools and supplies are accounted for and stored properly	Electric strimmers and blowers are used, with spare batteries – petrol plant very rarely used
32	Provide feedback on the day's operation to supervisors and discuss any areas for improvement	Supervisor keeps a daily issues log
33	Secure all equipment and vehicles in designated storage areas	Mowers in locked compounds / tractor at Broad Lane, Brook Road or Hollywood Lane sub depots
34	Hold a debriefing session to review the day's activities, discuss what went well, and identify areas for improvement	Supervisor calls team most days to discuss any issues – drivers also advise supervisor of any breakdowns and when each parish cut is complete
35	Review the operation to identify any inefficiencies and plan adjustments for the next session	Supervisor reviews any adjustments needed but so far is happy with progress and feels it is becoming more efficient
36	Plan for the next day's operation based on feedback and observations	

A single cutting crew (usually 4 operatives) was dedicated to carrying out all the Greenprint cut-and-collect runs. Using the same team had several advantages, including enabling staff to become familiar with:

- the cut-and-collect equipment and its performance – particularly the Iseki ride-on mowers

- the mapping of the cut-and-collect plots, in areas previously subject to cut-and-leave
- the documents used to record activities – fuel, time, grass volumes (see later section).



Process 15 – 3 x mower drivers cut-and-collect sections around a centrally placed skip container

In addition to the selected cut-and-collect plots in each council, 13 sample sites for biodiversity and soil carbon monitoring were selected by project partner consultants Plantlife International. The rationale and methodology behind the surveys is outlined in the following section.

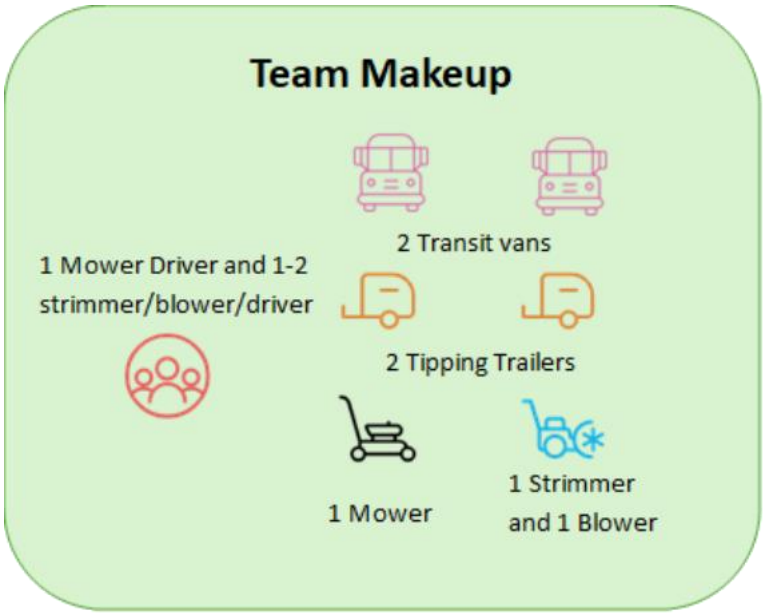
2. West Sussex

The cut-and-collect operating model implemented by specialist grass-cutting contractor, Grasstex, was designed to support the delivery of the trial programme across the designated areas. The model consisted of two independently operating teams, each comprising three trained operatives:

- Mower Operator – responsible for operating the flail-deck ride-on mower

- Strimmer/Blower Operative – undertaking supplementary vegetation management
- Logistics Operative – responsible for transporting collected arisings from site to the designated disposal depot.

This configuration enabled each team to operate autonomously while maintaining an efficient workflow between mowing, trimming, and material collection.



Depot Locations and Area Coverage

To optimise travel times and operational efficiency, the two teams were based at separate depots:

- Grasstex Depot, Rudgwick – providing coverage for the Horsham trial area
- WSCC Depot, Drayton – supporting operations across Pagham, Aldwick and Bersted

This distribution ensured timely response to local conditions and reduced downtime associated with vehicle movements.

Equipment

Standard equipment allocation per team included:

- 1 × Kubota FC4-501 flail-deck ride-on mower
- 2 × Ford Transit flatbed tipper vans
- 2 × 3,500 kg gross-weight cage-sided tipping trailers

- Kress electric strimmer and blower set
- Kress portable charging unit

This equipment mix enabled effective cut-and-collect operations while supporting safe and compliant transportation of collected arisings.

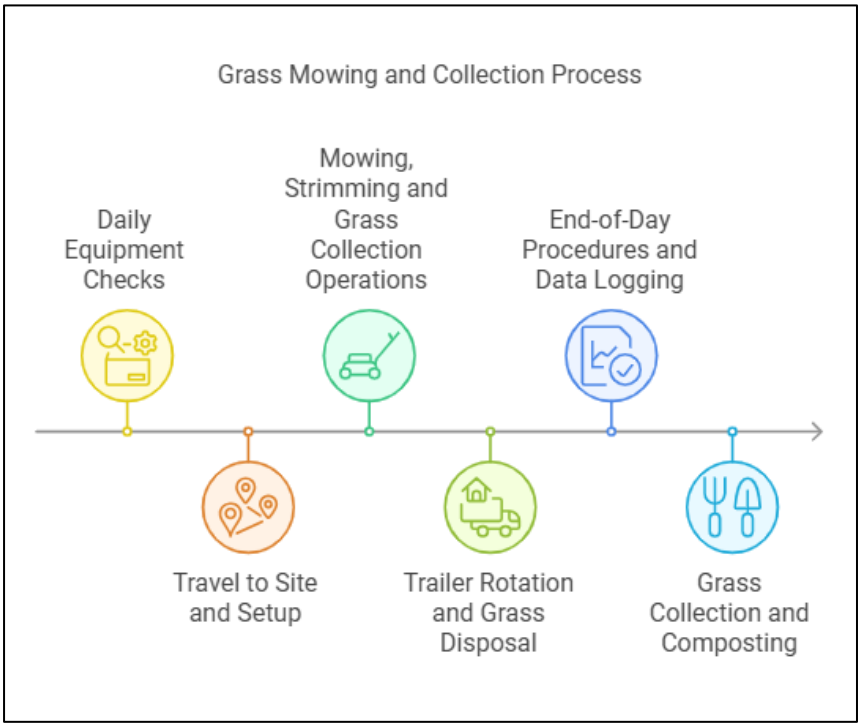
Approximately £285,000 was invested in the procurement of machinery and supporting equipment. The purchased assets included:

- 2 × Kubota FC4-501 Flail Mowers
- 4 × Tipping Trailers
- 4 × Ford Transit Flatbed Vans
- Kress Electric Strimmer & Blower Sets
- Kress Portable Charging Unit

Kubuto FC4-501 Flail Deck Mower

Tipping trailer – used to transport mower to site and transport cuttings back to depot

Grasstex typical operational day



	WSCC process	**Notes**

	3 person team, 2 number transit vans, 2 number trailers, 1 ride-on cut-and- collect mower. Grasstex depot-based crew.	
1	Operatives arrive at Grasstex depot. Undertake daily checks on equipment, including fuelling up mower and small tools.	Mower kept on trailer overnight, checking iPad for works location.
2	Team drive to site (Horsham area), 2 vans, trailer with mower on and empty trailer for grass collection.	Normally a distance of approx. 10 miles but varies slightly on whether cutting North/South Horsham.
3	Team arrives on site, van and empty trailers parked at a safe location as near as possible to the cutting area. Mower unloaded from trailer, Strimmer & Blower unloaded from van.	
4	Mowing operation starts, second operative operates strimmer	iPad checked to ensure correct areas being cut and updated during the day to show completed sites.
5	When mower grass box is full, drives to where the trailer is parked and empties grass, then continues cutting	Van trailer is moved from time to time so that it is parked as near to the cutting operation as possible. There is also transport within the cutting process as the team completes each plot and moves onto the next which involves loading the mower back onto the trailer and driving to the next location.
6	When the trailer is full, this is driven back to the Grasstex depot by 3rd operative, mower will continue mowing and emptying into second trailer	Trailer holds approx. 20 grass boxes of grass.
7	3rd operative returns to site with empty trailer and takes another trailer back to depot when full.	Average turnaround time 1 hour / 20 miles. Average 1 to 2 trips back to depot every day, however sometimes 3 trips depending on crew size and length of grass/number of boxes collected
8	End of day – Mower loaded on to trailer. All vehicles and equipment returned to Grasstex depot.	
9	Team & Vehicles arrive back at depot, any remaining grass tipped onto grass heap, end of day data collected and logged on confirm via iPad.	Any small tools removed from vehicles and locked in store
10	When sufficient grass has been collected at the Grasstex depot a grab truck collects cuttings and takes to composting site	This is carried out by a contractor called Eurogreen. During the cutting period there are usually around 1-2 collections a week, costing a flat fee of £300 each instance.

Emptying mower into trailer

Define the data required and monitoring methods

Data monitoring during Greenprint focussed on several key areas, including:

- Verge management operations – including labour, fuel, biomass yields
- Biodiversity and soil carbon
- Equipment performance
- Rural dual carriageway maintenance and litter contamination
- Laboratory testing of biomass (grass clippings)

Data and interpretation are available in separate Greenprint project reports and documents, but an overarching summary of the monitoring methods for each of the above is given below.

1. Verge management operations

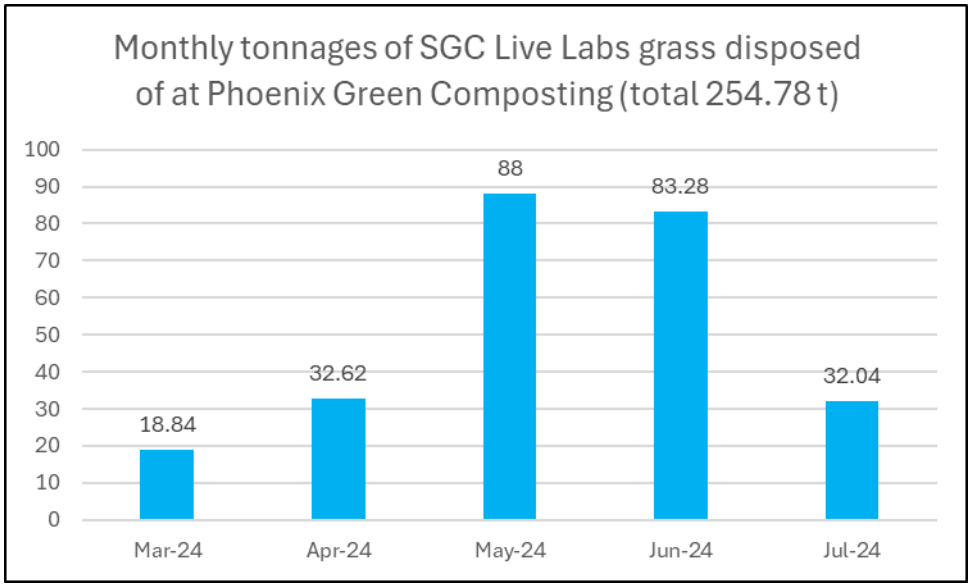
The Greenprint project commissioned the Future Highways Research Group (FHRG) Carbon Analyser Tool to determine the carbon emissions of the traditional cut-and-leave versus the experimental cut-and-collect verge management methods – along with detailed analysis of the biomass outputs too.

The following metrics were recorded:

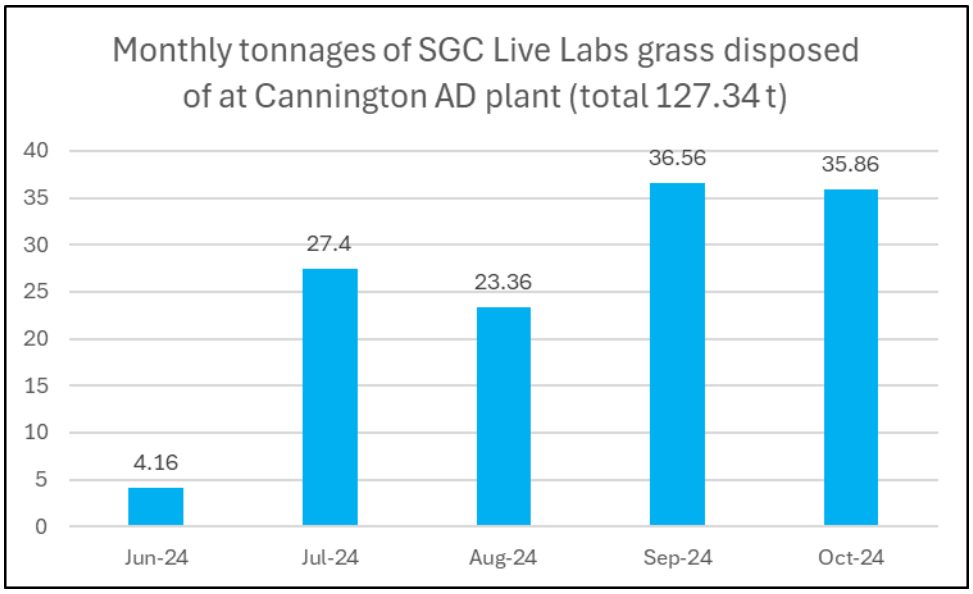
- Equipment used for mowing – mowers, flail collectors
- Equipment used for transporting - vans
- Time taken to cut (hrs)
- Labour cost (£)
- Plant costs (£)
- No. of loads (boxes - empty mower)
- Volume of grass (m3 - as cut)
- Weight of grass (kg)
- Transport cost between site and disposal site (£)
- Cost for disposal (£)
- Mower fuel cost (£)
- Servicing and breakdown costs (£)
- Mower fuel (Litres)
- Strimmer and blower fuel (litres)
- Electric strimmers and blowers (hrs)
- Transportation of mowers to site (miles)

Data was collected on a daily basis and summarised by cut number and parish area. Data was recorded manually using written report logs which were gathered up by the crew supervisor and submitted to the Greenprint project team for input onto a data spreadsheet. In WSCC data was imputed directly into the County Council's asset management system Confirm, on a daily basis by the Grasstex grass-cutting team via an electronic tablet. The cost data gathered in this way is reported on separately and was used to inform the wider project findings.

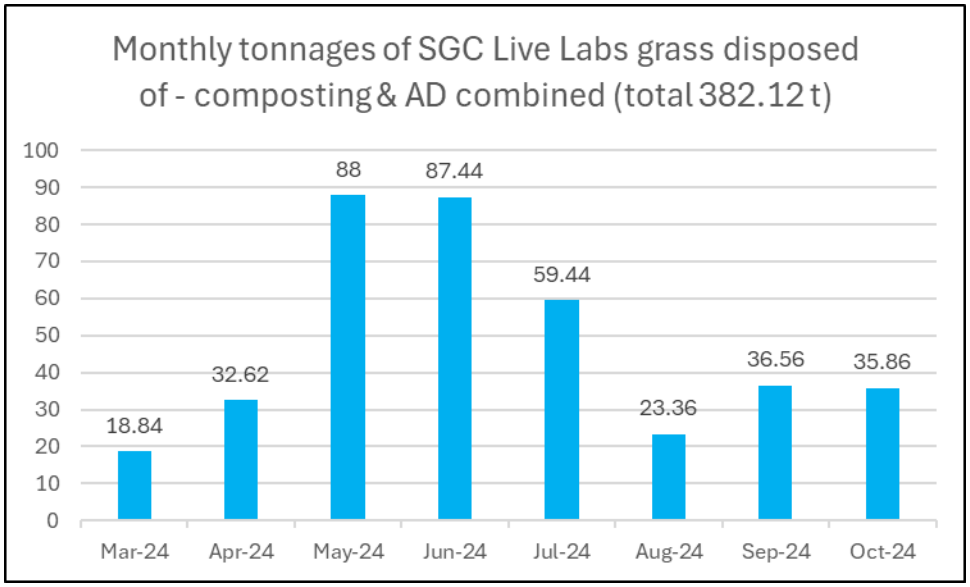
The tonnages of grass collected in South Gloucestershire during 2024 and 2025 is summarised below, by disposal route – composting and AD.
(In 2023, all grass collected in the Yate pilot area was delivered to the Council's existing composting contractor, Phoenix Green Solutions - a total of 45.72 tonnes).



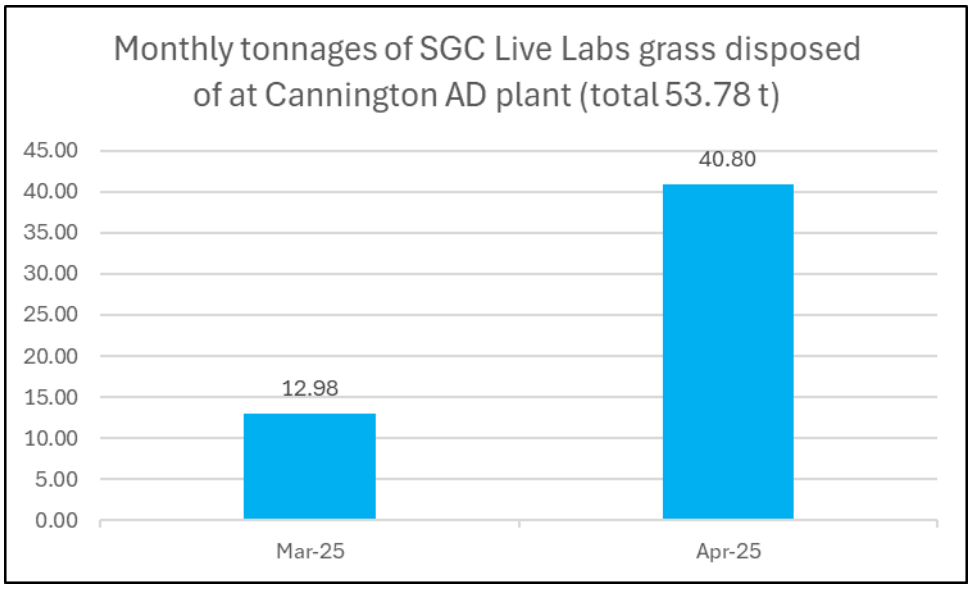
Grass disposed of by composting in 2024



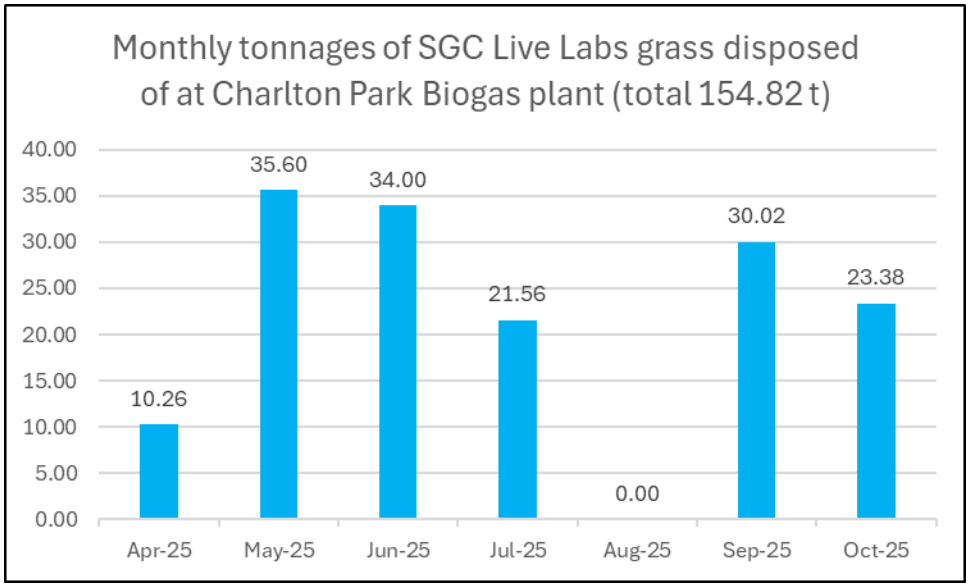
Grass disposed of at Cannington AD plant in 2024



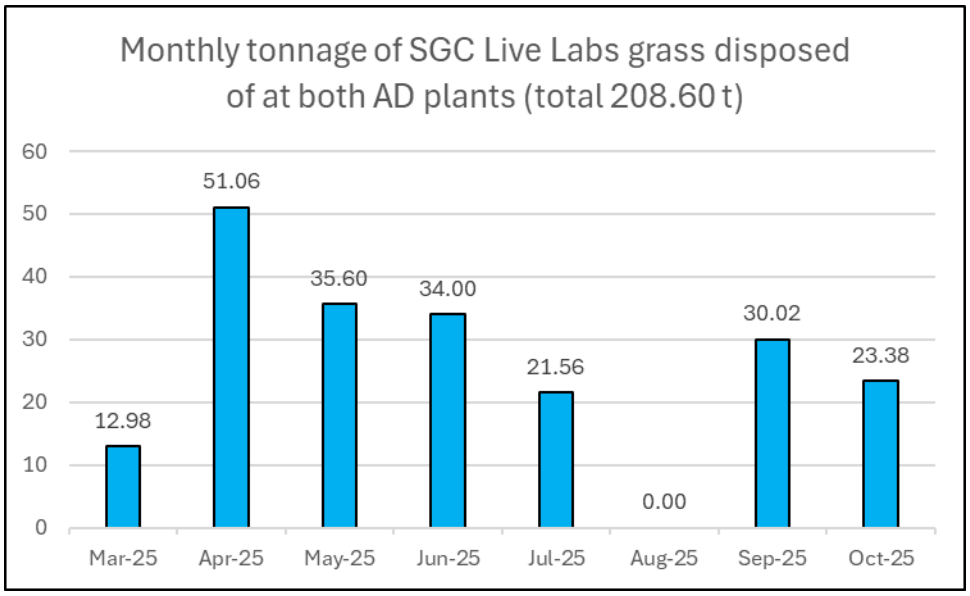
All grass disposed of by composting and AD in 2024



Grass disposed of at Cannington AD plant in 2025



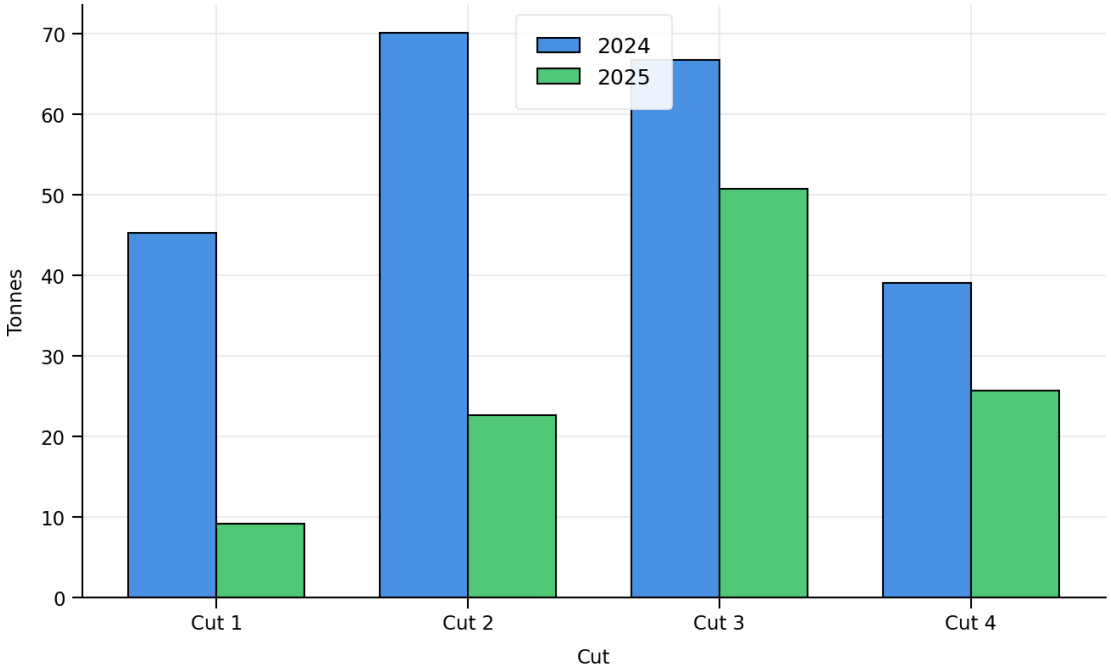
Grass disposed of at Charlton Park Biogas AD plant in 2025



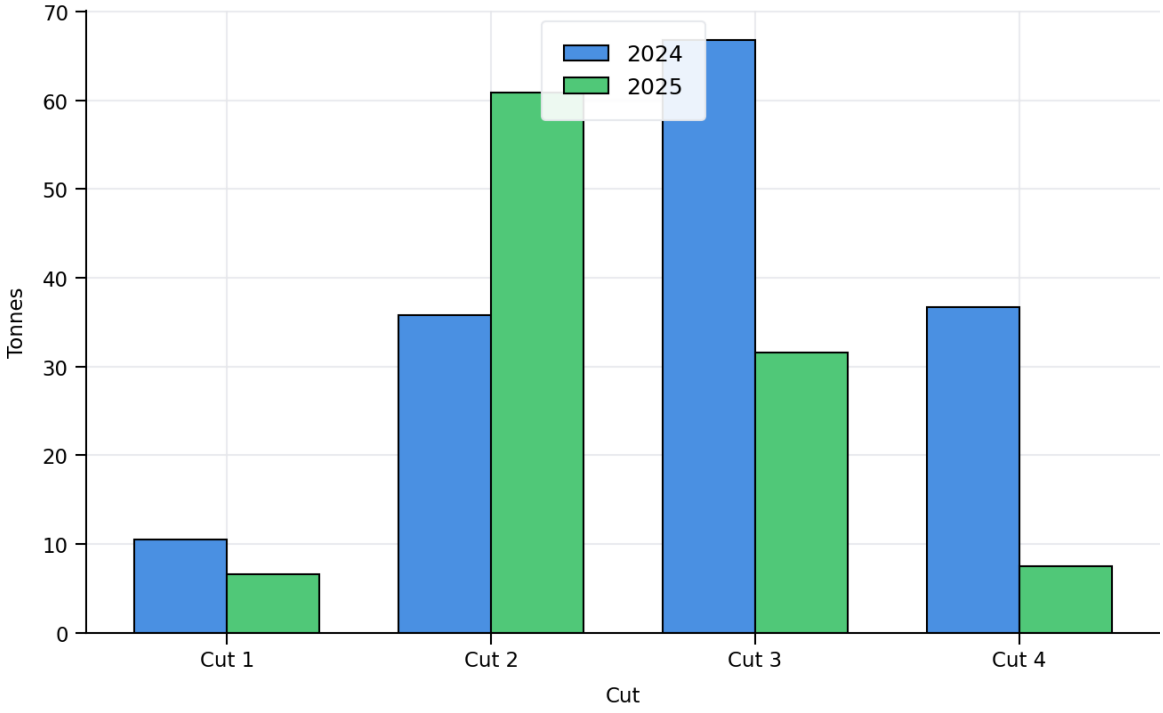
All grass disposed of by composting and AD in 2025

In West Sussex a total of 381 tonnes of cuttings were collected across all the trial areas in 2024 and 251 tonnes in 2025 - examples of how these varied by area and year are shown below. The wide difference in quantities collected between 2024 & 2025 can be explained by the different growing conditions, 2024 being particularly wet and 2025 being drier and warmer than average.

Tonnage of Grass Collected by Cut – Pagham, Bersted & Aldwick – 2024 vs 2025



Tonnage of Grass Collected by Cut – Horsham Area – 2024 vs 2025



2. Biodiversity and Soil Carbon

It has been estimated that approximately 97% of lowland species-rich grassland has been lost across England and Wales since the 1930s. To increase plant species richness, roadsides should be mown less frequently, and cuttings should be collected. Greenprint therefore presented a scalable opportunity to conserve and enhance roadside grassland biodiversity and to meet the biodiversity duties of local highways authorities under the Environment Act 2021.

Project partners Plantlife selected road verge sample sites to survey in South Gloucestershire and West Sussex, to represent a wide range of conditions such as rural / urban location and soil type, based on soil maps. In addition, suitability was also assessed based on width, use, safety, local public acceptance, risk of disturbance and appearance in Google Street View. In South Gloucestershire, selection was also informed by in-person visits in August 2023 which surveyed species richness and fertility as expressed by vegetation. A shortlist was agreed by the local highway authorities in each case for safety and practicality.

In terms of the operational challenge, the cutting crews had to ensure that the sites were cut differently from the general trial area which were instead subject to very specific requirements – the table below provide the schedules for 'no change' and 'cut-and-collect' mowing and accommodate the need to leave a minimum six-week gap before surveys for plant identification purposes. Crews had to ensure this pattern of cutting was followed during the project.

No change sub-sites

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2023	Mow as normal											
2024	Mow as normal				No mow		Mow as normal					
2025	Mow as normal				No mow		Mow as normal					

Cut-and-collect sub-sites

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2023	Mow as normal											
2024	Mow as normal				No mow				1x cut & collect		No mow	
2025	No mow		1x cut & collect	No mow					1x cut & collect		No mow	

Plantlife directed sample site cutting regime for 2025 and 2025 season

The vegetation surveys were undertaken in the first week of June in both 2024 and 2025. Metal survey pins with coloured plastic marker discs were used to mark quadrat corners to enable exact revisits to monitor detailed vegetation change.

The primary data source for biogenic carbon sequestration was yearly soil sampling for Carbon (C) and Nitrogen (N) from 26 Greenprint trial sites across South Gloucestershire Council (13) and West Sussex County Council.

The soil sample from each subsite consists of five core subsamples taken in a randomised pattern across the subsite. For each subsite, one set of five cores made up one sample for 0-30cm depth, and another set of five cores (from deeper in the same holes) made up a sample for 30-60cm depth. These samples were taken in January and February at the same time each year, 2024 and 2025.

3. Equipment Performance

Servicing and repair costs of cutting machinery was monitored from supplier invoicing:

Equipment	Make / model	Date of invoice	Cost (exc VAT)	Details
Cut & collect mower	Iseki SF551	28/06/2024	£496.01	Blade replacement
Cut & collect mower	Iseki SF551	28/06/2024	£496.01	Blade replacement
Cut & collect mower	Kubota	20/11/2024	£323.09	Damage to radiator door
Cut & collect mower	Iseki SF551	15/01/2025	£1,177.66	Service - preseason
Cut & collect mower	Iseki SF551	15/01/2025	£1,444.33	Service - preseason
Cut & collect mower	Iseki SF551	15/01/2025	£1,478.13	Service - preseason
Flail	Iseki Muthing	30/04/2025	£607.42	Mulching plate jammed into the fan / rotor
Cut & collect mower	Iseki SF551	23/05/2025	£901.23	
Cut & collect mower	Iseki SF551	23/05/2025	£401.86	
Cut & collect mower	Iseki SF551	29/07/2025	£890.49	Replacement deck arms
Cut & collect mower	Iseki SF551	29/07/2025	£321.88	New shear pins and repair to bent blade dish
Cut & collect mower	Iseki SF551	25/08/2025	£597.82	Antiscalp wheel & cover, bracket & hose / mowerchute
Cut & collect mower	Iseki SF551	20/10/2025	£1,045.77	Rear hopper damage repaired
		TOTAL	£10,181.70	

A simple handwritten log sheet was used to record down time, faults or performance issues with mowers and other equipment.

The performance of South Gloucestershire Council's Iseki mowers was tested by the conditions experienced - on typically longer grass than usual and terrain that was generally not level or smooth. It was sometimes necessary to go over an area more than once if the grass was especially long, or slightly damp. The mechanical issues listed above were symptomatic of the challenges experienced with the cut-and-collect – most issues or breakdowns occurred because of wear and tear rather than faulty parts or mechanisms.

West Sussex County Council's Kubota mowers proved to be unreliable at times and prone to blockages, particularly when cutting long wet grass. The mowers frequently broke down, and the availability of replacement parts was poor, resulting in the equipment being out of service for long periods of time. At the end of the Year 2 a meeting was held with the manufacturers' representatives to outline the main concerns. Whilst some upgraded parts were provided it became apparent that the mowers were operating at or beyond the limit of their performance capabilities. Over the 2 years of the trials, over 50 mechanical / technical issues with the 2 mowers had been experienced. Equipment issues and down time were recorded by the mower driver directly into Confirm - below is a summary of the issues reported.

Defect Date	Grass Condition	Grass Length	Lost Time Notes
13/11/2025 14:30	DRY	MEDI	Belts snapped had to change
11/11/2025 14:36	DAMP	MEDI	Mower wouldn't start this morning
07/11/2025 14:37	WET	MEDI	Belts gone on mower
06/11/2025 09:33	DAMP	MEDI	Gear box went on mower caught in traffic morning
03/11/2025 14:56	WET	MEDI	Roller fell off bearings gave up
30/10/2025 07:32	WET	LONG	Torrential rain from 11 o'clock
24/10/2025 15:37	WET	LONG	Usual blocking
22/10/2025 14:45	WET	LONG	Too wet leaving more grass on ground than picking up, one word disaster
21/10/2025 19:44	WET	LONG	Blocked mower all day long and shoot on cutting deck broke off due to blocking of the pipe with grass
21/10/2025 19:38	WET	LONG	Every basket clogging mower, far too wet and ground saturated, had to raise cutting height because mower can't cut-and-collect on

			low level when it's wet, it also leaves 20per cent of the cut grass on the ground as it can't pick it up
21/10/2025 09:21	WET	LONG	Torrential rain all day we were making a mess, ground conditions were awful, ground was saturated leaving deep ruts everywhere
17/10/2025 15:39	DRY	LONG	Half hour
16/10/2025 15:48	DAMP	LONG	Half hour
03/10/2025 12:20	WET	MEDI	Constant heavy rain, worked until we were soaked through, we were making a mess so had to clean it up and call it a day
24/09/2025 15:46	WET	LONG	Constantly blocked grass, too wet and long
23/09/2025 17:27	DAMP	LONG	Half hour
22/09/2025 13:54	DAMP	LONG	Half hour
19/09/2025 14:25	DRY	LONG	Half hour
18/09/2025 14:04	WET	LONG	Wheel blow out: accident on A272 road was blocked for 1 hour
17/09/2025 15:13	WET	LONG	Half hour
16/09/2025 12:00	WET	MEDI	Torrential rain all day long mower kept blocking up
15/09/2025 16:36	DAMP	MEDI	Half hour
11/09/2025 16:14	WET	MEDI	Half hour
18/08/2025 15:39	DRY	SHOR	Back door hinges broken off
13/08/2025 15:42	DRY	SHOR	Mower getting fixed on site this morning lost 2 hours
12/08/2025 15:30	DRY	SHOR	Strimmer broke and mower gear select broke
08/08/2025 17:13	DRY	SHOR	Wheel snapped of mower
08/07/2025 15:56	DRY	MEDI	Half hour
04/07/2025 15:49	DRY	MEDI	Usual blocked mower and belt again today
03/07/2025 15:30	DRY	MEDI	Belt gone
02/07/2025 16:01	DAMP	LONG	Belts snapped on mower head that drives the flails
01/07/2025 14:39	DRY	LONG	Usual blocking and wrapping around auger
30/06/2025 16:07	DRY	LONG	Usual
30/06/2025 16:02	DRY	LONG	Same issues day in day out keeps blocking wrapping around auger long wiry grass

25/06/2025 15:30	DRY	LONG	Long wiry grass keeps wrapping around auger and blocking machine
24/06/2025 15:19	DAMP	LONG	Van power lights connection on van failed no lights on trailer
23/06/2025 18:00	DRY	LONG	Intercooler fan stopped working machine kept heating up
20/06/2025 15:58	DRY	LONG	Gear box gone on flail cutting head
19/06/2025 15:28	DRY	LONG	Trailor lights stopped working
19/06/2025 06:46	DRY	LONG	Belts keep slipping off very long thick wiry grass!! Mower keeps blocking up every 2 mins absolute disaster
17/06/2025 17:30	DRY	LONG	Half hour
06/06/2025 15:37	WET	LONG	Wash out of a day mower. Blocking with very long grass every 5 minutes pure headache
05/06/2025 15:43	WET	LONG	Blower belts snapped
03/06/2025 15:34	DAMP	LONG	Half hour
29/05/2025 16:52	DAMP	LONG	Hit manhole and mower kept blocking as grass so long and damp
19/05/2025 17:14	DRY	LONG	Trailor tipping issues at yard
01/05/2025 14:52	DRY	LONG	Change belts
30/04/2025 16:35	DRY	LONG	Half hour
25/04/2025 16:24	DRY	LONG	Half hour
24/04/2025 12:35	DAMP	MEDI	Belts snapped 1 hr - had to pick van up from Horsham
15/04/2025 17:07	DAMP	SHOR	1 hour change mower belts
01/04/2025 07:04	DRY	SHOR	Breakdown travel to gaskin to pick up another mower
24/03/2025 15:05	DAMP	MEDI	1
21/03/2025 09:09	DRY	SHOR	One hour wheel snapped off
04/12/2024 08:09	DAMP	MEDI	Half hour
19/11/2024 15:21	WET	MEDI	Slow tyre puncture
15/11/2024 15:01	DRY	MEDI	Half hour too many leaves on grass more leaves being collected than grass slows mower up as keeps blocking up
12/11/2024 15:17	DAMP	MEDI	Half hour
11/11/2024 15:06	DAMP	MEDI	Half hour
08/11/2024 15:23	DRY	MEDI	Tyre issues
31/10/2024 15:35	DAMP	MEDI	Half hour
30/10/2024 15:50	DAMP	MEDI	Blade change
25/10/2024 08:56	DAMP	MEDI	Half hour
21/10/2024 17:32	WET	LONG	Half hour

11/10/2024 15:20	DAMP	LONG	Broken lift arms blocked mower
08/10/2024 16:39	DAMP	LONG	Lift arms snapped
07/10/2024 16:30	DAMP	LONG	Half hour
02/10/2024 17:00	DAMP	MEDI	Wheel fell off mower 1 hour lost
01/10/2024 12:36	DAMP	MEDI	Half hour
30/09/2024 16:32	WET	MEDI	Half hour
27/09/2024 17:51	WET	MEDI	Half hour
25/09/2024 16:17	WET	MEDI	Half hour
24/09/2024 16:18	DAMP	MEDI	Half hour
23/09/2024 16:49	WET	MEDI	Half hour
08/08/2024 12:41	DRY	LONG	Half hour
06/08/2024 16:24	DAMP	LONG	Half hour
05/08/2024 16:14	DRY	LONG	Half hour
02/08/2024 15:44	DRY	LONG	Half hour
01/08/2024 16:13	DRY	LONG	Half hour
31/07/2024 16:18	DRY	LONG	Belts shredded had to replace
30/07/2024 14:11	DRY	MEDI	Broken mower hinges
26/07/2024 17:23	WET	MEDI	DECK ARM SNAPPED, EST DOWNTIME 6weeks
24/07/2024 16:47	DRY	LONG	Half hour
24/07/2024 16:43	DRY	LONG	6 hours arm snapped on mower
22/07/2024 16:34	DAMP	LONG	Half hr
19/07/2024 16:18	DRY	LONG	Half hour
18/07/2024 20:54	DAMP	LONG	1.5hr over 2 mowers
17/07/2024 17:04	DAMP	LONG	Half hour
16/07/2024 11:18	DAMP	MEDI	1hr
15/07/2024 17:00	DAMP	LONG	Half hour
01/07/2024 16:01	DRY	LONG	Half hour
19/06/2024 16:36	DRY	LONG	Mower broke arm on lift
18/06/2024 16:49	DRY	LONG	Half hour
18/06/2024 07:40	DRY	LONG	Half hour
07/06/2024 14:04	DRY	LONG	Belts kept slipping off couldn't tighten
07/06/2024 07:26	DRY	LONG	3 hours
06/06/2024 16:59	DAMP	MEDI	4 blocks
05/06/2024 15:02	DRY	LONG	Drive shaft stolen whilst machine being repaired
04/06/2024 17:03	WET	LONG	BELTS AND BLOCKAGES
04/06/2024 16:18	DRY	LONG	Half hour
04/06/2024 11:14	DRY	LONG	Wheels falling off mower blockage
03/06/2024 07:01	WET	LONG	1
03/06/2024 06:58	WET	MEDI	1.2hr
30/05/2024 16:45	WET	LONG	1 hour
29/05/2024 16:23	DRY	LONG	1
29/05/2024 07:05	WET	MEDI	1 hr

28/05/2024 16:22	WET	LONG	1 hr wet grass nightmare for blockages
28/05/2024 06:50	DAMP	LONG	2 hours unblocking
22/05/2024 16:14	DRY	LONG	Half hour
21/05/2024 16:44	DRY	LONG	15 mins
21/05/2024 12:21	WET	LONG	Blocked mower finished early due to rain
21/05/2024 06:57	DRY	LONG	Blocked 18 times due to grass length
20/05/2024 07:01	DAMP	LONG	8 blocks
17/05/2024 14:53	DAMP	LONG	2 hours
15/05/2024 16:59	WET	LONG	Changed worn belts and auger stop mechanism needed work. 8 blockages
14/05/2024 16:38	DAMP	LONG	Colleague van broke down and mower wheel change
13/05/2024 17:05	DRY	LONG	Jocky wheel came off
10/05/2024 15:59	DAMP	LONG	Blocked five times
09/05/2024 16:58	DAMP	LONG	Stuck mower
08/05/2024 16:55	WET	LONG	Blocked one time
07/05/2024 16:59	WET	LONG	Blocked eight times
07/05/2024 11:41	DAMP	LONG	Half hour
03/05/2024 16:53	DAMP	LONG	2.5 hours
02/05/2024 16:39	DAMP	LONG	Half hour
02/05/2024 16:20	WET	LONG	2.5 hours
01/05/2024 16:28	DAMP	LONG	Engine issue & vehicle accident
01/05/2024 16:18	WET	LONG	Half hour
30/04/2024 17:10	DAMP	LONG	Gaskin yard
29/04/2024 16:53	WET	LONG	Blocked
24/04/2024 16:56	DAMP	LONG	Caught wall with mower
22/04/2024 16:46	DAMP	LONG	Jockey wheel rubber came off
19/04/2024 16:34	WET	LONG	Plus 4 blockages
17/04/2024 16:45	DAMP	MEDI	3 hours, jockey wheel issue
11/04/2024 16:55	WET	LONG	Blocked mower

4. Rural dual carriageway maintenance and litter contamination

A trial took place in August 2025 in South Gloucestershire to see how collecting grass from the rural dual carriageway network could be integrated into the regular, annual maintenance programme already scheduled by the Council's Cleansing Team on the A1474 Avon Ring Road dual carriageway. The method statement for the annual cleansing operation can be seen in **Appendix 3**.

The trial demonstrated that using the Council's existing Major MJ2000 flail collector on an existing Case 115 tractor could be integrated into the devised maintenance programme

– all the cuttings were sent for analysis by a specialist company tasked with analysing the litter content. Three sites were selected – two of which were alongside the A1474 Avon Ring Road dual carriageway – the third site was a wide rural verge alongside a B-road.

Major MJ2000 flail collector – used by SGC on the dual carriageway / B-road cut-and-collect trial

The practical requirements for the trial were as follows:

- Tractor & driver to collect grass
- BigAb hook-lift trailer plus 1 x skip
- Existing flail collector (either Amazone Smartcut / Major 2000 / Trilo S4)
- Litter pickers from Grounds Team (for Site 2 only – as not on Ring Road programme)
- Van with cage (provided by Grounds) to transport litter from trial
- Grab lorry (provided via Waste team / Suez) – for litter / grass disposal
- Information sheets to record trial data

Trial activities ran in the following order (Traffic Management was set up from 09:30am, with work starting around 10:00am each day):

1) Tractor & trailer deposits 1 x empty skip in a suitable spot for loading with grass.

2) Trailer detached from tractor and chosen flail collector attached (Major MJ2000).
3) Litter pre-pick takes place over trial area – record time, number of staff.
4) Bags of picked litter then labelled as pre-pick litter, with site number.
5) Pre-pick litter then placed in rear cage of van.
6) Number of pre-picked bags recorded & written down.
7) Cut-and-collect carried out with tractor pulling flail collector – record time taken.
8) Flail tipped into empty skip during cut - until skip filled.
9) Flail detached from tractor & placed in safe area on verge.
10) Tractor attached to skip filled with grass - tractor then transports grass to Carsons Road Recycling Centre for weighing.
11) Tractor then tips grass at sampling site in Victoria Road, St Philips, Bristol – weighbridge ticket handed to sampling team from Integrated Skills Ltd.
12) Strimmer team cuts grass over trial area – record time, number of staff.
13) Litter post-pick takes place on trial area – record time, number of staff.
14) Bags of picked litter then labelled as post-pick litter, with site number.
15) Post-pick litter then placed in rear cage of van.
16) Number of post-picked bags recorded & written down.
17) Van with cage, transports all litter to Carsons Road Recycling Centre for weighing – without tipping off.
18) Van with all litter then continues on to tip off at sampling site in Victoria Road, St Philips – weighbridge ticket handed to sampling team from Integrated Skills Ltd and pre-picked / post picked letter separated out for analysis.

Site 1 – (A4174) before cutting

Site 1 – after cut & collect

Site 2 – (B4058) before cutting

Site 2 – after cut & collect

The litter analysis showed that, whilst labour intensive, the Council's cleansing team were effective in removing the litter contamination via a pre- and post-cutting pick, carried out by hand. The volume of grass collected was modest, despite the A4174 sites only being subject to a single annual cut.

Within the grass cuttings sample (cut following the pre-cut litter pick) there was a negligible amount of contamination, representing 0.1% by weight. If no pre-cut litter picking had taken place (and the pre-cut litter is considered contamination), this contamination would be 5.8%.
The analysis report prepared after the trial is shown in full in **Appendix 4**.

Appendix 5 shows analysis of a survey commissioned by Greenprint and completed by Keep Britain Tidy in February and March 2025, covering a sample of the wider project plots cut with ride-on mowers in the seven parishes in South Gloucestershire.

5. Laboratory testing of biomass (grass clippings)

Laboratory testing of biomass was required during the project for several reasons.

Criteria for the acceptance of feedstock materials into permitted treatment facilities, such as anaerobic digestion and composting sites, must be set before the Environment Agency deems them acceptable to be treated. Road verge cuttings in the UK are currently certified as a waste product due to the potential chemical and physical contaminants that could be found in them - of particular concern is the lack of knowledge of potential microplastic contamination from tyre and brake pad wear. The Environment Agency (EA) are the governing body in the UK who can change waste status and issue permits for waste. The EA have provided guidance on suitable European Waste Code(s) (EWC) to be applied to collected roadside verge materials.

Verge cuttings are a waste under Environmental Permitting (England and Wales) Regulations 2016 SI2016/115432. The material is designated as a municipal waste and described as EWC 20 02 01 Biodegradable waste from Parks and Gardens - during the Greenprint project all cut grass disposed of via composting or AD was done so using this code:

- EWC 20 02 01 for verge cuttings (i.e. plant matter only) from the A road, free of litter or other material.

All the biomass was subject to a litter pick prior to collection or was already free of litter upon cutting.

Other codes, not used in the project, but relevant include the following:

- EWC 20 03 01 for separately collected litter from the verge; and
- EWC 20 03 01 if all the waste on the verge is collected up together (i.e. a mixture of the verge cuttings and litter).

During the Greenprint project several sets of laboratory tests were carried out at UKAS accredited laboratories to characterise the roadside grass verge material. These tests were required at various stages to generate data for project partners and AD plant operators to determine the content and characteristics of the cuttings, including:

- Routine waste characterisation
- Biomethane Potential (BMP) Test - this gives information on the volume of biogas produced over time under conditions simulating the process in an AD reactor vessel
- Persistent Organic Pollutants (POPs)

Collection of the clippings to provide suitable material for laboratory testing was carried out as directed by the laboratories.

The process was typically as follows:

- Using a clean bucket push a gloved hand around 6 inches into the collected biomass and remove a single handful of grass.
- Place the sample into the bucket.
- (Note the presence of obvious soil contamination – physical contaminants; especially plastics, metals, glass & stones but do not remove).
- Collect additional samples at random – place into the bucket, until full.

- Pack into the grass into zip fastened freezer bags.
- Compress the grass as much as possible to maximise the overall weight of the sample give 1.5 – 2.0kg, but not less than 1.0kg divided between two bags.
- Place in fridge overnight if required.
- Clearly label the bags with the labels provided by the lab.

The courier then collects the samples within 24 hours.
Test results are recorded separately and can be shared upon request

Review and Quality Assurance

Establishing a project governance structure ensured regular meetings and feedback loops were established that allowed for progress monitoring to take place. For example, the Communications strategy created opportunities for regular stakeholder feedback via a project webpage, quarterly newsletter and email address for both local authorities. Regular work package or multiple work package meetings took place on at least a weekly basis and in relation to the verge management operations, systems were established to review progress throughout the cutting season.

The following headings summarise the main considerations kept under review within the verge management activities of the project. Addressing these items worked towards continuous improvement, identified lessons learned and encouraged best practice during the trials:

1. Scope & Methodology

- Objectives clearly defined and aligned with Greenprint outcomes (set out in the OBC)
- Trial methods documented for both cut-and-collect and cut-and-drop
- Roles, responsibilities, and dependencies confirmed

2. Site Selection & Baseline Conditions

- Trial sites documented, mapped, and approved – lead by stakeholder engagement
- Baseline ecological surveys programmed / completed – lead by Plantlife
- Soil type, verge width, traffic / safety environment recorded – informed plot selection
- Any site constraints (visibility, access, utilities) logged – local authority Grounds teams

3. Operational Readiness

- Machinery suitable and properly maintained
- Operator briefings completed
- RAMS reviewed and signed off
- Seasonal timing and weather constraints considered – very variable

4. Health, Safety & Environmental Compliance

- Safety controls implemented (traffic management, PPE, machinery safety)
- Environmental checks complete (nesting birds, protected species, pollution risks)
- Compliance with local verge-management policies confirmed

5. Data Collection Quality Assurance

- Data-collection methods standardised across all sites
- Monitoring intervals scheduled and consistent
- Grass height, biomass tonnage, and fuel-use measurements checked
- Processing facility type, location, outputs – AD, pyrolysis (biochar)

6. Carbon & Environmental Impact Data

- Fuel use recorded accurately – HVO and diesel
- Transport movements logged
- Biomass disposal / composting routes documented
- Carbon-accounting methodology applied consistently – FHRG pro-formas

7. Cost & Resource Tracking

- Labour time recorded per operation
- Equipment hours, maintenance, and hire costs captured
- Biomass disposal or reuse costs documented
- Business-as-usual data collected for comparison

8. Monitoring & Survey Consistency

- Vegetation surveys carried out at agreed intervals – lead by Plantlife
- Quadrat / transect methods applied consistently
- Soil carbon surveys carried out at agreed intervals – lead by Plantlife

9. Comparative Analysis QA

- Calculation methods peer-checked – to ensure consistency
- Statistical methods appropriate and documented

10. Stakeholder Feedback

- Maintenance crews consulted and feedback logged
- Ecology and environmental specialists consulted - Plantlife
- Public perception/issues recorded if applicable – project email address on websites

11. Risk Review & Issue Management

- Risks documented and updated
- Issues log reviewed and actions tracked
- Mitigation plans in place for operational challenges – Change Control process (ADEPT)

12. Documentation & Version Control

- All files stored in correct project structure - project SharePoint site
- Versions controlled and dated
- Record of changes maintained
- Evidence (photos, logs, raw data) archived properly

13. External Review / Peer Review

- Ecologist review completed - Plantlife
- Carbon specialist review completed – UWE, FHRG
- Highways / asset-management technical review completed

14. Lessons Learned & Improvement

- Successes and challenges captured - Year 1, 2, 3 Annual Reports
- Recommendations for future management identified
- Input prepared for Greenprint guidance and toolkit

These considerations defined the verge management project tasks needed to extract the information required to report on the findings of the cut-and-collect trials and how this method compared with the traditional cut-and-leave approach (Business as Usual).

Appendices

- Appendix 1 – South Gloucestershire Council Greenprint Briefing Note – February 2023
- Appendix 2 – Ofgem approval process challenges, (Geneco AD plant)
- Appendix 3 – Method Statement High Speed Roads (July 2022)
- Appendix 4 – Roadside Litter Waste Composition Report 2025
- Appendix 5 – South Gloucestershire Litter Counts 2025