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Textile Product Stewardship Project
Post-Consumer Clothing, Homewares & Linen
Audit & Impact Report

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UsedFULLY®
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Revision History

Date	Who	Description	Version
10 May 2022	Deborah Crowe & Peter Thompson	Initial Draft	0.1
12 May 2022	Bernadette Casey & Peter Thompson	Review and finalisation for DRAFT release	1.0
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16 Sep 2022	Bernadette Casey & Peter Thompson	Final Version	1.2

Purpose of this Report

The Formary / UsedFULLY are undertaking a Ministry for the Environment Waste Minimisation Fund funded "Textile Product Stewardship Project" (TPSP), as defined by Deed Number 23433. The second stage (Year 2) of the project is currently underway, and this report is one of the deliverables for Milestone 1, Activity 1.3 defined in the Deed's Variation Number 1, as:

> Establish Product Stewardship requirements for post-Consumer Clothing and Linen based on analysis of 100kg Post-Consumer Clothing and Linen audit.
>
> This includes:
> - Collect textiles, analyse composition and weight
> - Environmental impact measurement calculations
> - Identify end-of-use product pathways for post-consumer clothing
> - Summarise findings in an Audit and Impact Report

This report is the summary of the findings.

Acknowledgements

Our thanks to Daniella Pretorius & Kelly Pretty for all their work auditing the products for this report, kindly supplied by St Vincent De Pauls Op Shop and West Auckland Resource Centre.

We are grateful to the Ministry for the Environment's Te Pūtea Whakamauru Para – Waste Minimisation Fund and the Textile Reuse Programme Foundation Partners, Alsco NZ, Barkers Clothing, Deane Apparel and Wellington City Council for their support

Disclaimer

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The Ministry for the Environment does not necessarily endorse or support the content of this publication in any way.

Executive Summary

Aotearoa New Zealand's textile industry is composed essentially of small and medium size enterprises (SMEs). What little remaining onshore textile manufacturing capability is in the wool sector, onshore garment manufacture is limited and highly dependent on the importation of textiles. The sector needs to strengthen its resilience, in particular, in terms of material and product supply. The textile ecosystem has been hit particularly hard by COVID-19 and suffered sudden drops in demand, disruptions of value chains and price increases, all creating significant challenges for the industry.

As consumer awareness grows of the environmental and social impacts of clothing and household linens, so too do the expectations of brands and retailers to provide more ethical and sustainable products. Other external forces are also catalysing change, linked to increasing national and international regulation, for example The Zero Carbon Act.

Over the last few years work of a core group of industry stakeholders through the Textile Reuse Programme has resulted in a clearer understanding of the elements required in order to support a Product Stewardship scheme for textiles. The lack of onshore textile manufacturing has necessitated viewing circularity not from a product level (textiles) but from a resource level in order to make progress (textiles are broadly cellulosic, protein or petrochemical based). The scale of textile waste is considerable, its impacts vast, requiring industrial-scale solutions including coordinated collection, aggregation and sorting through to viable and pragmatic alternatives to landfill.

There are several key differences between commercial textiles and consumer clothing and household linen, that make the latter more challenging:

- Commercial textiles tend to be homogenous, in large volumes.
- Commercial organisations have more control over take-back options, especially of uniforms.
- Direct supply relationships can be established between organisations and re-processors, including requirements for pre-sorting / dehardwaring and minimum volumes for decommissioning.
- Consumer clothing is highly individual, its material composition broad and varied.
- The key reasons that Brands have been reluctant to offer take back schemes are, the concern of being inundated with returns while there is a lack of scaled onshore solutions for end-of-use products, and the associated additional costs.
- Local councils do not have separate collection mechanisms for textile products.

The lack of available data on the composition, volumes and condition of post-consumer textile waste has been a barrier to assessing potential reuse and recycling opportunities, and to understanding the investment required to manage these resources at end-of-use. This audit and analysis of ~100kg Post-Consumer Clothing, Homewares & Linen provides insights into steps which can be taken towards product stewardship for these textiles in New Zealand – those which typically come through the Charity retail sector.

Results (percentages based on weight):

- 362 items of post-consumer clothing were collected from a charity (majority female clothing), weighing 76.9kg. Of these 353 were able to be analysed, with a total weight of 75.2kg (~98% of the garments collected).
- 215 items of post-consumer homewares & linen were assessed, weighing 49.7kg. Of these 199 were able to be analysed, with a total weight of 45.2kg (~91% of the items collected).
- Analysed items were loaded into the UsedFULLY Resource Management Platform, using WRAP UK Environmental Impact Metrics calculating the embodied CO_2e as 2.54T (Consumer Clothing 1.7T and Homewares & Linen 0.84T) and H_2O as 175.43kL (Consumer Clothing 119.41kL and Homewares & Linen 56.01kL).
- The audit process identified a total of 77 unique material compositions (9 single fibre, 68 blended fibre) – clothing had 72 unique material compositions (8 single fibre, 64 blended fibre), and homewares & linen, 25 (7 single fibre, 18 blended fibre). These were categorised as single fibre items, blended fibre items with and without "stretch" (containing elastane, lycra or spandex).
- Approximately 61% of the items were single fibre, with 39% blended (of the total, 24% were blends without stretch, while 15% were blends with stretch).
- Nearly 60% of the single fibre items were natural fibres (any synthesised cellulose fibres were not considered natural).
- Over 80% of the petrochemical based fibres were polyester, with a significantly higher percentage in clothing (~92%) than the homewares & linen (~69%).
- Blended fabrics made up 45% of the consumer clothing, of these about half contained stretch fibres. These stretch fibres are problematic for end-of-use processing, research is needed to investigate end-of-use solutions for textiles with stretch fibres.

The snapshot of products analysed shows that the majority of the items were suitable for reuse, with a few being identified as needing laundering or repair. Fast fashion, and now ultra fast fashion, is increasing the flow of these items into the market, the pace and volume is unlikely to be curbed without the intervention of regulation discouraging unsustainable practices.

It was encouraging that nearly 60% of the items were either cotton (~26%), polycotton (~18%) or polyester (~15%). The Textile Reuse Programme is focused on the research and development of solutions for these dominant fibre types. Solutions have been identified, trialled and are being scaled for polyester and polycotton with onshore supply chains developed with third party processors. Just over 11% are 100% single non-cotton natural fibres which are potentially compostable until solutions are available onshore. Leaving 30% with few viable end-of-use pathways other than any possible down-cycling or landfilling. This report describes the current end-of-use pathways for textile products.

Background

Background – This Audit

The waste generated by the textile and fashion industry falls into two general categories. Pre-consumer and Post-consumer waste. Pre-consumer waste refers to manufacturing offcuts and deadstock from the production process. Whereas Post-consumer waste refers to clothes and textile products discarded by consumers after use. Aotearoa New Zealand's secondhand clothing trade is led by charitable organisations who use the proceeds from the sale of donated used clothing and household linen to fund their charitable purpose. Charities have become a major channel for clothing and textile circularity but also receive large amounts of donated post-consumer products which are damaged or degraded and not fit for resale. The high volumes and associated increasing costs of waste disposal for these products are an unwelcome expense for these organisations. To date there has been a lack of available data on the composition, volumes and condition of post-consumer textile waste. This has created a barrier to assess potential reuse and recycling opportunities, and to further understand the investment required to manage these resources at end-of-use. This audit is the first step to address this data gap.

Background – The Bigger Picture

The world's clothing and textile system is simply no longer working, annual clothing production is over 100 billion units and only a tiny fraction of these are ever recycled. "*The production and consumption of textile products continue to grow and so does their impact on climate, on water and energy consumption and on the environment. Global textiles production almost doubled between 2000 and 2015, and the consumption of clothing and footwear is expected to increase by 63% by 2030, from 62 million tonnes now to 102 million tonnes in 2030*" (EU Strategy for Sustainable and Circular Textiles, 2022)

According to McKinsey & Company "*the industry is on a trajectory that will exceed the 1.5-degree pathway to mitigate climate change set out by the Intergovernmental Panel on Climate Change (IPCC)*". In order to reach the 1.5 degree pathway, fashion would need to cut its GHG emissions to 1.1 billion metric tons of CO_2 equivalent by 2030. However, McKinsey & Co's current growth calculations show that the industry is set to overshoot its target by almost twofold, with emissions of 2.1 billion metric tons of CO_2 equivalent in 2030. (Fashion on Climate, McKinsey & Company, 2020).

Aotearoa New Zealand is the largest producer of waste per capita and has the lowest recycling rates in the OECD. We have a responsibility to take local action to support a more sustainable, decarbonised industry. UsedFULLY's research into the state of textiles in NZ estimates that annually 220,800 tonnes of textiles are landfilled each year (Usedfully – Looking in the Mirror, 2020). Scotland's Carbon Metric found that materials such as textiles have high carbon impact relative to weight – textiles that made up just 6% of Scottish household waste by weight, account for 34% of net carbon impacts. To maximise the climate change benefits of waste and resource management, Zero Waste Scotland suggest that focus should be placed on carbon intensive waste materials such as textiles.

Waste priorities previously focused on volume to landfill. In the global efforts to halve carbon emissions by 2030, waste is being viewed with a new lens – the carbon impacts of these resources. Textile products with their outsized impacts are becoming front runners for regulation and policy attention. In Aotearoa New Zealand, while textile products are yet to receive policy attention at a national level, action is being taken at a regional level with Auckland Council recently declaring textiles a priority product.

In regions where the research into, and understanding of, the impacts of textiles has matured, there is a reordering of the waste priorities. In Europe the understanding of the resource implications and impacts of the textiles sector has matured to the regulatory phase. With Mandatory Extended Producer Responsibility (EPR) requirements, new rules to limit exports of textile waste and effectively a ban on textiles to landfill and incineration through legislation to establish separate collection of textile waste by 1 January 2025.

Australia's Environment Minister has added clothing and textiles to the priority list of products and materials for product stewardship, funding the development of Textile Product Stewardship to the tune of AUD$1million through the Environmental Protection Agency.

This re-prioritisation of resources is not just happening at central government, but also at local government. In West London (United Kingdom), a 2021 investigation into the carbon impacts of textile waste has created new priorities of textiles and plastics within their authority. The following diagram shows textiles have the highest impact ratio to weight of all the waste categories, ~22 times its weight (354,520t CO_2e for 15,890t textiles), compared to food waste ~ 4 times (568,970t CO_2e for 153,720t food waste) and plastics with a similar weight at only ~3 times (48,780t CO_2e for 14,890t plastics).

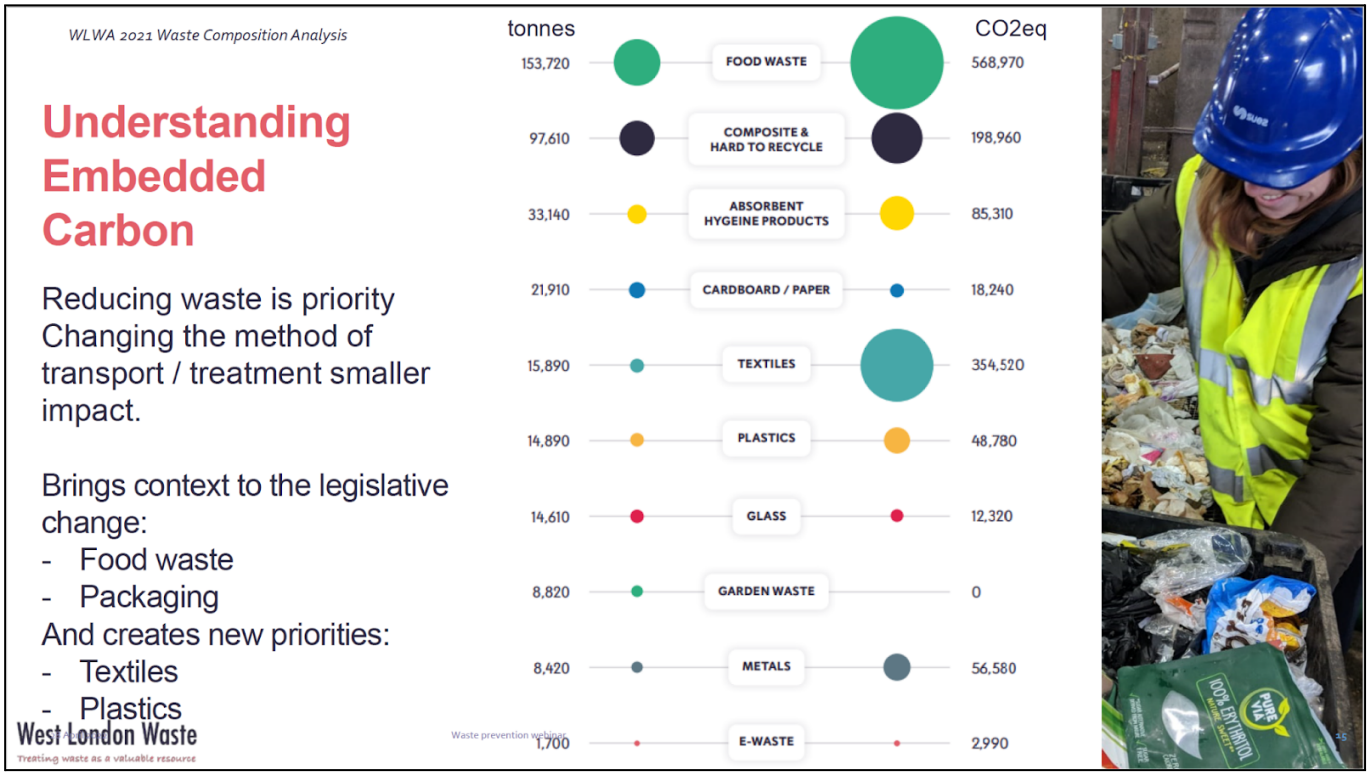

Figure 1 – West London Waste – Oversized Impact of Textiles

About UsedFULLY®

UsedFULLY's mission is to transition industry to a low carbon, circular economy by implementing new technologies and business models at scale. Reducing the environmental impacts of clothing and textiles aligned with global decarbonisation targets. Ensuring the full value of textile resources are maximised, to minimise the impacts of what we clothe and protect ourselves with. Creating a better world for all.

Working together with industry partners, UsedFULLY is driving the reuse of unwanted clothing and textiles, preventing them from going to landfill by co-designing and implementing a national textile circular system to fully utilise this untapped resource.

The textile industry in Aotearoa New Zealand is broad and includes domestic clothing, domestic textiles, commercial clothing, commercial textiles and industrial textiles. In the absence of a national textile body, UsedFULLY has been providing expert industry advice to Government and advocating on behalf of the textile industry.

To find out more we invite you to visit our website usedfully.com, and to read some of our recent publications:

- Looking in the mirror : A review of circularity in the clothing and textile industry in Aotearoa (November 2020)
- Usedfully – Textile Reuse Programme : Submission on the Climate Change Commission Draft Proposal (March 2021)
- Recommendations to the New Zealand Government from the Clothing & Textile Industry (May 2021)

Methodology & Process

Audit

1. Engage with potential suppliers of post-consumer textiles, identify their willingness to participate in the project by supplying textiles for audit (target 100kg). Participants to sign a participation agreement.
2. Refine and implement systems employed previously for corporate clothing and textile end-of-use audits (as undertaken for Auckland Council, Watercare, Wellington Zoo etc.) to analyse the textiles, particularly their composition and weight.
3. Analysis
    a. Using a spreadsheet, record as much detail as deemed informative for the purpose of the activity. Such things to be recorded are:
        i. the Description and Category of the textile e.g. Wrap Dress (Orange) – Clothing – Dress.
        ii. if applicable, the Brand, Condition and Colour.
        iii. photos (where required for understanding of the product).
        iv. the product weight (use handheld scales).
        v. if possible, record the product composition from the label.
        vi. if impossible (label not available), use the Sagitto scanner to analyse the fabric by spectroscopy utilising Sagitto's system (database and AI techniques) – record the link to the garment's Sagitto report (stored online in the Sagitto portal).
        vii. record any notions e.g. buttons, zips etc.
        viii. as needed, take any other notes.
2. UsedFULLY Resource Management Platform – recording and measuring impact.
    a. Flesh out the data in the spreadsheet to incorporate the necessary calculations to estimate the embodied environment impacts (CO_2e and H_2O).
    b. Set up an appropriate user login for the UsedFULLY Resource Management Platform – accessed with password from the UsedFULLY website here.
    c. Create the necessary organisation, to load / register the garments into the platform for, to calculate the embodied environment impacts.
3. Analyse audit results to identify end-of-use product pathways for post-consumer textiles.
4. Summarise findings in this Audit & Impact Report.

Audit Impact Measurement

The Usedfully Resource Management Platform (MVP) platform is used to register garments, recording the details of the garments – weight and blend of fibre types (e.g. percentage of cotton, polyester, wool etc.). The total weight of each fibre type is determined, and a calculation completed by applying a factor (based on WRAP UK modelling estimates in the figure below) to estimate the embodied footprint of all the garments/products registered.

Fibre type	Average footprint per tonne of fibre in clothing		
	Carbon (tCO_2e)	Water (m^3)	Waste (t)
Cotton	28	3,100	1.6
Polyester	21	80	1.4
Viscose	30	3,800	1.6
Acrylic	38	130	1.4
Wool	46	2,200	1.6
Polyamide (nylon)	24	80	1.4

Figure 2 – WRAP UK – Carbon, Water & Waste Footprint of Clothing

By finding an alternative use for these products other than landfilling, resources are conserved, reducing the impact of drawing on new virgin resources, for example:

- One t of new polyester has a carbon footprint of 21t CO_2e and a water footprint of 80,000L H_2O.
- One t of new cotton has 28t CO_2e and 3,100,000L H_2O.
- One t of new 65:35 polycotton has 23.5t CO_2e and 1,137,000L H_2O.

These figures give us the basis for impact calculations on an estimated embodied footprint.

There is currently no industry standard for measuring the environmental impacts of textiles and clothing, with an increasing number of tools emerging onto the market e.g. WRAP UK, Higg Index, Kerring etc. Merino NZ is looking to develop its own set of metrics. The UsedFULLY Resource Management Platform currently uses WRAP UK data and is investigating other data sets as additional calculators on the platform, broadening its calculation tool-set so users can select their preferred measurement system until an industry standard emerges.

Audit Results

Collection, Evaluation & Data Capture

In total the audit encompassed some 577 textile pieces with a total weight of 126.6kg.

Textiles were acquired from two sources – St Vincent De Pauls Op Shop, Kilbirnie, Wellington and West Auckland Resource Centre (WARC), New Lynn, Auckland. The Wellington garments were collected and audited by UsedFULLY ("Consumer Clothing"). Kelly Pretty from WARC audited an agreed selection of textiles from their centre ("Homewares & Linen").

Observations

The interactions with the possible textile supplier participants in this project highlighted:

- Five different organisations were contacted to arrange collection. Of the five, only one organisation was willing to provide items.
- Organisations were not willing to provide textiles for various reasons, commonly due to not wanting customers to know how much donated clothing was thrown away.
- Were happy to help but not currently accepting textile donations because they were at capacity.
- Others had no available unsorted textiles as they were already on the shop floor.
- Stores did not want textiles returned, they were already inundated.
- Majority of donations are of female clothing.
- Impacted by COVID-19 e.g. currently not open or limited staff available.
- Reluctance to sign a participation agreement, wanted an informal arrangement.
- Local store pushed to Head Office, Head Office pushed back to local store.
- Coordination difficulties due to part-time or volunteering staff.
- Real lack of understanding and limited / no measurement of volume through stores, how much is donated, how much sold / unsold etc. (some realisation of lower quality, higher quantity of donations, and resulting rising cost of disposal against income from sales).
- Variable processes around textile acceptance criteria, sorting process re-saleability etc.
- No laundering or repair undertaken.
- In sorting potentially contaminated textile products there was some mask use by staff (due to COVID-19) but other PPE (gloves etc.) was not widely evident.

Analysis was significantly slowed by having to scan. Initial sorting analysis timings with scan showed on average 17 items per hour (3.7kg), whereas this nearly doubled without a scan process (where labels were available).

Post-Consumer Clothing – Process & Timings

The collection coordination took ~8 hours, contacting and arranging with prospective sources of post-consumer clothing. The physical collection took 4 hours (~80 minutes travel and 160 minutes logistics). Eight heavy-duty black bags were filled and transported.

A total of ~50 hours was spent on the audit, processing the 76.9kg of product over four weeks, including admin tasks (spreadsheet clean up, Sagitto log links, changes to sheet, photo links, etc.). The sorting and analysing process involved setting up a workstation in a well ventilated area (tables, Sagitto scanner, PPE, laptop, notepad, boxes/bags, etc.), processing items following this process:

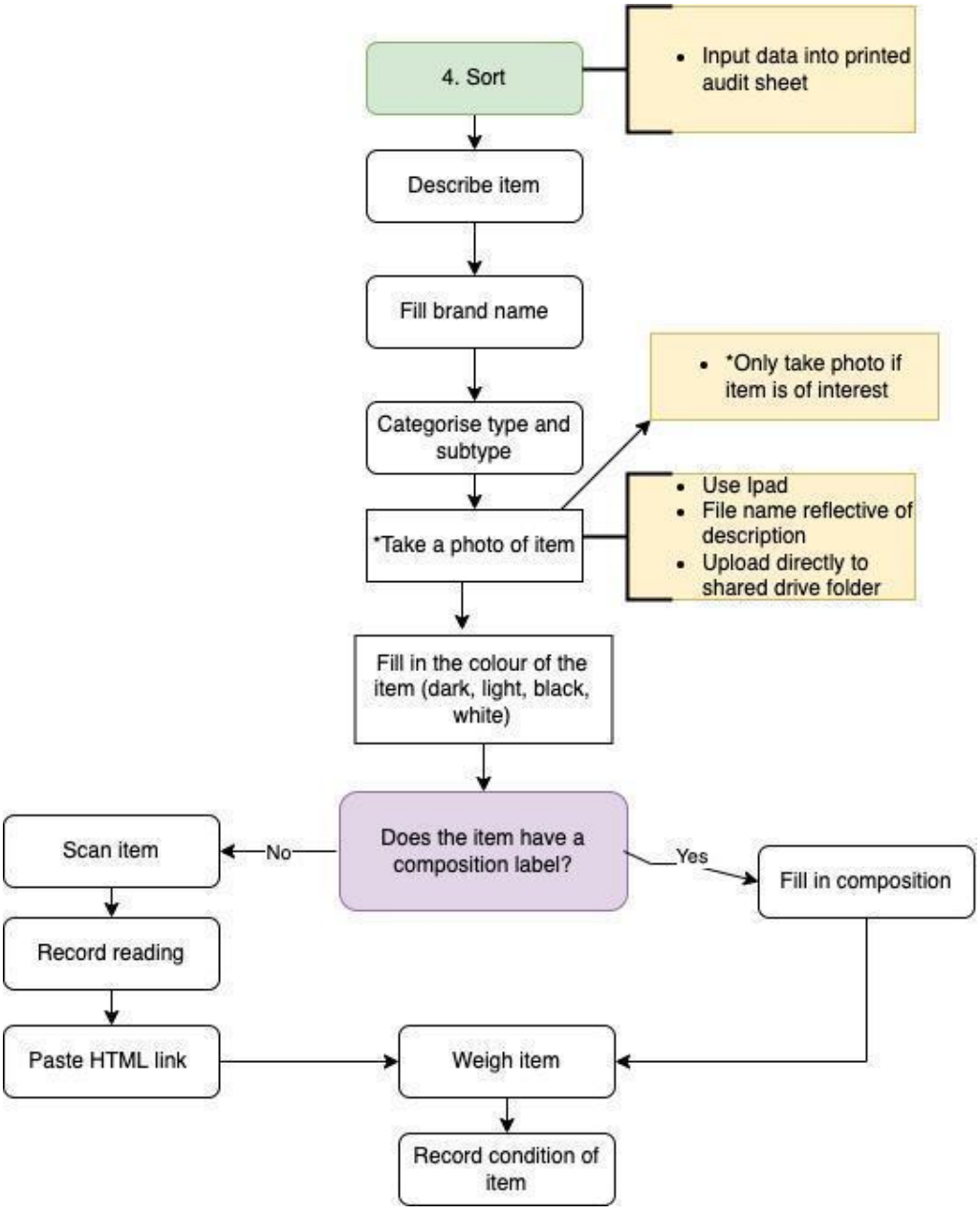

Figure 3 – Audit Sorting Process Flow

For each item the following details were noted and input into the audit spreadsheet:

- Brand name
- Notions e.g. zips (length / metal or plastic / number), buttons / domes (size / metal or plastic / number), reflective tape (length / width), anything unusual about the garment.
- Category (linen or clothing)
- Composition
- Weight
- Colour
- Condition

To gather information about how long the sorting process took, a 4 hour sorting sample was recorded as processing the following per hour (including items which needed to be scanned via Sagitto):

- 1 hour = 18 items = 3.8kg
- 1 hour = 19 items = 3.7kg
- 1 hour = 16 items = 3.5kg
- 1 hour = 15 items = 3.2kg

  (Total = 14.2kg)

A further 15 minute sorting process sample was recorded as the following (excluding items that needed to be scanned via Sagitto):

- 15 minutes = 8 items = 1.7kg

Post-Consumer Homewares & Linen – Process & Timings

The West Auckland Resource Centre (WARC) was approached and asked to contribute to the audit in order to obtain a sense of homewares & linen. WARC had suitable textiles onsite, and a Sagitto scanner to identify material composition.

Kelly Pretty from WARC spent a total of ~22 hours sorting, evaluating and logging the homewares & linen data into the spreadsheet, processing 49.7kg of product.

> *At a basic level, processing the clothing took over a third longer than the homewares and linen (approximately 1.5 compared to 2.3 kg/hr). This was not unexpected as there was considerably more complexity and variety of textiles in the clothing. While offering significant employment opportunities, the processing speed will be a determining factor in the viability of end-of-use pathways for post-consumer textiles.*

Summary – Weight & Numbers

For the Clothing, approximately 362 garments were collected for auditing, a total weight of 76.9kg. Of these 353 were able to be analysed and loaded into the platform with a total weight of 75.2kg (~98% of the garments collected).

For the Homewares & Linen, some 215 items were identified for auditing, a total weight of 49.7kg. Of these 199 were able to be analysed and loaded into the platform with a total weight of 45.2kg (~91% of the garments collected). Items included blankets, duvet covers, sheets and pillowcases, towels, tea-towels, tablecloths, upholstery fabric, scrap fabric and curtains.

Overall, 552 of the 577 garments were able to be analysed, 120.7 of 126.6kg (~95% by weight).

Approximately 25 garments with total weight of 5.9kg (~5%) were unable to be analysed (excluded from the data set) as:

- no label present and a scan was unable to determine definitively the fabric composition e.g. high degree of blended fibre, "complex blend" which could not be defined.
- label present but unhelpful in determining the fabric composition, or was an unusual fibre e.g. Chemical Fiber, Triacetate, Polynosic etc. which a scan was unable to understand.

Impact Results

The data was loaded onto the UsedFULLY Resource Management Platform in two categories:

1. Consumer Clothing (St Vinnies)
2. Homewares & Linen (WARC Trust)

The platform calculated the embodied CO_2e as 2.54t (Consumer Clothing 1.7t and Homewares & Linen 0.84t) and H_2O as 175.43kL (Consumer Clothing 119.41kL and Homewares & Linen 56.01kL).

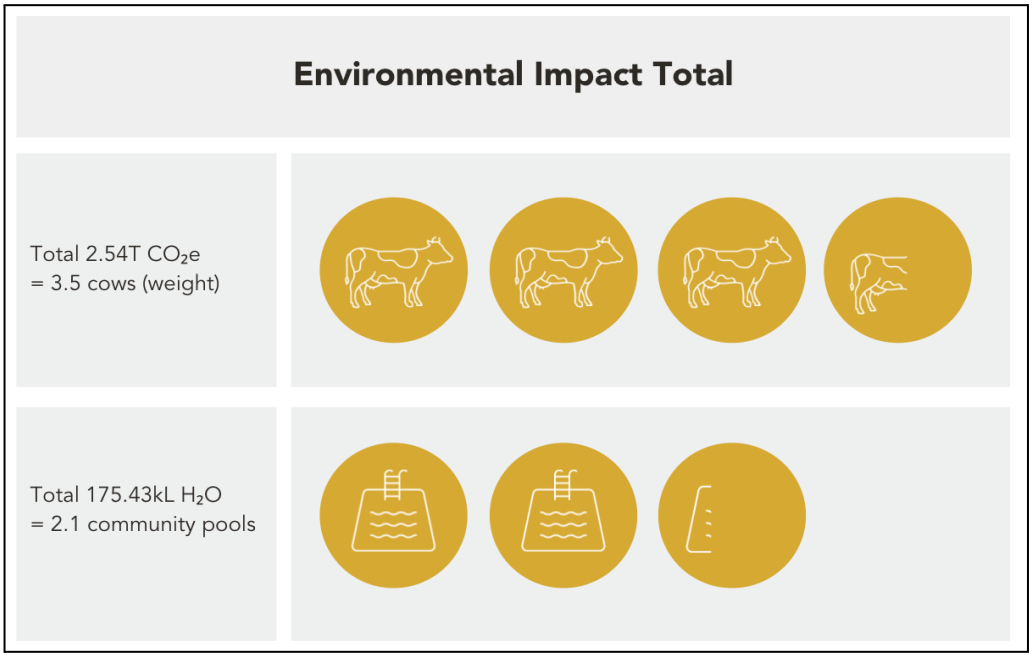

Figure 4 – Environmental Impact of Audited Textile (Carbon & Water)

Following are three dashboard images from the platform highlighting the impacts – first two are for each category, with the third one for both of the categories combined.

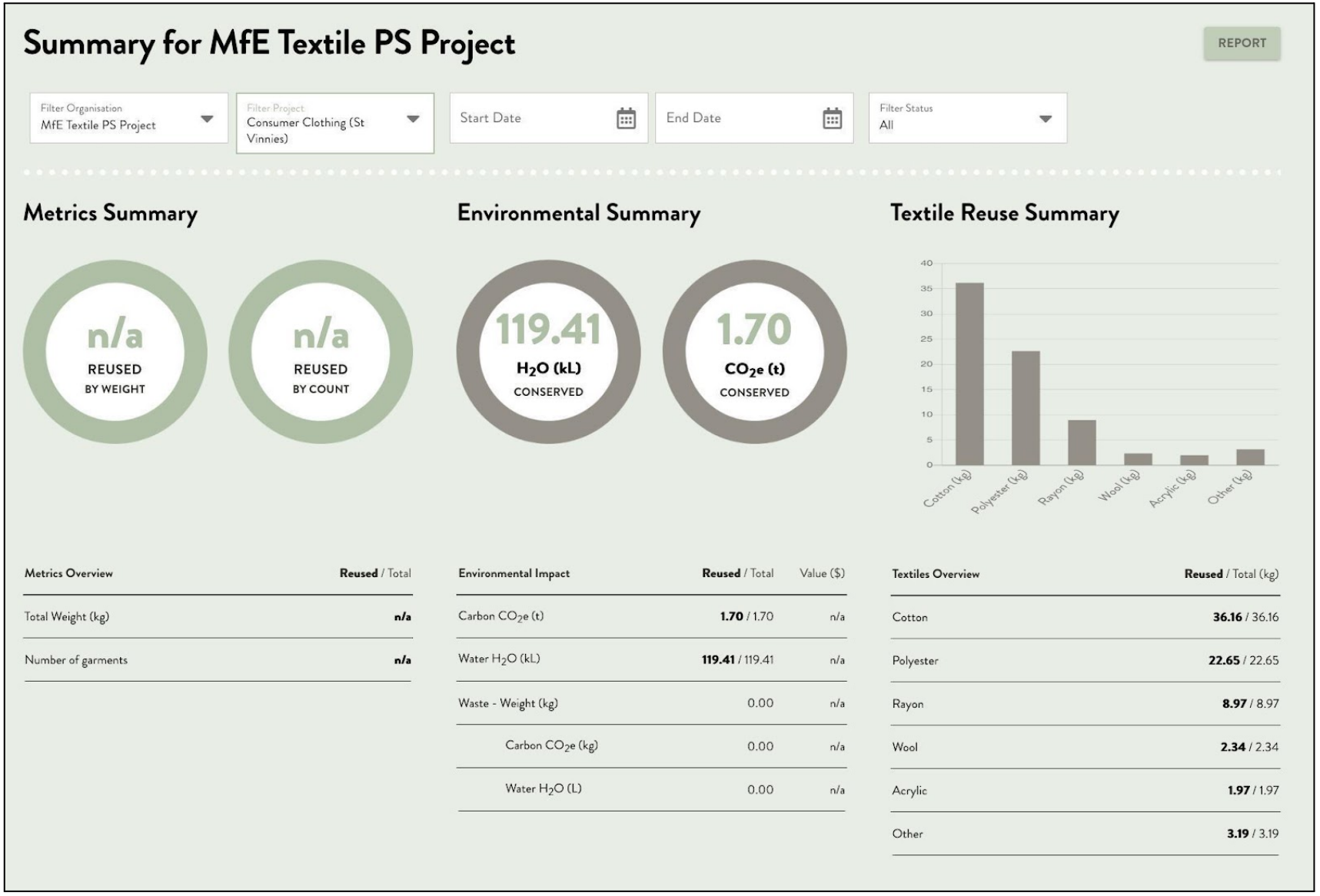

Figure 5 – UsedFULLY Platform – Dashboard of Impacts for "Consumer Clothing (St Vinnies)"

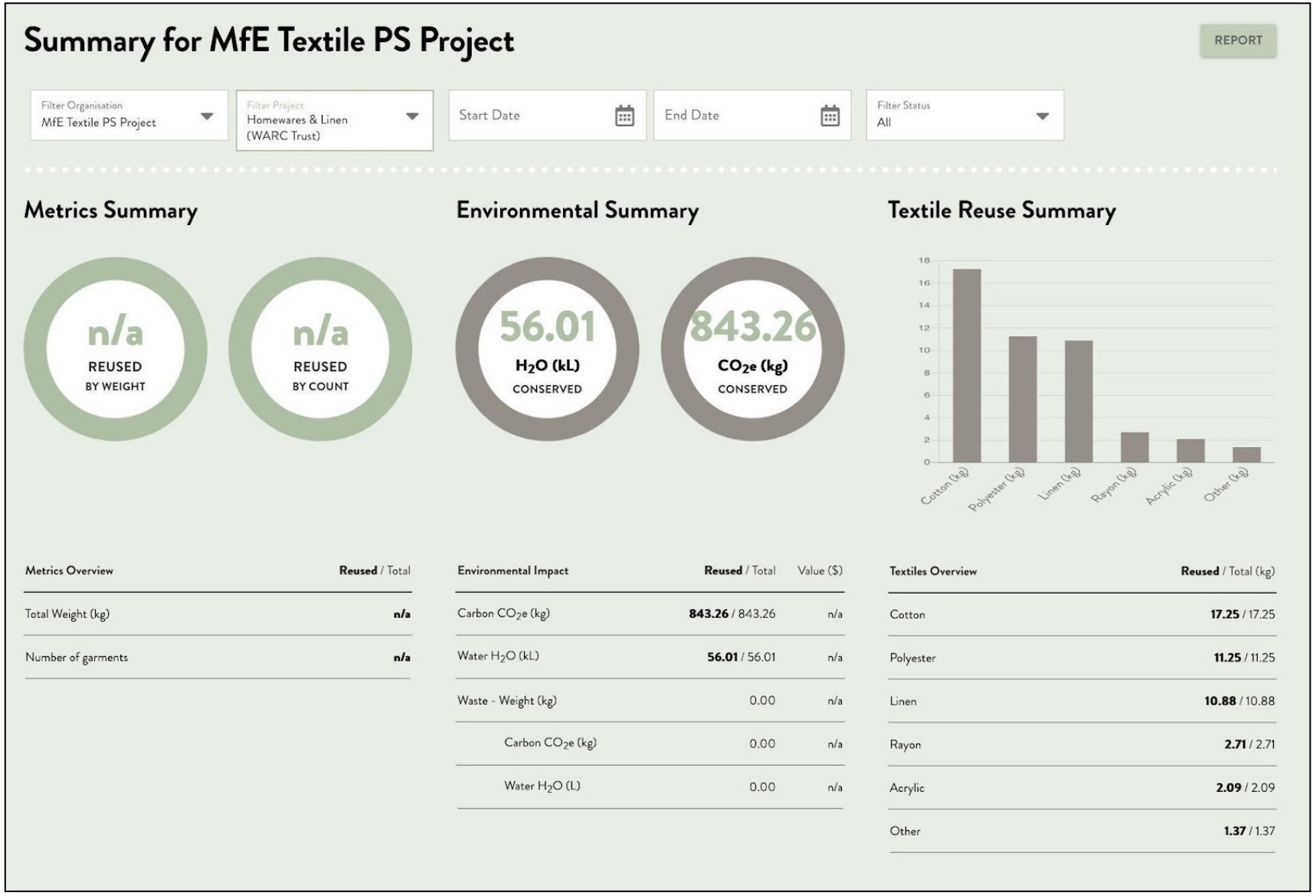

Figure 6 – UsedFULLY Platform – Dashboard of Impacts for "Homewares & Linen (WARC Trust)"

Figure 7 – UsedFULLY Platform – Dashboard of Impacts for All Textile Audited

Material Composition Analysis

The audit process identified a total of 77 unique material compositions (9 single fibre, 68 blended fibre) – clothing had 72 unique material compositions (8 single fibre, 64 blended fibre), and homewares & linen, 25 (7 single, 18 blended). These were categorised as single fibre items, blended fibre items with and without "stretch" (containing elastane, lycra or spandex).

The following table provides a summary of the items analysed:

	All			Consumer Clothing			Homewares & Linen		
Description	Weight	#	% Wgt	Weight	#	% Wgt	Weight	#	% Wgt
Single Fibre	73.5	329	60.9%	40.9	207	54.4%	32.6	122	71.6%
100% Single – Natural	45.4	193	37.6%	24.3	115	32.3%	21.1	78	46.4%
100% Single – Petrochemical	21.3	104	17.6%	12.6	69	16.8%	8.7	35	19.1%
100% Single – Synthetic Cellulosic	6.7	32	5.6%	4.0	23	5.3%	2.7	9	5.9%
100% Cotton	31.8	154	26.3%	22.1	106	29.4%	9.7	48	21.3%
100% Polyester	17.5	90	14.5%	11.6	66	15.4%	6.0	24	13.2%
Blend (Not Single Fibre)	47.2	223	39.1%	34.3	146	45.6%	12.9	77	28.4%
100% Polycotton	21.3	111	17.6%	10.8	50	14.4%	10.5	61	23.1%
100% Natural Blend	0.3	2	0.2%	0.2	1	0.3%	0.1	1	0.2%
Other Blends	25.7	110	21.3%	23.4	95	31.1%	2.3	15	5.1%
Single Fibre or Polycotton with Stretch	15.0	73	12.4%	12.7	58	16.9%	2.3	15	5.1%
Other Blends with Stretch	3.7	14	3.1%	3.7	14	4.9%	0	0	0.0%
Other Blends without Stretch	7.0	23	5.8%	7.0	23	9.3%	0	0	0.0%
All Textile	120.7	552	100%	75.2	353	100%	45.5	199	100%

Figure 8 – Blend Analysis for All Textile Audited

The Blend Analysis is broken down as:

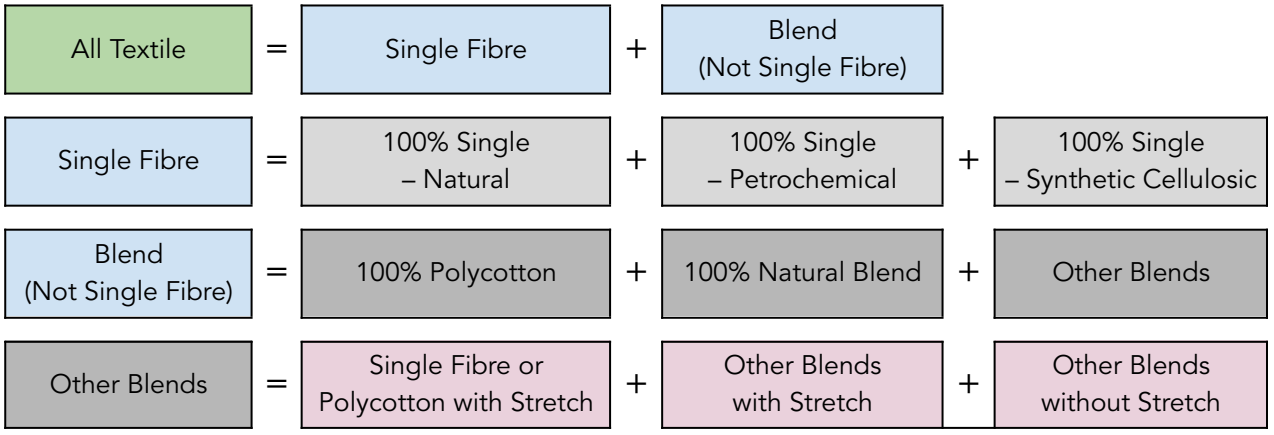

Figure 9 – Blend Analysis Breakdown

Approximately 61% of the items were single fibre, with 39% blended (of the total, 24% were blends without stretch, while 15% were blends with stretch).

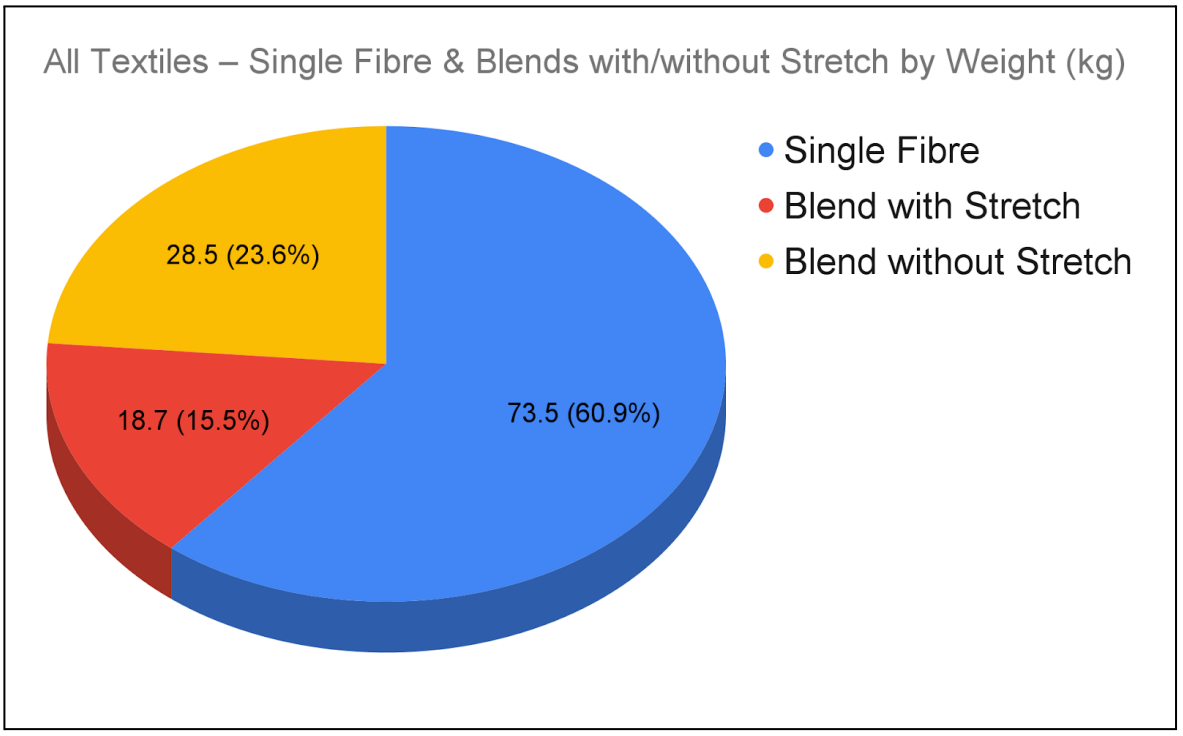

Figure 10 – Chart (All Textiles) – Single Fibre & Blends with/without Stretch by Weight (kg)

The 100% natural fibres are more likely to be found in homewares & linen than in the clothing, with 32% in clothing and 46% in homewares & linen.

Polycotton was more prevalent in homewares & linen than clothing.

Only 5% of homewares & linen were mixed blends that are not polycotton, and they all contained stretch fibres.

Single Fibre Items

Single fibre compositions are likely to have easier pathways at end-of-use, they can be classified in terms of their material resource:

1. Natural, which contain cellulosic or protein fibres:
    - Cellulosic – e.g. bamboo, cotton, flax, hemp, jute, linen, nettle, ramie.
    - Protein – e.g. merino, possum, silk, wool.
2. Synthetic Petrochemical – e.g. acrylic, nylon, polyester, satin (now typically polyester), trevira (flame retardant polyester).
3. Synthetic Cellulosic – e.g. lyocell, rayon, viscose.

Of note, nearly 60% of the single fibre items were natural fibres. Natural fibres are "at worst" compostable at end-of-use (any synthesised cellulose fibres were not considered natural as their compostability is unknown). Over 80% of the petrochemical based fibres were polyester, with a significantly higher percentage in clothing (~92%) than the homewares & linen (~69%).

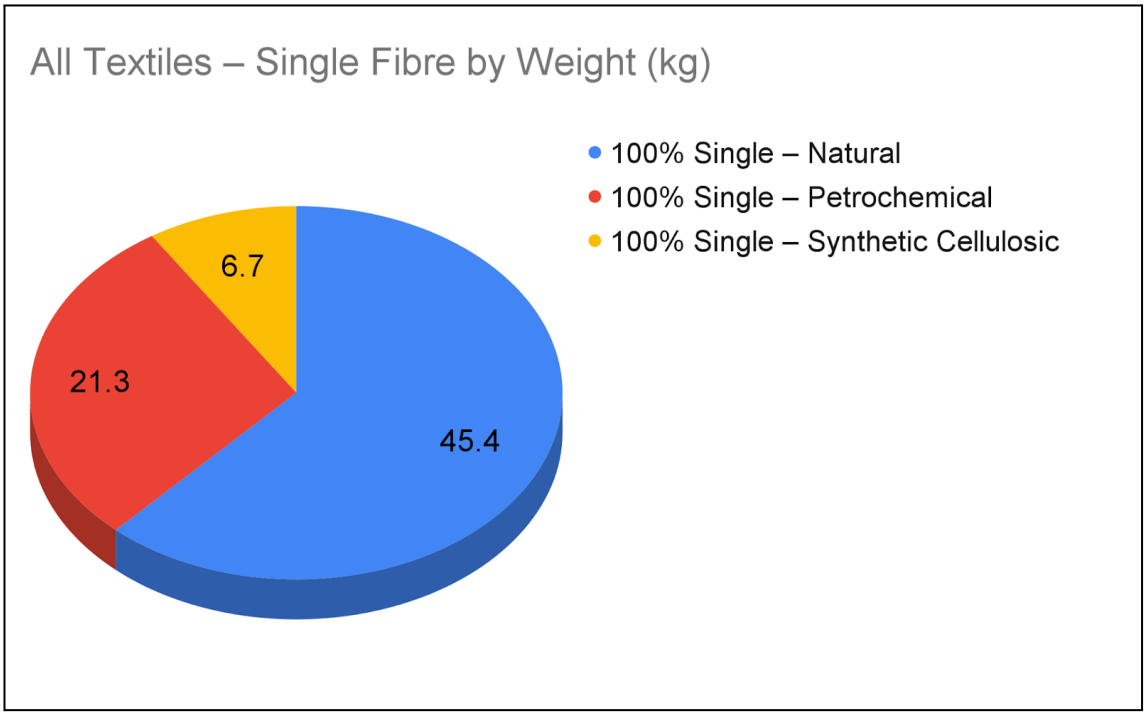

Figure 11 – Chart (All Textiles) – Single Fibre by Weight (kg)

Blended Fibre Items

We have classified blends into those which are:

- 100% natural fibre blends (e.g. merino + possum + silk; cotton + linen).
- Polycotton (of which there were 17 different ratio combinations of polyester and cotton).
- Other blends.

Cotton, polycotton & polyester are targets for commercial second generation products. Nearly 18% of the total items were polycotton, comprising ~14% of clothing and ~23% of homewares & linen. We have specifically assessed polycotton as there are known end-of-use product pathways in development for polycotton.

Other blends tend to be varied, with a broad array of material compositions recorded. This variability makes these products problematic for existing end-of-use pathways (further research and development of possible end-of-life uses for these will be required).

Blended Fibre Items with Stretch Fibres

Elastane, spandex or lycra are a common additive in textiles for stretch and comfort and is one of the more common components of Other Blends.

Blends with stretch made up 15.5% of all items and were far more prevalent in clothing (22% of total) than homewares & linen (5.1% of total).

Blended fabrics made up 45% of the consumer clothing, of these about half contained stretch fibres. These stretch fibres are problematic for end-of-use processing as they provide additional elasticity which affects mechanical processing while contaminating the majority fibre of the textile – research is needed to investigate end-of-use solutions for textiles with stretch fibres.

End-of-Use Product Pathways

Rewear / Reuse / Resell

With the rise of the secondhand reseller market, more used clothing flows first through resellers before donation to charity stores. Reseller stores range in product offering from Hunters and Collectors who carry international designers such as Vivienne Westwood and Comme de Garcon, Recycle Boutique stores which resell mostly mid-range fashion, to Paper Bag Princess which receives and sells slow stock from Recycle Boutique.

Charities are an enduring player in the clothing resale market but are being left with lower quality goods, attracting lower returns and higher volumes of waste and disposal costs, making it more difficult for them to fund their charitable purpose.

Exporting clothes for reuse and recycling is perceived as increasingly risky. With the added environmental and financial costs of transporting used resources across borders, international shipments of used textiles are decreasing.

Remaker spaces are becoming more popular, however the work can be labour intensive and most do it more for love and environmental reasons rather than commercial outcomes.

Interestingly, the audit identified that the majority of the items were suitable for rewear or reuse, with a few being identified as needing laundering or repair first – of the 577 items, 26 required laundering and 7 repairing; only 16 items were considered soiled or damaged beyond laundering or repair. However, it is interesting to note that the charity did not want these items back – they already have far more than they could sell.

Organisations such as Free For All are attempting to bridge the gap between these still usable items and people in need. Most charitable organisations working in the used clothing space are heavily reliant on the labour of unpaid volunteers.

Recycle

With the well documented global overproduction of textile products, there is a surplus to market. Some of which will go directly to available recycling initiatives. Examples are garments which have security or brand sensitivities, such as front-line uniforms or corporate clothing which cannot be looped through the resell/charity model. Clothing that has been looped through the rewear/resell process and has now reached end-of-life as a garment and is no longer wearable. As well as lower quality fast and ultra fast fashion clothing that has not been designed for extended life and fails fast.

It was encouraging that nearly 60% of the items were either cotton (~26%), polycotton (~18%) or polyester (~15%), as these will soon have local second generation end-of use product pathways as a result of research and development through the Textile Reuse Programme, which focuses on these dominant fibre types.

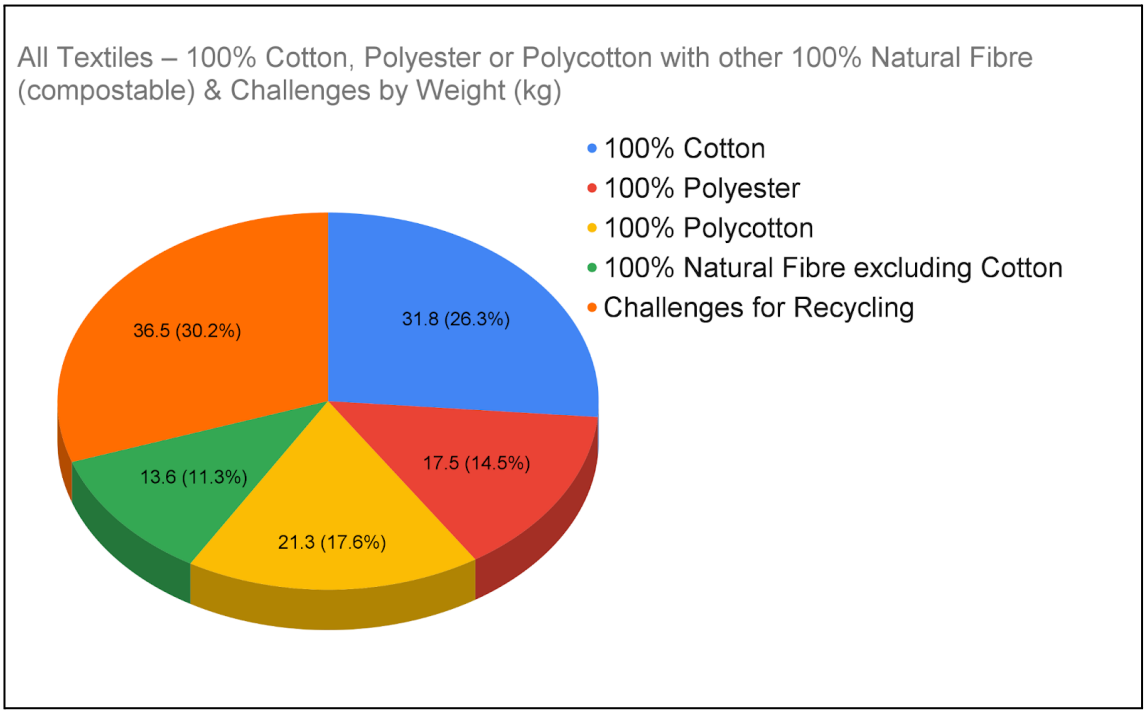

Figure 12 – Chart (All Textiles) – 100% Cotton, Polyester, Polycotton with Compostables & Challenges by Weight (kg)

Just over 11% are 100% single non-cotton natural fibres which are potentially compostable until other solutions are available. Leaving 30% with few viable end-of-use pathways other than any possible down-cycling or landfilling.

There are a handful of commercial organisations working on end-of-life recycling solutions for textile products. For example Textile Products and Terra Lana who predominantly work with wool offcuts and waste creating insulation, moving blankets and other second generation wool products.

Australian company Upparel has recently entered the market, aggregating and sorting textiles. They are looking to onshore capability in the future to turn used textiles into shoddy, stuffing and fillers.

The Textile Reuse Programme investigated fibre-to-fibre processing technology in the US using local waste textiles (Air New Zealand uniforms decommissioned in Los Angeles). While the project was

successful (able to take textiles back to raw rPET pellets), the business case for establishing fibre-to-fibre technology onshore is not currently feasible (too early stage technology development, very expensive, not viable for relatively small volumes onshore in Aotearoa New Zealand) , globally these technologies are yet to reach full commercial scale.

Little Yellow Bird currently has a project sending used cotton clothing to Europe connecting into a fibre-to-fibre process. Cost to participants is $20 a bag for 1 – 10 items.

UsedFULLY has focused on onshore processing of the dominant textile types – Cotton, Polyester and Polycotton. Due to the lack of onshore textile capability for these fibre types, research and development has focused on these textiles from a resource not a product level. Creating industrial scale waste-to-value solutions such as "StrengthTex" – a cellulose replacement for the roading industry. The first road using this high-value second generation product was laid in Wellington in April 2022. Work continues on other applications of textile resources within the construction and other industries.

Product Stewardship for Textiles

Production volumes continue to increase and are not anticipated to ease until global population rates plateau around 2064. With the entry of Ultra-Fast Fashion into the market, the quality of some clothing is further diminishing, increasing the churn of these garments and making rewear and resale of these items less viable.

There are several key differences between commercial textiles, and clothing and homewares & linen, that make the latter more challenging:

- Commercial textiles tend to be homogenous, in large volumes.
- Commercial organisations have more control over take-back options, especially of uniforms.
- Direct supply relationships can be established between organisations and re-processors, including requirements for pre-sorting / dehardwaring and minimum volumes for decommissioning.
- Consumer clothing is highly individual, its material composition broad and varied.
- Brands have been reluctant to offer take back schemes for fear of being inundated with a lack of scaled onshore solutions for returned products.
- Local councils do not have separate collection mechanisms for textile products.

Over the last few years work of a core group of industry stakeholders through the Textile Reuse Programme has resulted in a clearer understanding of the elements required to support a Product Stewardship scheme for textiles. Globally emerging fibre-to fibre technologies are all yet to reach commercial scale, the lack of onshore textile manufacturing has necessitated viewing circularity not from a product level (textiles) but from a resource level in order to make progress (textiles are broadly cellulosic, protein or petrochemical based). The scale of textile waste is considerable, its impacts vast, requiring industrial-scale solutions including coordinated collection, aggregation and sorting through to viable and pragmatic alternatives to landfill.

The Industry's Recommendations to Government (2021) proposed that a mandated Product Stewardship Responsibility Contribution (levy) on all textile products brought to market would assist in funding the existing plant and infrastructure gap, drive job creation and economic benefits for Aotearoa New Zealand. It is currently unclear where the responsibility to move this forward lies. Is it central government, local government, community organisations, industry itself, for-profit organisations, or a combination of all? In an ideal world this sort of work may sit within an Industry Body, however no such body currently exists for the textile sector in Aotearoa New Zealand.

> The industry has voiced a strong preference for a mandated scheme over voluntary participation, which punishes first movers and more progressive organisations. Discussions with publicly listed brands, which contribute larger volumes of textile products to market, highlighted that shareholders are unlikely to support voluntary participation in a scheme (suggesting it would need to be mandated to get approval from board members and shareholders). Without larger brands participation, boutique and smaller or more progressive brands would unfairly shoulder the responsibility and is unlikely to result in a feasible, equitable, financially sustainable Product Stewardship scheme.

Addressing circularity and decarbonisation of the industry needs to be expanded beyond "Waste Management" and viewed alongside the economic, political, and socio-cultural environment. The opportunity for increased regional resilience, industrial & commercial autonomy and economic and social opportunity through a revitalised industry could be catalysed through the implementation of a textile product stewardship scheme. The vehicle to achieve this is yet to be determined, one possibility would be to establish a Textiles Working Group within the appropriate government organisation to enable a greater two-way flow of knowledge, expertise and support between industry and government. Closer industry-government collaboration is needed in order to develop potential approaches to funding and financing of viable Textile Product Stewardship including:

- the establishment of a Textile Product Stewardship Scheme.
- ongoing research to establish pragmatic, onshore end-of-use solutions, particularly for complex post-consumer textiles blends.
- financing and assignment of infrastructure for collection, aggregation and sorting of post-consumer and post commercial textile resources.
- behaviour change initiatives to support and educate citizen consumers in sustainable consumption and care practices, and industry practitioners in ethical production and consumption; and stewardship of resources.

Appendix 1 – Data Collection Raw Data

Here are links to the two Google Sheets used to capture the audit data – please note these sheets may have links to other files e.g. photos or scan results (which may or may not be accessible).

- Post-Consumer Clothing
- Post-Consumer Homewares & Linen

Appendix 2 – Audit Analysis

Here is the link to the Google Sheet used to collate & analyse the raw audit data – please note these sheets may have links to other files e.g. photos or scan results (which may or may not be accessible).

- Audit Analysis

Appendix 3 – Glossary

Term	Definition (In the context of this report)
Textile	Textile is an umbrella term that includes various fibre-based materials, including fibres, yarns, filaments, threads, and different fabric types. Textiles are divided into two groups – Domestic purpose [Consumer textiles] and Commercial textiles, also called technical textiles where functional properties are the priority (e.g. Geotextiles, industrial textiles, medical textiles, PPE etc).
Post–Consumer	Textiles that have been acquired/used by an individual(s), and are no longer required by that individual(s).
Homewares & Linen	Goods and products used within households. Household goods made from textiles intended for daily use, such as bedding, tablecloths, towels, and curtains etc. (explicitly exclude shoes and carpet/underlay).
Single Fibre	Textiles that comprise 100% of the same material, where that material is either: 1. Natural, which contain cellulosic or protein fibres: a. Cellulosic – e.g. bamboo, cotton, flax, hemp, jute, linen, nettle, ramie. b. Protein – e.g. merino, possum, silk, wool. 2. Synthetic Petrochemical – e.g. acrylic, nylon, polyester, satin (now typically polyester), trevira (flame retardant polyester). 3. Synthetic Cellulosic – e.g. lyocell, rayon, viscose.
Blended Fibre	Textiles that are made of two or more different materials.
Second Generation Products	Products which are no longer being used for their primary purpose, whose value is being extended through redesign into another product (e.g. end-of-life clothing that has been remanufactured into insulation).
Stretch Fibres	A material called elastane or spandex (also known by the brand name of Lycra) – a synthetic fabric made out of stretchy elastomers that come from a polymer called polyurethane. Often used to add stretch and comfort to a garment through the addition of a small percentage to a blended fibre textile.
Ultra-Fast Fashion	Fast fashion is a design, manufacturing, and marketing method focused on rapidly producing high volumes of clothing. Recent increased pace has led to the coining of the phrase "ultra-fast fashion".
Rewear	When a garment is passed onto another person for use in its original form.
Reuse	When a textile product is used again, with no alteration to the original product.
Resell	When a textile is sold on to another person for use in its original primary purpose i.e. to be reworn / used by someone else.
Recycle	When a textile product is deconstructed into smaller units (possibly back to its constituent parts), which can then be in a process to create a new product.
rPET	When a polyester textile product has been recycled back into its raw form – creating recycled Polyethylene Terephthalate – PET is used to create polyester fibre for clothing.