Developing the business case for a programme of waste composition analysis in Scotland

November 2020

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Note: This document was finalised in March 2020 prior to Covid-19. At the time of publishing this document in November 2020 the timings of the programme have been delayed by approximately six months.

Zero Waste Scotland exists to lead Scotland to use products and resources responsibly, focusing on where we can have the greatest impact on climate change. Using evidence and insight, our goal is to inform policy, and motivate individuals and businesses to embrace the environmental, economic, and social benefits of a circular economy.

We are a not-for-profit environmental organisation, funded by the Scottish Government and European Regional Development Fund.

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Executive Summary

During 2019-20 Zero Waste Scotland developed a business case for a new programme of waste composition analysis research in Scotland, with input from the Waste Data Strategy Delivery Board. This document sets out the outline business case (OBC) for the proposed programme, using the five-case approach.

Waste composition analysis helps us to evaluate the impacts of future policies, establish targets and monitor progress, assess recycling performance and provide evidence for further intervention, and describe the nature, availability and flow of materials in Scotland's waste streams.

A strategic outline case (SOC) was completed in September 2019. The SOC identified key evidence needs and developed five strategic outcomes for the programme. In total nine high-level options were evaluated against the five strategic outcomes. The SOC evaluation concluded the following study options should be taken forward for further development and evaluation in this outline business case:

- A waste composition study of household waste
- A waste composition study of commercial and industrial waste
- A waste composition study of construction and demolition waste
- A waste composition study of waste destined for landfill

To develop a set of provisional options in the OBC, we reviewed evidence from a previous feasibility study, recent studies in the rest of the UK, existing datasets and Zero Waste Scotland's knowledge and expertise from delivering previous household and commercial studies. Provisional options were then discussed with the Waste Data Strategy Delivery Board and refined into a final options design.

Final options were built around variations in programme scope (household, commercial and landfilled wastes) and study timing (which impacts on resourcing requirements). In total six options were assessed against the socio-economic, financial, commercial and management case. Each option was evaluated for its strengths and weaknesses against the five strategic outcomes. The use of the five-case approach has clearly highlighted the complex trade-off's between programme benefits (evidence scope, quality and timeliness) and programme costs (resource requirements, timing, risks of poor delivery).

Following the qualitative evaluation described in Section Four and the requirements identified in Sections Five to Seven, we believe Option 1 (a household and commercial waste study over 2020-23) should be progressed as the preferred option. Other options either fail to deliver identified evidence needs, include study options where their cost-effectiveness is in doubt, or introduce significant resourcing risks that would threaten successful delivery.

Note: This document was finalised in March 2020 prior to Covid-19. At the time of publishing this document in November 2020 the timings of the programme have been delayed by approximately six months.

Section 1: Background and strategic context

This document sets out the outline business case (OBC) for a new programme of waste composition research in Scotland between 2020 and 2024, including funding for individual studies and programme management support. It has been developed by Zero Waste Scotland with input from the Waste Data Strategy Delivery Board.

This OBC follows on from the strategic outline case (SOC), completed in September 2019. The SOC developed a set of strategic outcomes for the programme:

- **Strategic outcome 1** - We deliver studies that are cost effective for SG funds
- **Strategic outcome 2** - We deliver studies that provide timely evidence of Scotland's Waste
- **Strategic outcome 3** - We deliver studies that provide reliable evidence of Scotland's Waste that meets the needs of stakeholders
- **Strategic outcome 4** - We can monitor and evaluate progress towards Scotland's targets and policies
- **Strategic outcome 5** - We have detailed information on the composition of Scotland's waste streams to inform future policies

The SOC identified key evidence needs[1] that waste composition analysis is required to fulfil. Evidence needs were then used to evaluate nine high-level options against the five strategic outcomes for the programme. The SOC evaluation concluded the following study options should be taken forward for further development and evaluation in the outline business case:

- Zero Waste Scotland delivers a waste composition study of the household waste stream.
- Zero Waste Scotland delivers a waste composition study of commercial and industrial waste.
- Zero Waste Scotland delivers a waste composition study of construction and demolition waste.
- Zero Waste Scotland delivers a waste composition study of waste destined for landfill.

Therefore, the objective of the outline business case was to take the shortlisted study requirements from the SOC and develop them into a more detailed set of programme options.

Strategic context

The Scottish Government have previously set several waste-related targets for 2025 with the aim of increasing recycling, preventing waste from occurring and diverting waste from landfill. Key targets are summarised below:

- 70% of Scotland’s waste to be recycled, composted or prepared for reuse by 2025.

[1] Household wastes, commercial wastes, landfilled wastes and construction and demolition wastes

- Reduce Scotland's food waste by 33% in 2025, based on 2013 baseline
- A ban on biodegradable municipal waste going to landfill from the 1 January 2025.
- Reduce all waste generated in Scotland by 15% in 2025, based on 2011 baseline.
- Maximum of 5% of all waste sent to landfill by 2025

To support the targets above:

- The Waste (Scotland) regulations established requirements for local authorities to provide recycling services, and for businesses to separate their waste.
- In November 2015, the Scottish Government and CoSLA agreed a Household Recycling Charter that aimed to improve household recycling and waste services.
- The Scottish Government's food waste reduction action plan was developed to support the 33% reduction target.
- The Scottish Government is currently developing a deposit return scheme for drinks containers.
- Over the next few years it is likely that extended producer responsibility (EPR) schemes will also be developed for Scotland.

Waste composition analysis is fundamental to our ability to:

- *Evaluate the impacts of future policies* - for example, the impacts of extended producer responsibility in Scotland.
- *Establishing targets, monitoring progress and annual reporting* - for example, monitoring of the food waste reduction target, food waste reporting to the EU, and modelling landfill emissions.
- *Improving recycling performance and supporting further intervention* – for example, characterising what is thrown away and recycled by households and businesses.
- *Defining the nature, availability and flow of materials in Scotland's waste streams* – for example, evidence on "problem" materials, the availability of recyclable materials, supporting efforts to assess the flow of materials in Scotland's economy, calorific value and associated carbon emissions.

Document structure

- Section 2 updates the strategic case for the programme, including key evidence requirements and how they have shaped the design of programme options.
- Section 3 details the programme options evaluated in the OBC, including a description of provisional options developed, their refinement into a final set of options for evaluation and a detailed description of each final option.
- Section 4 describes a qualitative evaluation of the socio-economic case for each programme option (including option 0 "do nothing"), using the five strategic outcomes established for the programme.
- Section 5 details the financial case and associated risks

- Section 6 details the commercial case, focusing on the procurement requirements to deliver individual studies and associated risks
- Section 7 describes the management case, identifying the resources required to deliver the programme and associated risks
- Appendix A describes other potential sources of waste composition data that have been reviewed as part of developing the outline business case

Section 2: Updating the Strategic Case

This section builds on the strategic outline case, by providing an updated assessment of key evidence requirements and how they have shaped the design of the proposed programme options. The sections on EPR and DRS also consider any future contribution from producers.

To support an assessment of evidence needs, Appendix A also provides a review of a recent UK household waste composition study commissioned by WRAP. This work is the basis of current Scottish household packaging waste estimates (Defra's EPR work) and Scottish household food waste estimates for 2017 and 2018. Appendix A also reviews the SEPA material recovery facility recycling dataset, to establish whether the dataset might be used to fulfil evidence requirements.

Evidence requirements for food waste

The European Union has developed a standardised approach to measuring food waste produced by member states. Alignment of Scotland to those requirements would require composition analysis of mixed waste streams from:

- Household waste
- EWC code 20 03 01 arising from selected[2] commercial sources

The first measurement period is 2020 with reporting anticipated no more than 18 months afterwards. Alignment would require new composition analysis of household waste to start in 2020. Producing an updated household food waste estimate during 2020-21 would also support monitoring progress against the 33% food waste reduction target.

The requirement to estimate the food waste in EWC code 20 03 01 from *selected commercial sources* will be more challenging, regardless of timing. The pilot work described in the national commercial waste composition study described later will explore this requirement further and will be supported by Zero Waste Scotland's ongoing work with SEPA on food waste estimates.

Evidence requirements for packaging waste

Defra are developing an extended producer responsibility (EPR) scheme for packaging waste. Waste composition analysis will have a prominent role in:

- the impact assessment and any further policy analysis prior to implementation
- full net cost recovery calculations which determine the fees paid by producers and income received from Local Authorities for delivering their services
- directed spend on the mandated consumer awareness activities that producers pay for

Defra's second stage consultation will be conducted in Autumn 2020. Packaging tonnage estimates for Scottish household waste will be based on a UK study delivered by WRAP. Zero Waste Scotland has reviewed that work and we have some concerns

[2] Restaurants and food services and Retail and other distribution.

with how Scottish household composition estimates for packaging have been produced (see Appendix A).

Defra's final scheme impact assessment is scheduled for 2021. If Scotland wishes to improve the Scottish packaging waste estimates used in Defra's current analysis, this would require completing a first interim phase of a new household study by late 2020. This is a challenging timescale that requires mobilisation from March 2020.

The requirements placed on producers to cover the costs of monitoring and reporting are unclear at the time of writing. For this business case, we have assumed there will be no alternative funding stream available for household waste composition until 2023 at the very earliest.

Evidence requirements for other EPR schemes

The business case has also considered the requirement for evidence on the other materials that could be managed under future EPR schemes. These include mattresses, furniture, carpets and textiles. A significant quantity of these materials is likely to be found in the household waste and recycling centre (HWRC) waste stream and current evidence for Scotland dates to 2009.

The lack of recent Scottish HWRC data means that Scottish estimates for household packaging waste in the HWRC stream (UK 2017 WRAP study) are currently based on data from HWRC's in England. Improving and aligning our evidence on the mixed HWRC stream also aligns with separate proposals for mandatory reporting of separated waste and surplus textiles.

Evidence requirements for a deposit return scheme

Waste composition analysis of household waste has previously been used in the modelling of DRS. A new *interim* national household kerbside composition estimate could be available from late 2020, but the business case does not include a requirement to update DRS national modelling with any new national estimates. The value of doing this at that point in the policy cycle would be questionable.

Zero Waste Scotland has also been providing support to help local authorities understand the potential implications of DRS, including an analytical tool that uses waste composition data. Assuming new composition analysis is completed in Autumn 2020, participating local authorities may wish to use that data in an updated assessment for their authority. Over the delivery period for the proposed household study, it will be important to ensure that all stakeholders are clear on the difference between data to improve individual local authority planning, and that used in national policy development.

In developing the business case, consideration was given to a requirement to support any future monitoring and evaluation of a deposit return scheme. Zero Waste Scotland has discussed the development of an evaluation strategy with Scottish Government, at the time of writing there is no requirement identified. If a requirement was identified, it is not clear whether a scheme administrator would financially support this. Therefore,

the current business case assumes there would be no alternative source of funding available during the 2020-22 period.

Section 3: Programme options evaluated in the OBC

The following section provides a description of how the final options for evaluation were developed and refined and a detailed description of each final option evaluated in Section 5 onwards.

Information used to develop options

The development of final options for evaluation utilised the following information:

- Discussion and development of programme options with the waste data strategy board and Zero Waste Scotland colleagues.
- Feasibility work completed in 2019 by Resource Futures, who have significant experience of delivering waste composition studies across household and commercial streams.
- Zero Waste Scotland's knowledge and expertise from delivering previous household and commercial studies. For example, the proposed procurement and delivery of the household study builds on what was done in the last project. Proposals for a commercial waste study also build on the significant methodological and cost challenges experienced with previous UK studies.
- A review of a recent 2017 UK level study of household waste composition
- A review of the Scottish material recovery facilities code of practice data

The development of programme options considered several inter-dependent factors:

- Evidence needs – for example, the type of evidence required and when.
- Costs – for example, the reasonable annual budget requirement for each year of the programme and measures designed to manage costs during procurement and delivery.
- Quality – for example, there is a point at which study quality is so compromised by managing costs that the study is no longer *cost-effective*.
- Technical – for example, whether there is supporting national data to match waste sampling data to produce annual estimates.
- Management & Commercial – for example, the scale of fieldwork that can be delivered in a single season is determined by the capacity of contractors. Fieldwork seasons also need to avoid sampling during bad weather, Christmas and summer holiday periods.

Review of provisional options

During development of the OBC, five provisional options were drafted and discussed with both the waste data strategy board and Zero Waste Scotland colleagues:

1. National household waste study only
2. National household and commercial waste study
3. National household and commercial waste study, with additional commercial sector case studies
4. As option 3, with additional landfilled wastes study
5. As option 4, with additional construction and demolition waste case studies

During discussion Option 2 was viewed as delivering the core evidence requirements for the programme, and options 3 and 5 (additional sector case studies) were viewed as lower priority. Views on the study of landfilled wastes were more mixed. The original objective of the study was to improve data on the composition of mixed wastes for landfill emissions modelling. This was viewed as desirable but not essential by the WDSB. During discussion with Zero Waste Scotland colleagues, it was felt this study could provide wider value (particularly in the context of the biodegradable waste to landfill ban if conducted in the first two years of the programme).

Final options design

The final options were designed around the following principles:

- All the final options should include a national-scale study of household and commercial wastes.
- None of the final options should include case studies of commercial waste and construction and demolition wastes. It was felt this evidence requirement could be fulfilled outside of a co-ordinated national programme.
- Some of the final options should include a study of landfilled wastes in the early years of the programme.

The design of final options for evaluation recognised the following constraints around programme delivery:

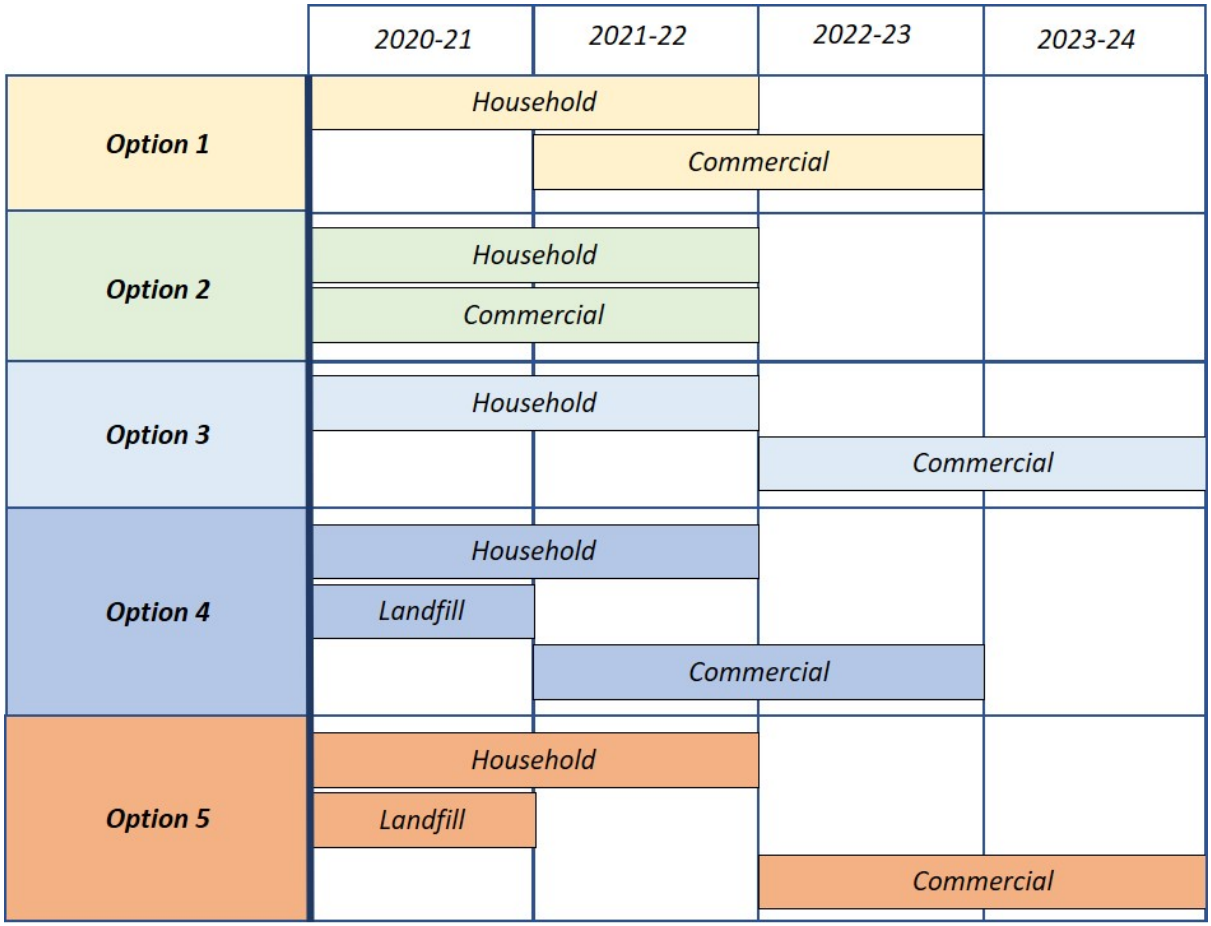
- Studies of household, commercial and landfill waste cannot be completed at the same time. All studies require a significant mobilisation period, enhanced capacity within both Zero Waste Scotland and waste composition contractors.
- Interim evidence on household waste is required in late 2020, early 2021. Hence all options program the same timing for a household study.
- Sampling of household waste is limited to a spring and Autumn period, in order to avoid Christmas and School holidays, and periods of winter weather. Delivering up to twenty individual local authority studies over a single financial year would not be possible regardless of the management resources applied.
- A landfill study could probably be completed in a single financial year. Discussion to date has questioned the value of completing the landfill study in later years of the programme. If the landfill study goes ahead, it should be in 2020-21.
- A commercial study would be challenging to complete in a single financial year. A pilot/planning phase is also required, working with SEPA waste data. Securing participation of targeted private sector sites will also take time.

Detailed description of final options for evaluation

The following section describes the final options that have been developed for evaluation during the OBC stage. Options vary by timing and study scope.

Option 1 describes the household and commercial studies in detail, subsequent options avoid repetition by highlighting only the elements that are different from that described in Option 1.

A summary of the key components of each option and their timing is provided below.



Option 0 – Do nothing

A "do nothing" option was assessed as not being a credible option during the SOC. However, we felt it was good practice to update our evaluation of this option to include any recent developments (e.g. potential alternative sources of data).

Option 1 – Household and commercial waste only (intermediate timing)

This option delivers waste composition analysis of household waste collected at the kerbside and recycling centre's (HWRC's), and commercial wastes at bulking/treatment sites. The household study is prioritised in 2020-21, the commercial study is phased in by completing preparatory work in 2020-21.

Option 1 - Household kerbside waste study

Delivery of the household study would require a procurement and funding mechanism to be established with local authorities, project management and overall direction, data quality assurance, and secondary analysis in order to produce national estimates.

A first phase of the project would involve requesting existing local authority data for studies conducted since 2018. Subject to response rates and a review of data quality, this approach could support an interim update to our current composition dataset by the end of 2020. This approach could also help prioritise local authorities to participate in the first phase of new composition analysis.

The main programme aims to complete twenty new kerbside composition studies taking place over three fieldwork seasons during Autumn 2020, Spring 2021 and Autumn 2021. Data from individual studies would be incorporated into a national dataset to produce updated national estimates in late 2020 and 2021.

Experience from the last household study in 2013-15 suggests twenty local authorities would deliver a representative picture for Scotland, subject to securing the participation of key local authorities (e.g. Glasgow, Edinburgh, Dundee).

Each of the kerbside studies would capture a representative sample of residual waste for a given local authority, according to guidance developed previously. The exact requirements for kerbside dry mixed recycling would be determined through a review of services in place (e.g. whether participating local authorities ran a comingled or “dual stream” service).

Approximately seven local authorities would be completed in each fieldwork season. The timing of fieldwork is restricted by avoiding Christmas/New year and summer holidays and bad weather during late winter. The number of local authorities completed in each fieldwork season is subject to finalising a procurement process with local authority partners, the required project management support and the capacity of contractors.

Option 1 - Household waste recycling centre study

Sixteen studies of HWRC residual waste would also be completed over the same timescales as the kerbside study. No provision has been made for sampling the composition of segregated recycling (e.g. glass) or other relatively rare mixed waste streams (e.g. dry mixed recycling) collected at recycling sites.

There should be overall efficiencies in commissioning HWRC studies alongside kerbside studies (e.g. funding and procurement process). We have assumed that HWRC studies can be incorporated into scheduling and delivery of kerbside studies. We will review this during procurement and engagement with local authorities.

Option 1 - Commercial waste study

The commercial waste study would involve a planning phase, followed by two phases of sampling of commercial waste at waste management sites.

The planning phase would start in October 2020 and is designed to respond to key methodological challenges with past national-scale commercial waste studies. This phase would involve:

- Working with SEPA to develop a suitable methodology within the SEPA dataset to estimate a national commercial residual waste tonnage, which would be used to produce national estimates of composition using sample data.
- Working with SEPA to identify the largest sites handling residual waste collected from commercial premises.
- An engagement plan for waste management sites, using the list of sites targeted for waste sampling.
- Working with those large sites to see if they can reliably identify residual waste collected from commercial premises (to ensure household waste can be clear differentiated).

The timing of the planning phase is designed to ensure there is a viable way forward for the main fieldwork phase, prior to commissioning (April 2021). The planning phase would be led by Zero Waste Scotland, working with SEPA. The requirement to review individual site returns data means that this task may not be suitable for a third-party contractor[3].

The main fieldwork for waste composition analysis of commercial waste would be conducted on residual waste deposited at bulking or treatment facilities, after waste from individual premises has been combined in a collection vehicle. This approach should manage study costs but would not produce composition data for individual commercial sectors.

Two phases of waste composition analysis would be completed during September to December 2021 and April to June 2022. Proposed timings aim to spread the budget requirement relatively evenly over 2021-2 and 2022-23. This approach would not deliver any new national evidence for commercial waste composition until summer 2022, which may be significant for EPR impact analysis and food waste monitoring and reporting.

Waste composition analysis would be contracted out as a single project. Projected costs assume sorting through 80 samples of 500kg at 10-15 sites over the two phases. Contracted costs would include setting up and logistics for individual site studies, and provision of waste composition datasets from study sites. Costings currently assume any secondary analysis to produce national estimates will be completed by Zero Waste Scotland in-house.

[3] SEPA and Zero Waste Scotland have a data sharing agreement in place. We will explore whether this could be extended to a contractor, but it's assumed this is unlikely.

Option 2 – Household and commercial waste only (compressed timing)

Option 2 delivers the same household and commercial waste studies as described in option 1 above, but compresses the delivery requirement into two years, by starting the commercial study during 2020-21.

Option 3 – Household and commercial waste only (extended timing)

Option 3 delivers the household and commercial studies described in option 1 and extends the delivery requirement by starting the commercial study in 2022-23.

Option 4 – Household, commercial and landfilled wastes (compressed timing)

Option 4 delivers the same household and commercial waste study as option 1 and includes a study of landfilled wastes starting in 2020-21. Delivery requirements are very compressed into the first three years of the programme.

ZWS has not commissioned a study of landfilled wastes previously so costs and methodological challenges are more uncertain. A pilot phase would have to start in early 2020 to work with SEPA to identify target sites, priority waste streams and fully develop a methodology using SEPA data. Focus would be placed on sampling mixed waste streams landfilled where current biodegradable content assumptions are uncertain. Waste sampling would be completed over two phases of fieldwork during Sept to Nov 2020 and March to April 2021. Estimated fieldwork costs assume approximately 50 samples of 500kg of waste will be sorted at up to 10 sites.

Option 5 – Household, commercial and landfilled wastes (extended timing)

Option 5 delivers the household, commercial and landfilled waste studies as per option 4 and extends the delivery requirement by starting the commercial study in 2022-23.

Section 4: The Socio-Economic Case

In a typical socio-economic case, a quantitative value (e.g. net present value or similar) is estimated for each option, to allow costs and benefits to be compared. The SOC identified the qualitative benefits of waste composition analysis, which are not readily monetised:

- Enabling Scottish Government to make better informed decisions about current and future policy.
- Enabling Zero Waste Scotland and others to conduct analysis to support existing and future policy.
- Enabling local authorities, other public bodies, businesses and the waste management industry to assess recycling service performance and making the case for further change.
- Enabling improved monitoring and reporting against Scottish Government, UK and EU targets.

This section therefore provides a qualitative evaluation of options 1-5, using the five strategic outcomes established for the programme (see Section 1)). The strengths and weaknesses of each option were assessed against each of the strategic outcomes.

Option 0 (do nothing) implies using other data sources to fulfil evidence requirements, and so is assessed on that basis.

Full details of the anticipated costs of each option are provided in Section 5.

Evaluation of Option 0 (do nothing)

The table below summarises the strengths and weaknesses of not proceeding with a new programme of waste composition research. Not proceeding implies reliance on alternative data sources. For commercial waste, the only alternative data sources available are UK level studies. For household waste, there are *technically* three alternative sources of data:

1. Evidence from the previous household study from 2013-15
2. WRAP's current household estimates for Scotland in 2017, which are unlikely to be wholly representative of a national picture (for further details see Appendix A).
3. Local authorities to provide data from studies commissioned by themselves (mirroring the retrospective approach adopted at UK level)

Strategic outcome	Strengths	Weaknesses
We deliver studies that are cost effective for SG funds	No additional cost to Zero Waste Scotland budget.	Cost burden redistributed elsewhere (e.g. poorer decision-making impacts on Scotland's waste management system).
We deliver studies that provide timely evidence of Scotland's Waste	Adoption of alternative data sources would remove the requirement to wait for the completion of fieldwork. Information could be available by the end of 2020.	For household waste, adoption of 1 above would be hard to defend (increasingly dated) and does not deliver a contemporary assessment of household recycling performance.
We deliver studies that provide reliable evidence of Scotland's Waste that meets the needs of stakeholders	No quality & reliability benefits identified.	Significant questions over reliability of alternative approaches. Use of 2 above would prove hard to defend (assessed as unrepresentative). Reliance on 3 highly likely to introduce significant problems with coverage & data quality (as per WRAP study).
We can monitor and evaluate progress towards Scotland's targets and policies	Adoption of 2 or 3 above could *potentially* support food waste monitoring.	Limitations with 2 and 3 above would question our ability to reliably monitor and report on food waste.
We have detailed information on the composition of Scotland's waste streams to inform future policies	Previous Scottish study and WRAP's current estimates for Scotland contain sufficiently granular info on material types.	Use of 3 above introduces variation in how wastes have been categorised and uncertainty around individual material estimates.

Evaluation of Option 1 - Household and commercial waste only (intermediate timing)

Strategic outcome	Strengths	Weaknesses
We deliver studies that are cost effective for SG funds	One of the lower-cost options, delivers comprehensive info on household and commercial waste streams. Kerbside study assumes 25% contribution from local authorities. HWRC study assumes 100% contribution from Zero Waste Scotland.	Costs spread over 3 years, but still heavily loaded to 2021-22 due to timing of fieldwork seasons. Commercial waste study will be challenging to derive a cost-effective and reliable national picture.
We deliver studies that provide timely evidence of Scotland's Waste	Provides interim national household estimate in late 2020 for use in EPR evaluation and food waste monitoring. More comprehensive estimates in 2021-22. HWRC study provides info on wider EPR scope (e.g. furniture, carpets, textiles). Delivers new detailed assessment of household recycling performance. New evidence on commercial waste in late 2021-22.	Timing of commercial study would not deliver new evidence (inc packaging) until late 2021-22. For EPR impact assessment on commercial waste stream, Scotland might have to rely on UK estimates based on dated England data, which are only reflective of local authority collected commercial waste. Does not include a landfilled wastes study. New household study starting in 2020 requires careful management of local authority stakeholder expectations in relation to DRS.
We deliver studies that provide reliable evidence of Scotland's Waste that meets the needs of stakeholders	Co-ordinated approach to household study and proposed budget should deliver a representative national sample by 2021-22. Also delivers evidence on local authority recycling performance, supporting any internal case for improvement. For commercial study, phasing in allows for proper preparatory phase.	Commercial waste study will be challenging to derive a cost-effective and reliable national picture.
We can monitor and evaluate progress towards Scotland's targets and policies	Supports food waste reporting and monitoring with new household estimate in late 2020/early 2021, with improved estimates in subsequent years.	No data on landfilled wastes with this option. No new data on food wastes in commercial waste stream until late 2021 at the earliest.
We have detailed information on the composition of Scotland's waste streams to inform future policies	Delivers up to date evidence on the quantities of key household and commercial waste types (packaging, food waste) and changes in what we throw away and recycle.	No data on landfilled wastes with this option. No new detailed data on commercial waste stream until late 2021 at the earliest.

Evaluation of Option 2 - Household and commercial waste only (compressed timing)

Strategic outcome	Strengths	Weaknesses
We deliver studies that are cost effective for SG funds	Household as per option 1.	Significant annual budget requirement (£300-350k per annum) over 2020-22. Compressed timing could mean diverting staff resources from other policy area work (opportunity cost). Commercial waste study will be challenging to derive a cost-effective and reliable national picture.
We deliver studies that provide timely evidence of Scotland's Waste	Household waste as per option 1. New evidence on commercial waste brought forward to early 2021.	Household study as per option 1. Does not include a landfilled wastes study.
We deliver studies that provide reliable evidence of Scotland's Waste that meets the needs of stakeholders	Household study as per option 1. Estimates for packaging in household and commercial waste stream could be available in early 2021, supporting a more robust assessment of EPR impact in Scotland.	Bringing forward commercial study limits proper preparatory phase and could risk the quality of the commercial study, and impact on delivery of the separate household study. Commercial waste study will be challenging to derive a cost-effective and reliable national picture.
We can monitor and evaluate progress towards Scotland's targets and policies	Household waste as per option 1. Estimates for food wastes in commercial waste stream could be available in early 2021.	Quality and delivery risks with timing of commercial study impact on our ability to monitor and evaluate. No data on landfilled wastes with this option.
We have detailed information on the composition of Scotland's waste streams to inform future policies	Household study as per option 1. Detailed evidence on commercial waste composition could be available in early 2021.	No data on landfilled wastes with this option.

Evaluation of Option 3 - Household and commercial waste only (extended timing)

Strategic outcome	Strengths	Weaknesses
We deliver studies that are cost effective for SG funds	As per option 1, with budget requirement spread more evenly over 2020-24.	Commercial waste study will be challenging to derive a cost-effective and reliable national picture. Overall cost effectiveness of a commercial study may reduce if completed in later years.
We deliver studies that provide timely evidence of Scotland's Waste	Household waste as per option 1.	Timing of commercial study would not deliver new evidence (inc packaging) until late 2022 at the earliest. Household study as per option 1. Does not include a landfilled wastes study.
We deliver studies that provide reliable evidence of Scotland's Waste that meets the needs of stakeholders	Household study as per option 1. Commercial study timing allows for adequate preparation and improved reliability of subsequent fieldwork.	Timing of commercial study would mean relying on UK data for EPR impact assessment. Once completed, commercial waste study will be challenging to derive a cost-effective and reliable national picture.
We can monitor and evaluate progress towards Scotland's targets and policies	Household waste as per option 1.	No data on landfilled wastes with this option. Estimates for food wastes in commercial waste stream not available until early 2023.
We have detailed information on the composition of Scotland's waste streams to inform future policies	Household study as per option 1. Detailed evidence on commercial waste composition could be available in late 2022.	No data on landfilled wastes with this option. Timing of commercial study means no detailed information until late 2022.

Evaluation of Option 4 - Household, commercial and landfilled wastes (compressed timing)

Strategic outcome	Strengths	Weaknesses
We deliver studies that are cost effective for SG funds	Delivers studies of household, commercial and landfilled wastes within the first 3 years of the programme.	One of the higher cost options, with costs heavily loaded to 2021-22 due to timing of fieldwork seasons. Commercial waste and landfilled waste studies will be challenging to derive a cost-effective and reliable national picture.
We deliver studies that provide timely evidence of Scotland's Waste	Landfill study in year 1 would deliver timely & updated evidence on the composition of key mixed waste streams.	Very compressed delivery requirement with household and landfill study both running in year 1 and commercial study starting in year 2. Allows little time for preparing commercial study. Timing of commercial study would not deliver new evidence (inc packaging) until late 2021 at the earliest (implies reliance on other data sources until then).
We deliver studies that provide reliable evidence of Scotland's Waste that meets the needs of stakeholders	Delivers key evidence requirements	Inclusion of landfill study in year 1 limits proper preparatory phase (working with SEPA), could risk study quality and impact on delivery of the separate commercial and household studies.
We can monitor and evaluate progress towards Scotland's targets and policies	Supports monitoring of food waste and assessment of mixed wastes to landfill.	Quality and delivery risks with timing of landfill study impact on our ability to monitor other areas (e.g. food waste).
We have detailed information on the composition of Scotland's waste streams to inform future policies	Household study as per option 1. Detailed evidence on composition of mixed wastes landfilled could be available in early 2021, and commercial wastes in early 2022.	Delivering new evidence on mixed wastes to landfill in the current context of preparing for the bio-ban could introduce wider risks around project delivery (scope drift) and stakeholder expectations. Could ultimately result in the diversion of resources away from household and commercial studies.

Evaluation of Option 5 - Household, commercial and landfilled wastes (extended timing)

Inclusion of landfill study in year 1 limits proper preparatory phase and could risk study quality and impact on delivery of the separate household study.

Strategic outcome	Strengths	Weaknesses
We deliver studies that are cost effective for SG funds	Delivers studies of household, commercial and landfilled wastes over a four-year programme.	One of the higher cost options, with costs more evenly spread over four years. Commercial waste and landfilled waste studies will be challenging to derive a cost-effective and reliable national picture.
We deliver studies that provide timely evidence of Scotland's Waste	Landfill study in year 1 would deliver timely & updated evidence on the composition of key mixed waste streams. Timing of commercial study spreads delivery requirement more evenly over programme, reducing risk of impacting on other studies.	Compressed delivery requirement with household and landfill study both running in year 1. Timing of commercial study would not deliver new evidence (inc packaging) until late 2022 at the earliest (implies reliance on other data sources until then).
We deliver studies that provide reliable evidence of Scotland's Waste that meets the needs of stakeholders	Delivers key evidence requirements (with more extended timeline & allowance for adequate preparation).	Inclusion of landfill study in year 1 limits proper preparatory phase, could risk study quality and impact on delivery of household study.
We can monitor and evaluate progress towards Scotland's targets and policies	Supports monitoring of food waste and assessment of mixed wastes to landfill.	Quality and delivery risks with timing of landfill study impact on our ability to monitor other areas (e.g. food waste).
We have detailed information on the composition of Scotland's waste streams to inform future policies	Household study as per option 1. Detailed evidence on composition of mixed wastes landfilled could be available in early 2021, and commercial wastes in early 2023.	Delivering new evidence on mixed wastes to landfill in year 1 (preparing for the bio-ban) could introduce wider risks around project delivery (scope drift) and stakeholder expectations. Could ultimately result in the diversion of resources away from household and commercial studies.

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Section 5: The Financial Case

This section identifies the funding requirements for options 1-5 described previously. The options vary by scope (all options include the same household and commercial study, options 4 and 5 additionally include a study of landfilled waste) and the timing of each study (which has implications for annual budget requirement). The annual and total cost of each option are summarised below. Details are then provided on how individual study costs have been estimated.

Option 1

	2020-21	2021-22	2022-23	2023-24	Total
Household	270,395	343,583	-	-	588,978
Commercial	-	100,000	75,000	-	175,000
Landfill	-	-	-	-	-
Total	**270,395**	**443,583**	**75,000**	**-**	**763,978**

Option 2

	2020-21	2021-22	2022-23	2023-24	Total
Household	270,395	343,583	-	-	588,978
Commercial	100,000	75,000	-	-	175,000
Landfill	-	-	-	-	-
Total	**370,395**	**418,583**	**-**	**-**	**763,978**

Option 3

	2020-21	2021-22	2022-23	2023-24	Total
Household	270,395	343,583	-	-	588,978
Commercial	-	-	100,000	75,000	175,000
Landfill	-	-	-	-	-
Total	**270,395**	**343,583**	**100,000**	**75,000**	**763,978**

Option 4

	2020-21	2021-22	2022-23	2023-24	Total
Household	270,395	343,583	-	-	588,978
Commercial	-	100,000	75,000	-	175,000
Landfill	115,000	-	-	-	115,000
Total	**385,395**	**443,583**	**75,000**	**-**	**878,978**

Option 5

	2020-21	2021-22	2022-23	2023-24	Total
Household	270,395	343,583	-	-	588,978
Commercial	-	-	100,000	75,000	175,000
Landfill	115,000	-	-	-	115,000
Total	**385,395**	**343,583**	**100,000**	**75,000**	**878,978**

All costs below cover contracted services and the additional Zero Waste Scotland project manager post only. Costs do not account for the contribution from existing Zero Waste Scotland or SEPA staff to support delivery.

Household waste study costs

Establishing the Scotland excel framework

Scotland excel have submitted a draft service level agreement and formal proposal including costs associated with establishing the framework.

Kerbside waste compositional analysis

Estimated costs use the average cost of a local authority study during the last household programme in 2013-15, adjusted for 3% inflation. Costs assume twenty local authority studies will be completed in total and each local authority will contribute 25%. Annual costs assume seven local authorities will be completed between Sept 2020 and November 2020, seven between April 2021 and June 2021, and six between Sept 2021 and Nov 2021.

Recycling centre waste compositional analysis

Estimated costs use information from a feasibility study completed in early 2019. Costs assume Zero Waste Scotland will provide a 100% contribution to study costs, which may be a conservative estimate. We have assumed local authorities will place less of a priority on analysis of this waste stream. We will explore local authority contribution during the planning phase in Q1 2020.

Cost estimates assume completing analysis of two 500kg samples of residual waste at 16 local authority sites, assuming £2,000 per sample sorted[4]. Cost also include project set-up, securing sites, analysis and provision of datasets. Secondary analysis to provide national composition estimates is covered under “Household study analyst”.

Waste composition project manager

Cost assume Zero Waste Scotland employs a two-year fixed term (1 FTE) project manager post (grade F), using 2019-20 pay scale and allowing for 2nd year increment. Pension, NI contributions and IT overheads are included.

Household study analyst

Cost assume a day rate of £500 inc VAT for an experienced analyst in this field.

Costs for 2020-21 are £30k (60 days) to cover interim update to existing dataset, one-to-one support to seven LA's on household sampling design, integrating phase 1 fieldwork data once complete, production of updated national kerbside estimate (and potentially new estimate for HWRC composition).

[4] Following review of available data on national HWRC practices it may prove more appropriate to focus on a smaller number of authorities, sampling from multiple sites within an authority.

Costs for 2021-22 are £20k (40 days) to cover integrating phase 2 and 3 fieldwork data into the national dataset, one-to-one support to thirteen LA's on household sampling design and planned updates to national kerbside and HWRC estimates.

Commercial waste study costs
Estimated costs use information from a feasibility study completed in early 2019.

Costs assumes the pilot/planning phase is completed by Zero Waste Scotland and SEPA staff. Contracted project costs allow for a pilot phase of sampling, main project set up and logistics. Fieldwork costs assume 80 samples of 500kg analysed at 10-15 sites (~£1,500 per sample sorted), plus allowance for analysis and data provision. Estimated costs are split over two fieldwork seasons (Autumn and Spring).

Landfilled wastes study costs
Estimated costs use information from a feasibility study completed in early 2019.

Costs assumes the pilot/planning phase is completed by Zero Waste Scotland and SEPA staff. Contracted project costs allow for a pilot phase of sampling, main project set up and logistics. Fieldwork costs assume 50 samples of 500kg analysed at 10 sites (~£1,500 per sample sorted), plus allowance for analysis and data provision. Estimated costs are split over two fieldwork seasons (Autumn and Spring).

Financial risks
Zero Waste Scotland could be asked to fund all thirty-two local authorities

Current household study costs assume twenty local authorities will be completed. Given the planned introduction of DRS and EPR, there may be a call to complete waste composition studies with all thirty-two local authorities, which would have a significant impact on both programme budgets[5] and delivery timescales.

Procurement activity results in significantly higher projected costs

The costs of contracted waste composition analysis are determined by:

- The geographic location of waste sampling sites – contractors will need to cover the additional travel costs associated with fieldwork at relatively remote sites/authorities
- The type of waste sorted – for example, sorting through residual waste takes significantly longer than dry recycling. Analysing waste at household recycling centres presents a different set of challenges compared to kerbside waste.
- The quantity of waste sorted - in practice any national-scale study has to rely on a tiny quantity of waste sampled, when compared to how much waste is produced each year.

[5] We have estimated the Zero Waste Scotland contribution to total project costs for twenty kerbside waste studies will be approx. £340,000 over the period 2020-22. The Zero Waste Scotland contribution for all thirty-two local authorities would be in the region of £550,000.

- The number of material categories used during sorting – a larger number takes longer to sort. Reducing the number of sort categories is one way to reduce costs, but it can also produce results that are not fit for purpose
- The time required to secure site participation

Most of these factors can be specified/controlled for during procurement.

Kerbside waste cost estimates are well-understood and are at relatively low risk of being significantly higher than current estimates. In the last household study, the quantity of waste to be sorted was not fixed (i.e. we defined a set number of households to sort waste from, rather than a minimum weight). In practice this introduces a risk that some contractors do not sort through all the waste collected. These issues will be explored as part of the procurement strategy with Scotland excel.

Household recycling centre costs are more uncertain as Zero Waste Scotland has not conducted a similar study for at least 10 years. We will explore what information local authorities hold as part of planning. Forecast costs for the household study will be updated on completion of the Scotland excel framework.

Cost estimates for the commercial and landfill studies are more uncertain and will be clearer on completion of procurement exercises. Risk can be managed through very clear specification, accepting trade-off's in relation to scope and coverage and conducting some required activities in-house (for example, we have proposed secondary analysis and reporting is conducted in-house).

Section 6: The Commercial Case

This section identifies the procurement requirements for the delivery of options 1-5 and the commercial risks associated with those options. All the final options involve a national-scale study of household and commercial wastes. Options 4 and 5 also include an additional study of landfilled wastes.

A description of the overall delivery requirements for each study is provided in the Management case, Section 7.

Procurement requirements for the household study

Project management support

Section 7 details the project management role required to deliver the household study, including the pros and cons of fulfilling this requirement through either a temporary role within Zero Waste Scotland or contracted resource. In the long term a role within Zero Waste Scotland represents lower risk and better value for money when compared to contracting out. At the time of writing, a role request for a two-year post has been submitted. If this role is not approved, there will be a requirement to procure a project management resource during Q1 2020-21.

Waste composition contractors for individual local authority studies

Waste composition analysis will be conducted by specialist contractors. Zero Waste Scotland's previous experience suggests several firms can provide the services required. They are also highly likely to bid in any procurement undertaken.

During the last household study during 2013-15, individual procurements were used to commission contractors. They were led by local authorities and heavily supported by Zero Waste Scotland. However, individual procurements are not particularly efficient, particularly given the study requirements are very similar in nature.

Zero Waste Scotland is working with Scotland excel to explore an alternative framework approach, where contractors are available on a framework, and local authorities select a contractor from a more straightforward call off. At the time of writing, Scotland excel have provided confirmation they are willing to develop a framework from March 2020 subject to Zero Waste Scotland covering their costs. Planning currently assumes the Scotland excel framework approach will be adopted for the household study.

Zero Waste Scotland will be required to provide significant technical input to developing the framework, including specification, reviewing and assessing bids. To enable fieldwork studies to start in September 2020, development of the framework requires completion by late August 2020. Scotland excel has indicated this timescale is achievable.

Waste composition analyst

The delivery requirements for this role are detailed in Section 7. We anticipate contracting out this role, with procurement starting in April 2020, with an objective of having a contractor in place by June 2020. The contractor will run over the period June 2020-March 2022. The contract is relatively specialist but likely of interest to a group of experienced contractors. Estimated total costs for the life of the contract are £50k, with £30k in 2020-21 and £20k in 2021-22.

Procurement requirements for the commercial and landfilled waste studies

Section 7 details the delivery requirements for studies of both commercial and landfilled wastes. The procurement requirement for both studies involves securing the services of waste composition analysis contractors to deliver fieldwork at select waste management sites.

For the commercial study, a planning phase starting in October 2020 will explore the viability of using SEPA waste management data. Planning assumes this task will be carried out by Zero Waste Scotland and SEPA staff, with no procurement implication. The requirement to review individual site returns (fully attributable data) means that this task may not be suitable for a third-party contractor.

If a viable national methodology is developed, procurement of a waste composition contractor will be initiated by April 2021 in order to start fieldwork during late summer 2021. Projected costs assume the contractor sorting through 80 samples of 500kg at 10-15 waste management sites over two phases. Contracted costs would include setting up and logistics for individual site studies, and provision of waste composition datasets from study sites.

Planning currently assumes any secondary analysis to produce national estimates will be completed by Zero Waste Scotland in-house.

Commercial risk assessment and mitigation

Risk description	Risk rating	Assessment and Mitigation
Commissioned work is unattractive to contractors	Low	Zero Waste Scotland's previous experience suggests several firms can provide the services required. They are also highly likely to bid in any procurement undertaken. All contracted requirements have been successfully commissioned in the past. Specifications will be clear and allow for clear costing. A co-ordinated national programme should enable contractors to plan resources. A process for informing contractors of opportunities is required to aid planning.
Household study bids come in much higher than estimated costs	Low	We have good information from the previous programme. Estimated costs are adjusted for inflation and based on a defined set of requirements.
Commercial and landfill study bids come in much higher than estimated costs	Med	Estimated costs more uncertain due to infrequent commissioning of these studies. Costs managed through clear specification (sites completed & waste tonnage analysed). Planning phase with SEPA will be crucial in developing the specification for subsequent waste analysis at waste management sites.
Household study excel framework approach introduces commissioning risks we are unfamiliar with	Low	Framework is a different approach compared to previous programme. Procurement strategy will be developed by Scotland excel, with Zero Waste Scotland input. This will require clear communication of our requirements to Scotland excel and local authorities.
Requirements for the HWRC element of the household study are less standardised	Low	Existing guidance focuses more on kerbside collected household waste. A set of minimum requirements for analysis of HWRC waste will be developed during framework development with Scotland excel.

Section 7: The Management Case

Introduction

This section identifies the delivery requirements for a successful programme of waste composition analysis and an assessment of the associated risks to successful delivery. Delivery requirements are split into those for individual studies and the overall management of the programme.

All the programme options involve a national-scale study of household and commercial wastes, with some options including an additional study of landfilled wastes. The requirements for all three study types are detailed below.

Household study delivery requirements

Procurement of waste composition contractors

The procurement of waste composition contractors to fulfil individual local authority study requirements is detailed in Section 6.

Waste composition project manager role

Co-ordinating the delivery of up to twenty individual local authority studies requires a significant project management role that is critical to a successful national-scale study. The project manager will be responsible for the following, supported by the project director:

- Take over the day-to-day responsibility for co-ordinating a Zero Waste Scotland project management team, and associated project plan.
- Working closely with Zero Waste Scotland resource management team, to support the ongoing engagement with local authorities.
- Oversee the delivery of individual local authority projects, to ensure each study is completed to a consistent standard[6], supported by procurement specifications, guidance and observation of studies in progress.
- Provide support from project initiation to completion, with partnership working with each local authority and the selected contractor.
- Facilitate the payment of Zero Waste Scotland funds to individual local authorities upon completion of agreed milestones.
- Work closely with a separate analytical support role to ensure that each project delivers a consistent approach to household sampling design and quality assurance of data outputs from each study.

The project manager role could be fulfilled through a two-year fixed term post within Zero Waste Scotland, or via commissioning a contractor. The pros and cons of each option are described below.

[6] Depending on the procurement solution that is finalised consistency could include how local authorities call-off work from a framework, or commission individual studies. Consistency also applies to all subsequent points in project delivery (e.g. how waste is sampled, sorted and reported).

A contracted route would not contribute to Zero Waste Scotland overheads, but would only deliver project management support to the household study. During the last household study in 2013-15, a contractor (sole trader) was used to fulfil a project management role. Experience from the last programme suggests the capacity of local authorities varies markedly. It may prove difficult to assign a fixed amount of time to an individual local authority, which could introduce a higher risk of cost overrun. A contracted route could also introduce conflicts of interest for this programme. For example, if the project manager was working for the same consultancy who was also conducting waste composition analysis.

A two-year fixed term post within Zero Waste Scotland would contribute to Zero Waste Scotland overheads, but would also create greater capacity and flexibility to deliver additional studies of commercial and landfilled wastes. A dedicated role would also mitigate risk of conflict of interest highlighted above and widen out the knowledge and capacity within Zero Waste Scotland to conduct similar studies in future. In the long term this option arguably represents lower risk and better value for money when compared to contracting out.

Current costs and procurement requirements assume a two-year fixed term post will be recruited within Zero Waste Scotland.

Waste composition analyst role

There is a requirement for an analyst role to support delivery of the household study. The analyst would be contracted in to complete two distinct sets of tasks below.

Interim update to the national household composition dataset in late 2020

This will involve:

- reviewing any new waste composition data sourced through a request to local authorities over summer 2020
- integrating any suitable composition data into the existing national composition dataset (using the most recent waste data flow data).

The outcome of this work will be to produce an interim update to the national household composition dataset in late 2020. The outcome is dependent on the quality of data sourced from local authorities.

Analytical support for the delivery of new local authority studies

This will involve the following tasks:

- Establishing a household sampling design for each individual local authority study. Previous approaches have relied on the use of commercial socio-demographic packages, which incur significant additional costs to each study and the potential for licensing restrictions. We have built on previous experience by proposing to use publicly available data based on the 2011 census. Guidance in the use of census data was developed previously, but that process

highlighted the level of analytical support that would be required. This is a methodology that few local authorities will be comfortable with, so they will require support from an experienced contractor during the planning stage of each study.

- Finalising a local authority data template to be used by waste composition contractors and providing a data quality assurance role (supported by the project manager) for data supplied by waste composition contractors. This is crucial to ensuring data capture is standardised, any deviations from agreed methodologies are accounted for and local authorities are eventually supplied with a usable dataset at the end of each study.
- Creating a local authority annual composition estimate using waste composition sample data and waste data flow tonnages. This will ensure each local authority is provided with an annual waste composition estimate in excel format at the end of each study.
- In the previous programme individual waste composition analysis contractors were asked to produce written reports and quality was variable. The requirement for producing written summary reports and who is best placed to produce them will be reviewed prior to any procurement exercise.
- Further updates to the national household composition dataset over the course of the household study programme. As individual local authority studies are completed, this will involve periodically integrating new waste composition data into the existing national composition dataset (using the most recent waste data flow data). Waste data flow is updated annually in September each year, so further updates may be best aligned with those timescales.

Engagement with local authority partners

To support local authority participation, Zero Waste Scotland will use established networks to ensure local authorities are aware of the opportunity and how they can express an interest in participating. This role will be led by Zero Waste Scotland Resource management team, supported by Zero Waste Scotland PRE and the waste composition project manager following recruitment/commissioning of the post.

During the last household study, Zero Waste Scotland paid local authorities a grant to cover our contribution to overall project costs. The same approach will be used this time and a grant funding process will be established (application through to payment). Grant terms and conditions will be one of the ways to support the delivery of individual studies to a consistent standard.

A process for local authority expressions of interest will be developed by Zero Waste Scotland resource management team early in the first quarter 2020, so a formal call can be issued with good notice. We may need to consider how to prioritise which local authorities participate in the first phase of fieldwork in Autumn 2020, in order to deliver the best possible interim update to the national dataset in late 2020.

Once individual studies are up and running the administration of individual project finances will be delivered through the waste composition project manager.

As part of local authority engagement, Zero Waste Scotland PRE will also develop an approach for requesting any existing waste composition data during 2020.

Commercial and landfilled waste study delivery requirements
Both studies have very similar delivery requirements described below.

A planning phase is required to review SEPA data, identify waste management sites and develop methodologies for producing national estimates. This phase will be delivered by Zero Waste Scotland PRE, with support from SEPA. The requirement to review individual site returns data and form a view on the viability of a subsequent national methodology means this task may not be suitable for a contractor.

A main fieldwork phase of waste composition analysis would be completed at waste management and landfill sites. Waste composition analysis will be conducted by specialist contractors and project managed by Zero Waste Scotland PRE. The procurement implications for this requirement are detailed in Section 6. Fieldwork would be split into two seasons. Contracted costs would include securing set up with individual sites, waste sorting and logistics and provision of waste composition datasets from each site.

Secondary analysis of the data produced from individual site studies will be used to produce national estimates and associated reporting. This task will be completed by Zero Waste Scotland PRE and supported by SEPA.

Programme management

Zero Waste Scotland roles and responsibilities

Zero Waste Scotland will be responsible for the day-to-day delivery of the programme, through the following roles and responsibilities.

Role	Named people
Operational business case owner and management oversight	Daniel Stunell
Operational project owner, day to day management of the programme	Phil Williams
Recruitment of household project manager	Phil Williams, Daniel Stunell, Jon Marshall
Development of household study excel framework	Jon Marshall, Katie Ferrie, Phil Williams, and Val Hendry.
Household study local authority engagement	Jon Marshall, potentially moving to Resource management team member (TBC)
Household study analyst role	Phil Williams, Katie Ferrie, Zero Waste Scotland procurement team.
Delivery of household study	Waste composition project manager (TBC), supported by Phil Williams and Katie Ferrie.
Delivery of commercial and landfill waste studies	Phil Williams & Katie Ferrie (project specification and management, SEPA data analysis[7]). Resource management team (private sector engagement, TBC), SEPA (supporting datasets, TBC), Zero Waste Scotland procurement (contracting, TBC).

Stakeholder roles and responsibilities

SEPA colleagues will support tasks associated with using SEPA datasets and provide strategic input to the programme. Local authority waste managers may be involved in a user group as part of the development of a Scotland excel framework for the household waste study. We will also explore if SEPA, local authority waste managers and Scottish Government would value establishing a small steering group.

Programme reporting

The programme will be reported on using Zero Waste Scotland's established operating plan processes.

[7] Depending on a final decision on timing of these studies and workload, the household study project manager may also be able to support delivery.

Delivery risk assessment and mitigation

Risk description	Risk rating	Assessment and Mitigation
Zero Waste Scotland lacks the required skills, knowledge and resources to deliver the programme	Low	The business case process has identified the technical and project management requirements to deliver the programme. Zero Waste Scotland has the skills, knowledge, and experience to deliver the programme.
Stakeholders would like to bring forward the commercial and/or landfill studies.	Med	The preferred option 1 spreads Zero Waste Scotland resourcing more evenly and allows key Zero Waste Scotland staff more time on other operating plan projects. Adoption of options 2,4 and 5 would require re-prioritisation of other projects in 2020-21.
Local authorities are unwilling to participate in the household study	Low	Updated national household estimates rely on good national coverage. National study design should produce useful data for each participating local authority. The 75% contribution from Zero Waste Scotland, excel procurement framework and project manager support should all make the offer more attractive. Early communication in Q1 2020 should aid LA planning.
The waste management industry is unwilling to participate in the landfill and commercial waste studies	Med	The waste management industry may be trickier to engage as participants, but this has been done in the past. Both studies will require Zero Waste Scotland to engage with the sector to secure participation at individual sites. Contractors are also experienced in engaging and have successfully done so in the past.
Negative press is generated from analysing household waste	Low	This was not a feature of the last programme. Local authorities are familiar with this issue and Zero Waste Scotland guidance on communicating with households will support individual studies. The project manager can also ensure good practice is followed.
Commercial and landfill waste studies do not deliver reliable national estimates	Med	To control costs only a tiny fraction of national waste managed can be analysed in both studies. This has been a significant criticism of previous studies in the UK. Pilot/planning phase will explore the feasibility of a method prior to contracting, working with SEPA and their waste datasets.

Risk description	Risk rating	Assessment and Mitigation
The quality of individual household studies varies significantly, compromising consistency requirements for national estimates	Med	Excel framework enables local authorities to call off contractors and lowest price drives individual decisions. Risk of contractors cutting corners to maintain profitability. Will require careful consideration during framework development. Monitoring and oversight of projects taken forward by the project manager will be key to mitigating this risk.
Landfill study introduces wider risks around project delivery and stakeholder expectations	Med	Study intended to deliver improved evidence for landfill emissions modelling. Current context of preparing for landfill ban could result in different expectations re: study objectives. If study takes place, will require clear communication and expectation management.

Section 8: Conclusions from the five-case evaluation

The proceeding sections have reviewed options for a programme of new waste composition analysis research using the five-case approach. The use of the five-case approach has clearly highlighted the complex trade-off's between *programme benefits* (evidence scope, quality and timeliness) and *programme costs* (resource requirements, timing, risks of poor delivery).

Following the qualitative evaluation described in Section four and the requirements identified in Sections Five to Seven, we believe Option 1 should be progressed as the preferred option.

Option 1 provides comprehensive new evidence on household waste, and potentially new data on commercial wastes (subject to piloting). Delivery and resourcing timescales are realistic subject to the resources identified being in place. Option 1 delivers timely information but also spreads the resourcing requirement over a more balanced period when compared to Options 2 and 3. There would be no new evidence on landfilled wastes with Option 1, discussion with the Waste Data Strategy board and within Zero Waste Scotland suggested the value of a landfill study was less clear.

Option 0 (do nothing) is rejected as it does not deliver reliable and timely evidence. Any financial saving from not running a programme will be outweighed by a lack of useful data. Options 2 and 3 could deliver the same evidence as Option 1, but present resourcing constraints and associated risks due to their timing. Options 4 and 5 include a study of landfill wastes, but as highlighted above the value of this work is less clear.

Appendix A Other potential sources of Scottish waste composition data

The composition of UK household wastes in 2017

WRAP have produced a study on the composition of household wastes in the UK in 2017. The outputs from this project are being used by Defra for UK policy evaluation of EPR, including estimates for Scottish household packaging waste. WRAP have also used the approach described below to produce Scottish household food waste estimates for both 2017 and 2018.

Zero Waste Scotland has reviewed the 2017 report and contacted WRAP to better understand what data has been used to estimate the composition of Scottish household waste.

The project relied on sourcing data from waste composition studies previously completed by local authorities themselves (i.e. retrospective data gathering exercise). This approach may be suitable for the much larger number of local authorities to draw from in England, but it can lead to poor representation of local authorities in Scotland, due to the much smaller number of authorities who might have completed a waste composition study. The other challenge with this approach is ensuring that waste is sampled and sorted using a consistent methodology.

WRAP have been unable to provide a list of the Scottish local authorities that supplied data (citing confidentiality). Zero Waste Scotland's understanding is that estimates for the composition of kerbside residual waste in Scotland in 2017 are based on eight[8] Scottish local authorities. The report suggests the eight local authorities were skewed towards low population density and least deprived areas (with no samples for the most deprived). This suggests that data from large city authorities have not contributed to national estimates.

The composition of household residual waste is subject to the significant variation in recycling performance across Scottish local authorities. Zero Waste Scotland are concerned that the current national estimates for Scotland rely too heavily on data from higher performing local authorities and therefore does not provide a representative national picture.

The limitations with the retrospective approach described above were a key justification for a co-ordinated programme of funding and technical support during the last Scottish household programme in 2013-15. A programme approach enables the development of a nationally representative sample of Scottish local authorities through targeting and prioritisation and greater control and standardisation of study design.

[8] According to WRAP some of the eight local authorities had completed more than one phase of sampling, a total of thirteen datasets were used.

Material recovery facilities code of practice recycling data

The Waste (Scotland) Regulations 2015 and the Code of Practice on Sampling and Reporting at Material Recovery Facilities (CoP) require the operators of certain Material Recovery Facilities (MRFs) in Scotland to report to SEPA on the composition of *dry recycling* processed at their facilities. As part of the OBC, Zero Waste Scotland has consulted with SEPA to understand how this existing monitoring system might be aligned to waste composition evidence needs for dry recycling.

It's worth immediately noting that MRF reporting is focused on dry recycling only, so the composition of non-recyclable (residual) waste is not captured through this system.

The composition of dry recycling site inputs

Sites report the total weight of a sample of input material, and the non-target and target weights for each of plastic, glass, paper, card, metals and other, plus non-recyclable material within the input sample. Sites also report total quantity of waste inputs, the total number and weight of samples and the average % target in a sample for each of Plastic, Glass, Paper, Card and Metal.

Data on site inputs would provide a broad assessment of composition by key recyclable categories. However, it lacks the granularity of material categories developed in the last household study in Scotland[9]. For example, it would be very difficult to produce an estimate for plastic packaging wastes with these broad categories.

The sample of input material can be attributed to a supplier and waste management site (e.g. dry recycling sent from a Stirling Council site). However, it would not differentiate whether the sample was sourced from household and commercial rounds. Where a local authority does not provide a commercial collection service it might be possible to attribute all data to household recycling. For others that do provide a commercial service, it may be possible to work back and establish the source of recycling that was sampled. However, it may prove hard to establish whether that sample was representative of the local authority (e.g. if the sample originated from a high or low performing area).

The composition of site outputs

The data on site outputs (following treatment on-site) is broken down into a more granular list of key recyclables that in some cases go beyond the material categories used in previous waste composition analysis (e.g. "Plastic - LDPE Film Clear"). However, detailed composition at the output stage would be hard to attribute to an individual source (e.g. local authority), as inputs to site might be held for a period,

[9] For example, plastics were split into ten categories including PET and HDPE bottles, dense plastic packaging, other dense plastic and plastic films.

material might be passed through more than once, and materials will be mixed from various sources.

The other consideration for a national methodology is the ability to match any MRF composition data to annual tonnage datasets for household (waste data flow) and commercial waste (site returns), in order to scale to national estimates. For household waste, it could be feasible to match dry recycling tonnages on waste data flow with typical input compositions by the broad material types, but this approach would not provide the required granularity as highlighted above.

Based on the review above, the MRF dataset is unlikely to provide an alternative approach to sourcing composition data for household dry recycling collections.