CITY OF LOS ANGELES

Textile Recovery Project

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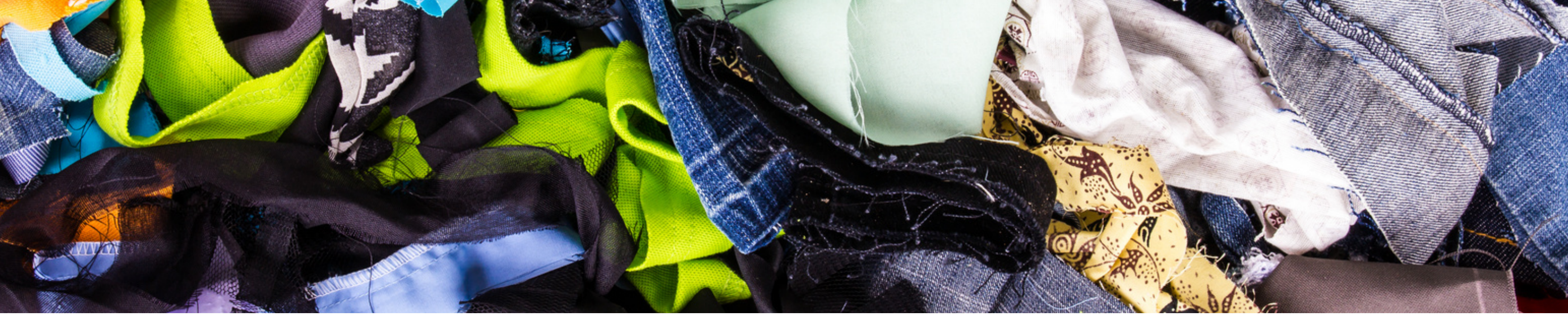

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ACKNOWLEDGEMENTS

The City of Los Angeles Textile Recovery Pilot report was prepared by LA Sanitation & Environment (LASAN) in partnership with California Product Stewardship Council (CPSC). Thank you to the project team listed below, who provided support and contributed to the completion of this report.

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1.0 EXECUTIVE SUMMARY

Textile manufacturing contributes to between three and ten percent of the greenhouse gas emissions that drive climate change. In addition, clothing production and usage resulted in water pollution, pesticide pollution, and the release of microplastics[1] into oceans that can negatively impact human health and natural ecosystems. While fast fashion offers consumers an opportunity to buy more clothes for less, those who work in or live near textile manufacturing facilities bear a disproportionate burden of environmental health hazards. Furthermore, increased consumption patterns have also created millions of tons of textile waste in landfills and illegal dumping and littering.

The Goldhirsh Foundation awarded LA Sanitation and Environment (LASAN) $25,000 in grant funding from the LA2050 Grants Challenge to spearhead the LA Circular Textiles Initiative. This circular economy initiative aims to establish a local textile reuse market through creating recovery roadmaps and piloting textile recovery models. The project was contracted to the California Product Stewardship Council (CPSC), a 501c3 nonprofit, with the mission to help industry develop complex end-of-life solutions for hard to manage materials. Textiles are considered difficult to manage because of the high volume, material complexity, and lack of innovative material recovery opportunities.

Dr. Joanne Brasch from California Product Stewardship Council (CPSC) is leading five (5) publicly-funded textile recovery pilot projects in California: two (2) in Los Angeles for the City and County to characterize and divert commercially-generated textile waste into the highest-and-best use; one (1) in Alameda County to build the reuse and repair database to include textile handlers, both traditional and innovative; and two (2) with the City and County of San Francisco in partnership with Goodwill to test feasibility and pilot a repair program for damaged garments. These five (5) projects have made concerted efforts to collect relevant and comparable data for comparative analyses and build the evidence needed to make impactful recommendations for state and local textile programs.

From 2019-2021, the City of LA's recycLA Franchise Program reported a total of 215,695 tons of textiles collected from black bins with an average of 71,898 tons of textiles per year. This amounted to a 6.02% annual average composition of the total black bin commercial waste stream. There was a total of 9,717 tons of textiles collected from blue bins with an average of 3,239 tons per year from the same period of 2019-2021. This amounted to a 2.13% annual average composition of the total blue bin commercial waste stream.

The scope of this pilot focused on the feasibility of collecting and repurposing post-production textile scraps. The data collected from the study provided the sources of commercial textile waste, the fiber nature and content, and current practices to manage unwanted textiles such as landfilling blended fabrics. This study focused only on textiles going to the black and blue bins under the recycLA franchise. It was not inclusive of all commercial textile generators and did not include any residential textiles; it also did not include mechanical recycling due to budget constraints. LA County Public Works funded another pilot project that included hotels, hospitals, and detention centers. The collected data was also used in the general analyses. More than half the textiles in the waste stream came from 39% hospitality textiles (sheets, towels, blankets, mops) and 39% commercial fabrics (scraps, headers, deadstock, swatches, incomplete garments). Uniforms, at 17%, came in as the third largest category.

The Circular Textile Feasibility Study included six objectives and outcomes:

1. Develop a full list of potential participants, collect relevant information, and select potential case studies
2. Provide participant incentives to presort and provide textile waste to participate in the case studies
3. Fund drop-off/pick-up bin(s) and transportation to sorting locations - Record weight and composition of processed textile waste
4. Develop best management practices and education strategies for presorting and ways to achieve zero waste. Propose recommendations for future textile hub
5. Manage data collection, summarize analyses of pilot study, and prepare a technical report
6. Final report and technical report sharing/communication - host two webinars with a national audience

The following results were achieved:

1. Identified and ranked recycLA Service Provider (RSP) zones from highest to lowest tonnages of textiles in the black bin; these zones include disadvantaged communities (DACs) in South LA (1st & 2nd), Pacoima (4th), Boyle Heights (8th) and Wilmington (11th), the full details can be seen in Appendix A.
2. Started a textile database with textile generators, processors, and end users
3. Mapped out a circular textile framework as part of a collective statewide effort
4. Conducted waste characterizations for unwanted textiles from the City of LA's project case studies
5. Comprised a list of the City of LA's project participants (generators and processors)

In conclusion, the results from this study recommend that the creation of a circular textile framework have these components in place to be successful:

- Existing leadership in the textile sector
- Shared infrastructure in collection and a centralized database
- Promotion of greener designs and green purchasing to expand upcycling, repair, and recycled content for textile products
- Inclusion of textile microprocessors by addressing the unfair advantages of the insurance and licensing requirements to participate in textile recovery project

The results from Phase 1 of this study also identified these current gaps in infrastructure needed for a Los Angeles textiles program:

- Convenient collection for source separated textiles by RSPs
- Large facilities for textile sorting by quality, condition, and fiber type
- Consolidation and transportation of materials to preferred markets (repair over upcycling over recycling)
- In-state processors turning fibers into yarns and fabrics, and mechanical recycling

It is our utmost priority and commitment to reduce the environmental burden on disadvantaged communities (DAC) contributed by textile manufacturing and waste. The next steps are to expand the education and outreach to manufacturers in the DAC communities to reduce their impact. We intend to develop a web-based application to help connect and track materials between the generators and processors to increase the best valued and most beneficial reuse of unwanted textiles. We aim to secure and test larger scale textile sorting sites to increase the processing volume and to improve the separation of materials by content. And finally, to coalesce a textile recovery working group to engage multiple industries contributing to the textile waste stream and for co-funding to avoid detrimental risks and costs for small businesses, local government and DAC communities. Currently, the largest externalized costs are storage and transportation of textile waste, which are typically covered expenditures in an extended producer responsibility (EPR) or a stewardship program.

2.0 INTRODUCTION

The Goldhirsh Foundation awarded LA Sanitation and Environment (LASAN), LA Industry $25,000 in grant funding from their LA2050 Grants Challenge to spearhead the LA Circular Textiles Initiative. This circular economy initiative aims to establish a local textile reuse market through creating recovery roadmaps and piloting textile recovery models. The project was contracted to the California Product Stewardship Council (CPSC), a 501c3 nonprofit with the mission of saving money for local government and solid waste rate payers by engaging industry in complex end-of-life solutions for hard to manage materials. Textiles are considered hard to manage because of the abundance, complexity, and lack of innovative material recovery opportunities.

2.1 PARTNERSHIPS

<u>LA Sanitation and Environment (LASAN)</u>
LASAN is responsible for the collection, treatment, and recycling of solid waste and wastewater generated by residents, businesses and industries in the City of Los Angeles and surrounding communities. LASAN serves over four million residents through four broad program areas: Solid Resources, Clean Water, Watershed Protection, and Environmental Quality (Livability). LASAN protects the public health and environment while enhancing the quality of life in the City of Los Angeles neighborhoods.

Industrial Waste Management: LA Industry Program
LASAN launched LA Industry as a pollution prevention and outreach program to build collaborative partnerships with industries, sharing common underlying goals of protecting public health and the environment, as well as, our own goals of aiding economic development and business continuity in the LA Region. LA Industry promotes sustainable manufacturing principles, such as green chemistry and biomimicry, to work towards a zero-waste circular economy. LA Industry has a successful track record of providing outreach symposia to multiple sectors, such as food manufacturing, metal finishing, microbreweries, car washes, cannabis, and construction dewatering. Interaction extends beyond these symposia to general business resource guides and how to navigate City resources. The LA Industry team is always exploring new strategies and opportunities with a collaborative network of internal and external partners to cultivate a business-friendly environment for businesses and industries to thrive while achieving regulatory compliance.

RecycLA
In 2017, the City of Los Angeles launched a public-private partnership that offers customer-friendly and efficient waste and recycling services to all commercial and industrial businesses, institutions, and large multifamily buildings. This innovative program is part of the City's commitment to enhance the quality of life in Los Angeles by improving the air that we breathe, the roads that we travel, and the overall cleanliness of Los Angeles. RecycLA extends recycling opportunities to everyone in the City, and ensures better customer service, predictable and protected rates, and much needed infrastructure and equipment improvements. It moves us closer to achieving "zero waste" through pioneering waste reduction, reuse, recycling, and recovery programs.

Authorized recycLA service providers (RSPs) conduct regular waste audits and report volume and characterizations to LASAN. The Facility Certification Program, one of the cornerstones of recycLA, ensures that facilities accepting solid resources collected through the recycLA program are aligned with and meet the goals of the City. Unfortunately, there are currently no authorized facilities that specialize in textile collection, sorting, or recycling that can handle the volume and sorting requirements of end-market specifications.

California Product Stewardship Council (CPSC)

CPSC's mission is to shift California's product waste management system from one focused on government-funded and ratepayer-financed waste diversion to one that relies on producer responsibility in order to reduce public costs and drive improvements in product design that promote environmental sustainability.

CPSC is leading five publicly-funded textile recovery pilot projects in California: two in Los Angeles for the City and County to characterize and divert commercially-generated textile waste into the highest-and-best use; one in Alameda County to build the reuse and repair database to include textile handlers, both traditional and innovative; and two with the City and County of San Francisco in partnership with Goodwill to test feasibility and pilot a repair program for damaged garments. The five projects have made concerted efforts to collect relevant and comparable data for comparative analyses and build the evidence needed to make impactful recommendations for state and local textile programs.

Goldhirsh Foundation

The Goldhirsh Foundation is a small organization with a big focus on social innovation. The foundation seeks to create events and mission-driven initiatives meant to bring together thinkers and doers across a spectrum of disciplines. The Goldhirsh Foundation has been awarding grants for almost a decade, but was re-launched in 2012 in Los Angeles, where the majority of our grant strategies are created. Since 2013, the Goldhirsh Foundation has conducted a large portion of its grant award in Los Angeles via the annual My LA2050 Grants Challenge. To date, more than 1,500 proposals to make Los Angeles a region that is healthy, thriving, and a desirable place to live have been submitted through the grants challenge on the My LA2050 Ideas Archive.

2.2 BACKGROUND

Ever-changing fashion trends and an increased purchasing of fast fashion products have devastated our planet. The fashion industry produces 10%[2] of all humanity's carbon emissions and is the second-largest consumer of the world's water supply. In fact, textile production alone is estimated to release 1.2 billion tons[3] of greenhouse gases into the atmosphere every year. This does not include the overall waste produced by the fashion industry. In the United States, the average American throws away 81 pounds[4] of clothing annually, leading to an excess of textiles being landfilled yearly. Currently, just 13%[3] of clothes and shoes thrown away in the US end up being recycled. From 2019-2021, the City of Los Angeles reported a total of 215,695 tons of textiles being landfilled and an average of 71,898 tons of textiles per year.

To tackle LA's growing textile and garment waste, LASAN LA Industry team partnered with the CPSC to create a centralized textile hub where material byproducts from businesses can be repurposed rather than going to landfills. This hub creates a local closed-loop market that promotes a circular economy by providing stable and consistent material streams for reuse.

The scope of this pilot targeted the collection and repurposing of post-production textile scraps. The information gathered from the textile generators provided sources of commercial textile waste, fiber content, and established processes to manage unwanted textiles including high occurrences of landfilled blended fabrics. These case studies were selected based on leadership and investment in textile recovery in Los Angeles that broke the status quo in terms of local business models and practices. Finally, the selected generators sent pre-sorted materials to processors and reported their outcomes. This pilot project focused on recovering textiles going to the landfill or is contaminating the blue recycling bin. Results included existing leadership, shared infrastructure, the need for green design, and the power of green purchasing to expand upcycling, repair, and recycled content for textile products. Further details about the results are provided in section 4.0.

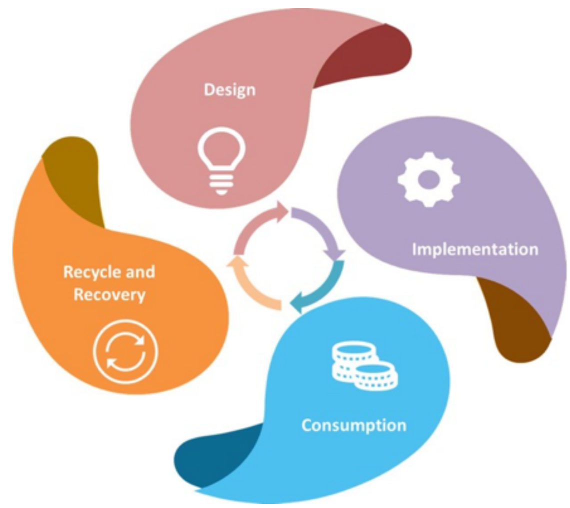
The project scope, however, did not include all commercial textile generators or residentially generated textiles. The scope also did not include mechanical recycling due to budget constraints. LA County Public Works funded a complementary scope to this pilot project that included hotels, hospitals, and detention centers that collected data in the general analyses.

The goal was to create a successful, circular, and streamlined business model for textiles that could be applied to various material streams, which aligns with the targeted goal set forth by LA's Green New Deal of 100% organic waste diversion by 2028, 100% landfill diversion by 2050, and 50% local material reuse by 2035[5].

2.3 CIRCULAR ECONOMY

Current consumer disposal habits have crafted the mindset of “take, make, and waste.” As a result, the adverse effects are reflected by the inefficient usage of raw materials and large amounts of preventable waste going into landfills.

A circular economy is much more than simply recycling. It encompasses everything from recycling to redesigning our economic system to be regenerative and resilient. Approaching textile waste with a circular economy mindset is the solution to diverting excess waste from landfills. Using circular economy principles within this pilot will help in the methods and techniques for diverting textiles and organics from landfills. By capturing these material streams, it can provide a systematic roadmap and framework to construct successful pathways to a circular economy amongst local businesses and manufacturers in the City of Los Angeles.



One key component to the creation of a circular economy is to map out the existing waste streams and conduct waste characterizations of the material stream of interest. Achieving a successful circular business model for textiles streamlines this industry’s practices and then can be applied to other material streams.

2.4 WASTE CHARACTERIZATION

In the City of Los Angeles, commercial, business, and multi-family dwelling waste management data were collected and analyzed by the recycLA service providers (RSPs). Between 2019 and 2021, RSPs reported an average of 71,898 tons of textiles landfilled per year, a total of 215,695 tons for three years. This represents 6% annually weighted average of the total commercial waste stream as seen in Figure 1., The waste characterization indicated Los Angeles’ large volume and diversity of fiber materials in the textile and clothing industry are immense, with additional complexities of microprocessor access and equity discussed in point two of section 3.2.

Collectively, the average percentage of textile collected in the commercial waste stream is 6% of the waste stream and 2% of the recycling stream. RecycLA service providers service 15 zones in the City. The top three zones with the most landfill-bound textiles produce a total of 31,880 tons of textile waste, annually. At least two high-capacity sorting facilities will be needed to manage these amounts if each facility can sort 30,000 tons annually. Education should start in those zones immediately to reduce contamination and costs of textiles incorrectly placed in recycling bins. Specifics on Los Angeles textile waste totals can be found in the Appendix A.

In 2020, CalRecycle identified textiles as the fifth[5] most common material in California’s single-family waste stream, a top priority for landfill diversion and an opportunity for innovative material management programs. The City of Los Angeles has a higher rate of commercially generated textile waste, when compared to the statewide data. It is evident that textile waste must be addressed within Los Angeles, due to the large-scale fashion industry and high volume of waste. The City of Los Angeles' commercial black and blue bin waste from 2019-2021 can be seen in Table 1.

Figure 1: CalRecycle and LASAN's estimated percentage of textiles in the commercial waste stream

Table 1: City of LA Commercial Waste Totals for the Black and Blue Bins 2019-2021

Commercial Textile Waste Totals in the City of Los Angeles			
	Total weight (tons)	Annual average weight (tons)	Percent of total commercial collection
Total reported commercial black bin waste	3,612,261	1,204,087	-
Textiles in the black bin	215,695	71,898	6%
Total reported commercial blue bin waste	474,667	158,222	-
Textiles in the blue bin	9,717	3,239	2%

3.0 MATERIALS AND METHODS

The following section describes the objectives and outcomes set for this pilot and the design and methods used.

3.1 OBJECTIVES AND OUTCOMES

LASAN's textile recovery pilot project's objectives and outcomes are illustrated in Table 2. In the data collection phase, both qualitative and quantitative approaches were employed to ensure the necessary data was collected to create a textile hub database and map, to characterize unwanted textiles coming from commercial generators, and to process unwanted textiles with select case studies. The case study candidates were selected based on their active role in textile recovery, which may skew the results to be "greener" than the reality for the full commercial waste stream. For this reason, it should be noted that the data used in the analyses is not representative of the vast market.

Table 2: LASAN Textile Recovery Pilot Project Objectives and Outcomes

Objectives	Outcomes
Contact potential participants, collect relevant information, and select potential case studies	Full list of project stakeholders
Provide participant incentives to pre-sort and provide textile waste	Short list of case studies
Fund drop/pick-up bin(s) and transportation to sorting locations	Weight and composition of processed textile waste
Develop best management practices and education strategies for pre-sorting and ways to achieve zero waste	List of recommendations for future textile hub
Manage data collection, summarize analyses of pilot study with technical report	Final report
Final report and technical report sharing/communication	Communication strategy

3.2 CREATING TEXTILE HUB DATABASE

A major component of the project was to map out existing textile recovery stakeholders in the City of Los Angeles[7,8].

Stakeholders involved with textile recovery in the City of Los Angeles shared with the project partners, then added to a map hosted by CPSC as seen in Figure 2. Three approaches were taken to gather as many stakeholders as possible.

Figure 2: Textile processors, including collectors, upcyclers/designers, and recyclers in the LA pilot region

1. Phone interviews were conducted with key stakeholders who already had established relationships with LASAN for their interest and involvement in textile recovery. Additional interviewees were selected through a snowball sampling method using referrals from each interview to snowball into the next interview. Interview questions were standardized, but free flowing conversation was encouraged to allow the interviewee in sharing as much information as they wanted.

Phone interviews were conducted and logged; a detailed call log tracked every call made, including the voicemails and messages left unreturned. Each interview's results were codified and analyzed for the characterization and final recommendations.

2. A Call for Sewing Professionals was developed and launched on October 25, 2021, with a link [view here] distributed via direct email and social media. Interested participants were directed to an entry form with standardized questions needed to determine the next steps, including adding them to the hub database, map, and considering them as a paid case study. The statewide calls garnered over 20 submissions of interested participants and can be utilized in future projects that have more funding in education and outreach, which can then support boosting social media posts or advertising with the California Market Center.

Not all submissions were qualified to participate due to the insurance and licensing requirements. Several state and local regulations guided the design of the pilot and future recommendations. The three main oversight agencies are CalRecycle and the Labor Commission at the state level and LASAN and LA County Public Health at the local level. This barrier may lead to unintended yet inequitable consequences by not including microprocessors and decentralized collection channels.

3. Internet research using search engines and social media platforms were used to find additional textile recovery stakeholders to share the Call for Sewing Professionals so they could be added to the hub database and map. This method was best utilized for finding textile handlers and processors.

3.3 CHARACTERIZING UNWANTED TEXTILES IN PILOT CASE STUDIES

RSPs provided textile waste characterizations to CPSC as a baseline for background information on the textile waste in Los Angeles and to guide final recommendations.

CPSC collected information on unwanted textile characteristics during phone interviews and the Call for Sewing Professionals. These results were entered, codified, and analyzed for this report. Combined results from the City of Los Angeles and LA County studies reflected that more than half the textiles in the waste stream came from hospitality textiles or commercial fabrics as shown in Figure 3. Uniforms came in as the third largest category, which could be affiliated with hospitality textiles if the uniforms are using the same commercial laundry systems. It should be noted that neither all commercial businesses nor any residential textiles were included in the scope, such as the waste coming from a thrift store.

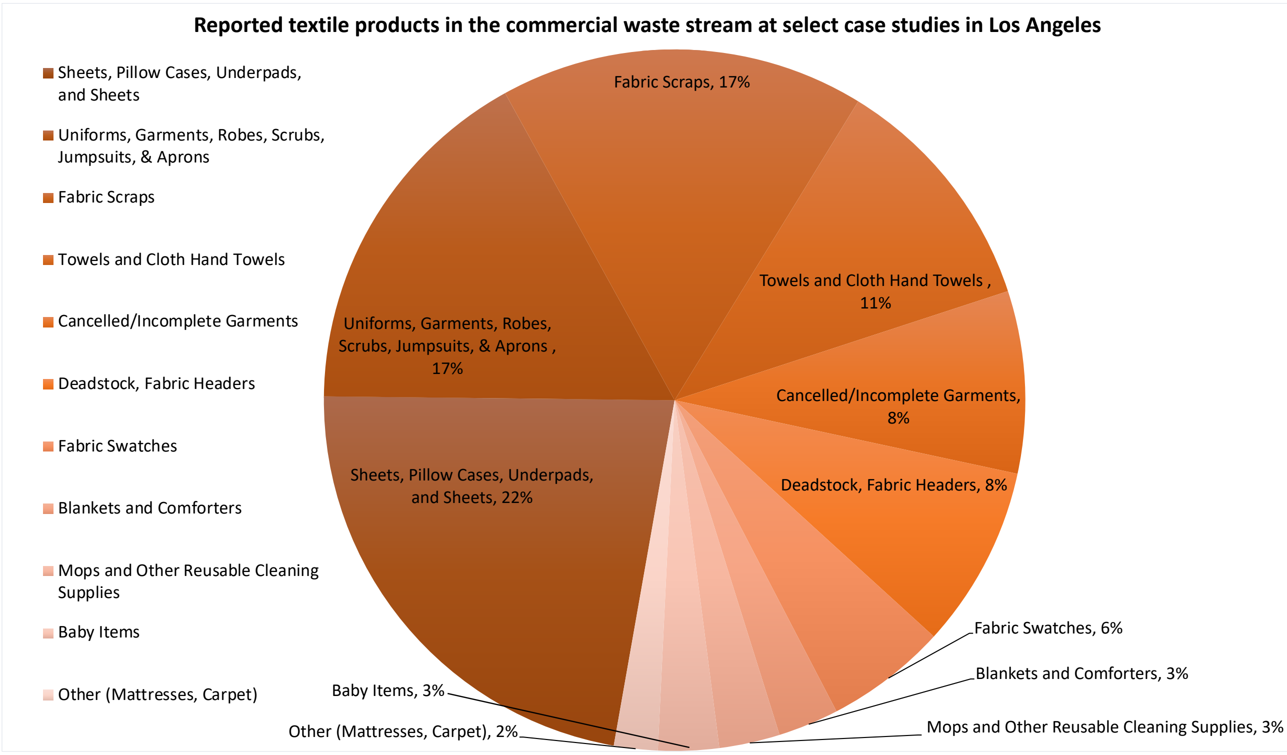


Figure 3: Textile categories reported for select commercial generators for both the City and County of Los Angeles

Participants were asked to describe the products as seen in Figure 4 and fiber types as seen in Figure 5 of textiles in their waste streams, and the processes they had in place to manage unwanted textiles. The largest portion came from consumer goods, such as linens, towels, and uniforms, and the second largest category was post-production textiles including deadstock, swatches, scraps, and fabric headers. Both categories of commercially generated textiles are considered more recyclable than residential textiles.

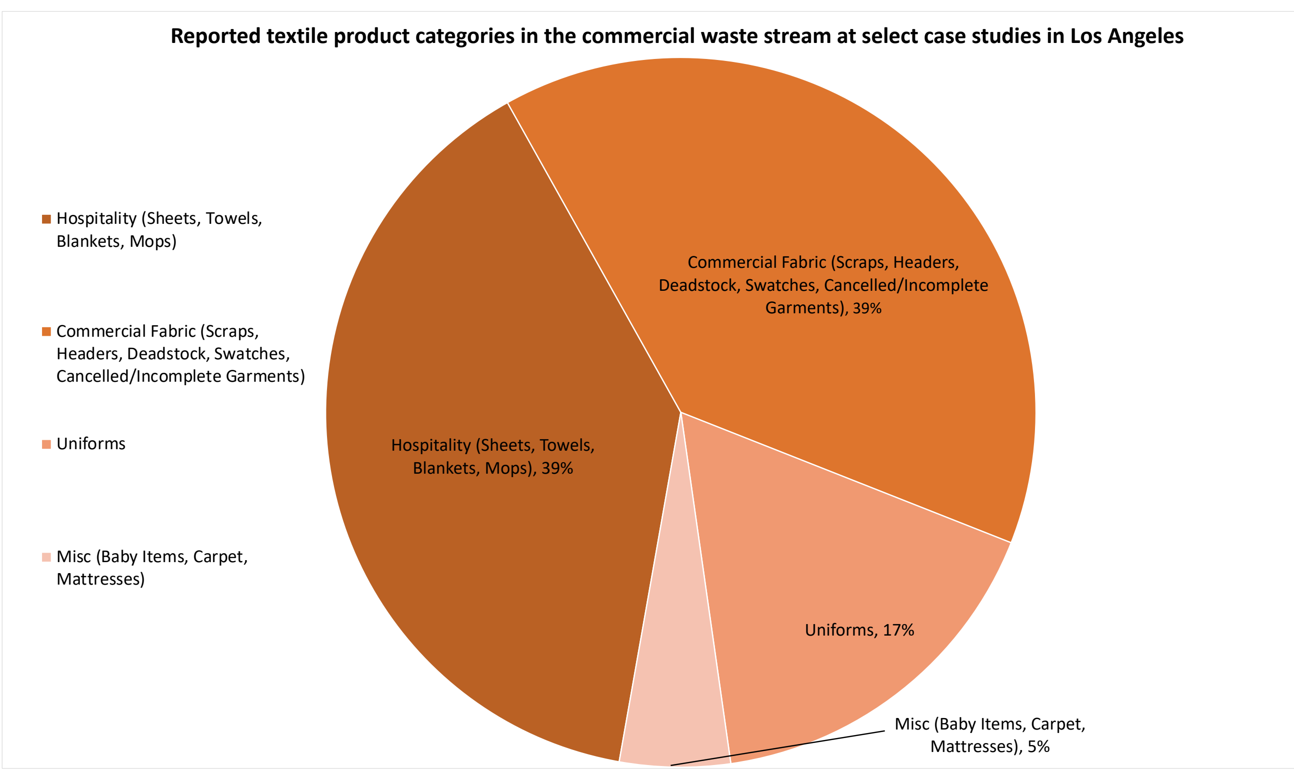


Figure 4: Textile products prior to the pilot project for select commercial generators for both the City and County of Los Angeles

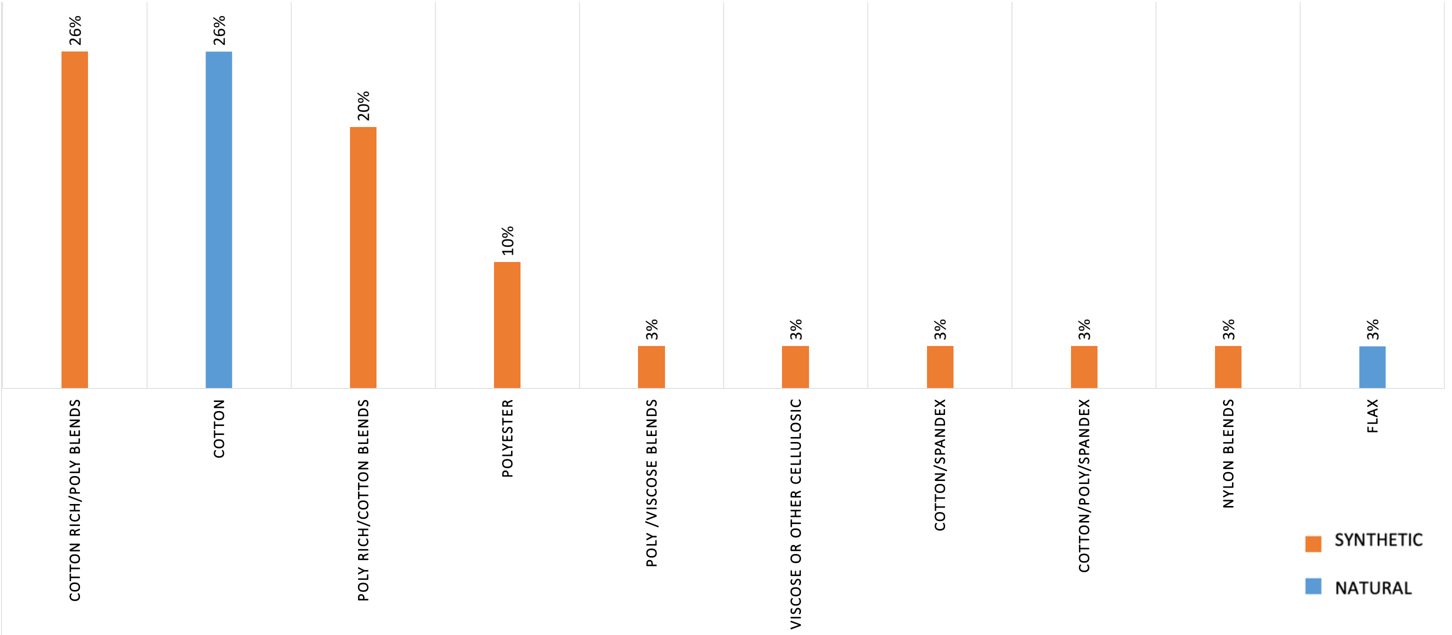


Figure 5: Reported case studies' fiber content types and the estimated percent of commercial textile stream containing synthetic materials

When recovering unwanted textiles and diverting them to their highest and best use, detailed information down to the fiber content, quality, and quantity are needed. As noted previously, due to the small sample size, these analyses are not an accurate representation of the entire market. For the purposes of this project, only singular and dual fiber blends were tracked, whereas in reality most fabric blends have more than two fiber types and manufacturers do not need to report fiber content less than 10 percent or fabric treatments sprayed on the surface. These details can greatly influence the end processors, especially if they are chemical recyclers that cannot risk equipment contamination.

The second method used to build the hub database and provide insight to Los Angeles's current landscape for textile recovery was the referrals to other stakeholders and processors. The responses to the question of what participants were currently doing with their unwanted textiles prior to the involvement of the pilot project can be seen in Figure 6 and the responses relative to the waste management hierarchy can be seen in Figure 7. As noted previously, many participants in this project had already invested in textile recovery; therefore, their responses may not be an accurate reflection of the average commercial generator. For example, 20 percent of responses indicated some sort of compost or recycling process, where they voluntarily pre-sort and pay to process their waste, whereas a statistically significant sample might have had lower responses for voluntary processes.

The reported processes currently used by participants of the selected case studies in Los Angeles, when compared to the waste management hierarchy for preferred recovery processes reflected that there is already a culture of reuse and repurposing. However, although the processes of disposal and destruction are the least preferred by statute, they are still the predominant processes reported and should be addressed in future projects and outreach.

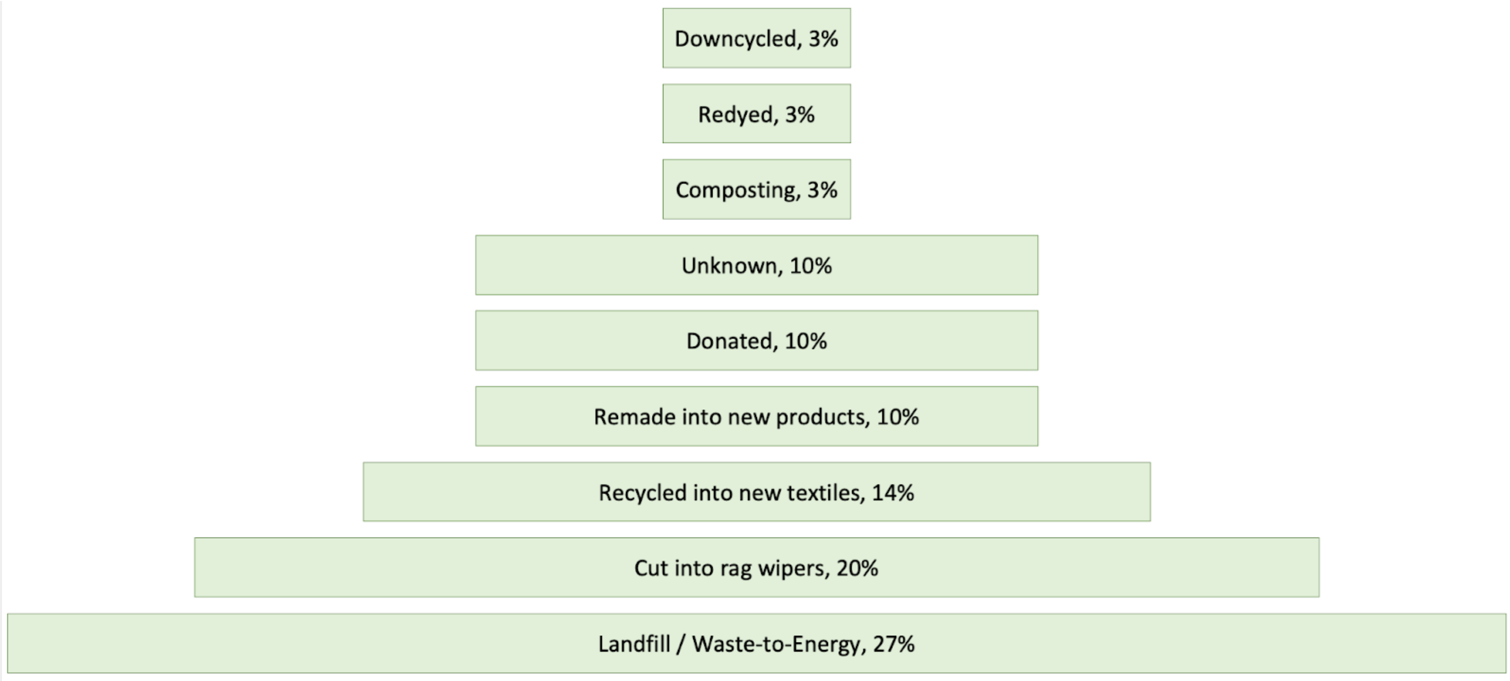


Figure 6: Commercially generated textile waste streams from selected case studies

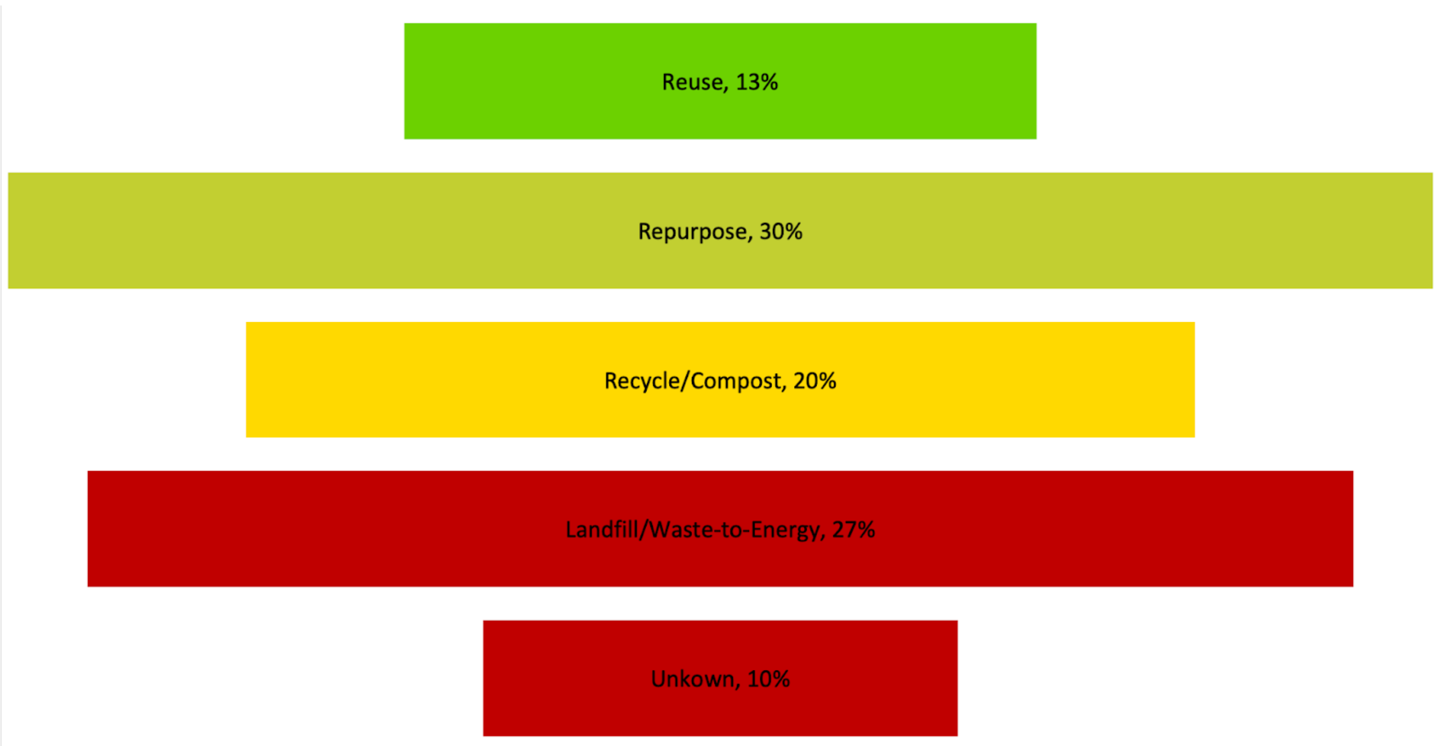


Figure 7: Waste hierarchy processes used at selected case studies prior to the pilot project

3.4 DESIGNING CASE STUDIES

This pilot project selected participants for the case studies on ways to divert textiles into better uses than their current destination, the landfill. These businesses had features that exemplified leadership and investments in textile recovery in Los Angeles and broke the status quo in business models and practices. It can be seen in Figure 8 the steps taken to divert these textiles and in Figure 9 the material flow diagram followed by case studies.

Figure 8: Steps to divert textiles from select case studies in the CPSC led Los Angeles textile recovery pilot project

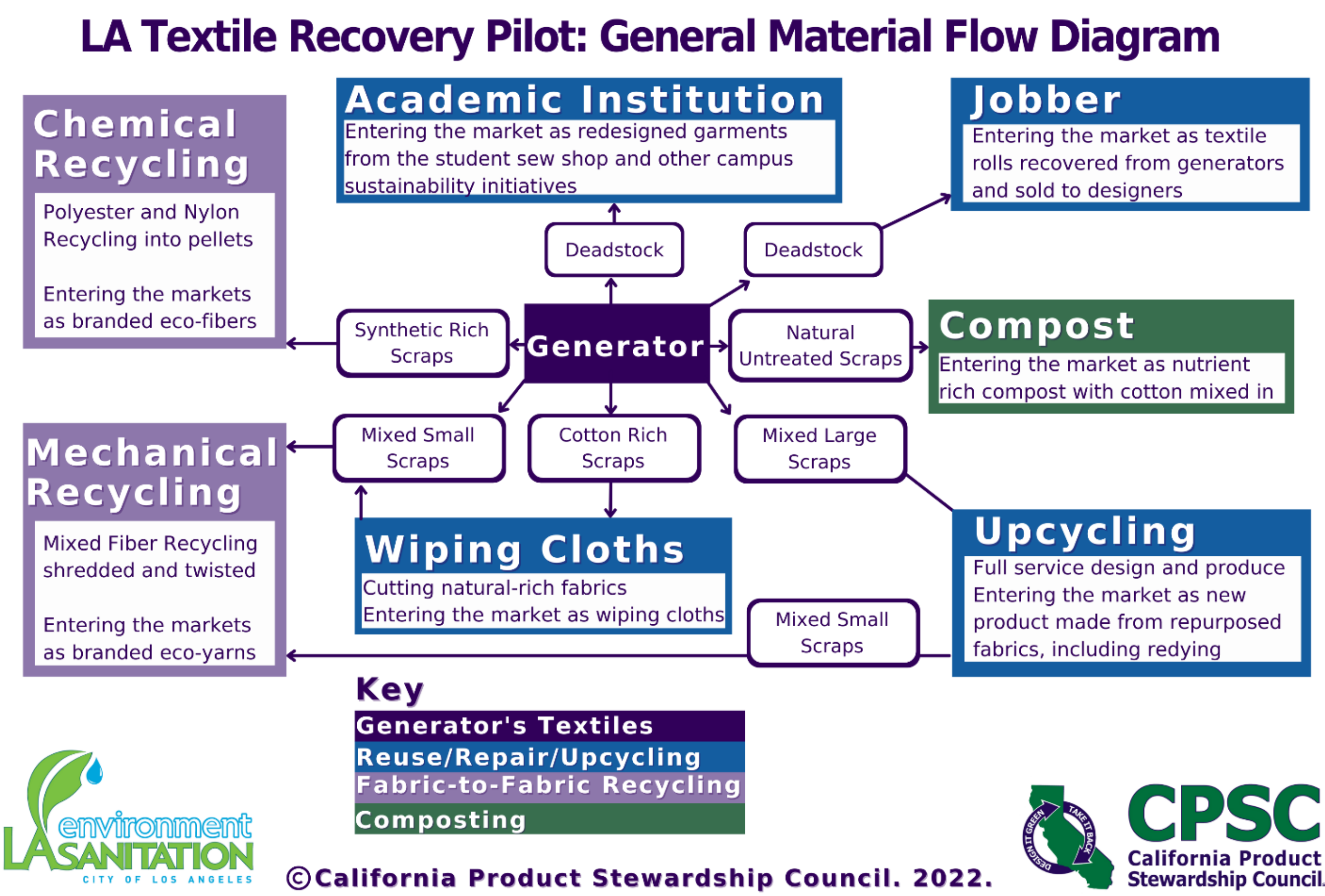


Figure 9: General material flow diagram for case studies in the textile recovery pilot

It can be seen in Table 3, the summary table of all the selected case studies that participated in this pilot project. The table details the participant's name, type of business, types of process (es), and materials handled for the pilot project. A full breakdown of each participant including company profiles, involvement details, and material flows can be seen in Appendix B.

Table 3: List of Case Study Generators and Processors and Descriptions of Materials Handled for the Textile Recovery Pilot in Los Angeles

Case Study	Type of Business	Type of Process(es)	Materials Handled for the Pilot (See Appendix D for material descriptions)
Nature USA	Generator	Garment Manufacturing, On-Site Sorting	379 lbs. of natural greige goods to CSUN and LA Art Center
Roboro6	Generator	Garment Manufacturing, On-Site Sorting Upcycling	50 lbs. of PET scraps to Circular Polymers/Purecycle, 50 lbs. of nylon scraps to Aquafil USA, and 150 lbs. of deadstock fabric to CSUN
CA Cloth Foundry	Generator	Garment Manufacturing, On-Site Sorting	180 lbs. naturally treated scraps to Compostable LA and 30 lbs. of untreated natural scraps to CSUN
Upcycle-it-now	Processor	Upcycling	50+ lbs. of mixed fabric from Roboro6
LA Art Center	Processor	Upcycling	182 lbs. of natural greige goods from NatureUSA
CSU Northridge	Processor	Composting, Upcycling	30 lbs. of natural scraps from CA Cloth Foundry and 197 lbs. of natural greige goods from Nature USA and 150 lbs. of deadstock from Roboro6
Compostable LA	Processor	Composting	180 lbs. naturally treated scraps from CA Cloth Foundry
Circular Polymers/ Purecycle	Processor	Chemical Recycling	50 lbs. of PET scraps from Roboro6
Aquafil	Processor	Chemical Recycling	23 lbs. of mixed Nylon scraps from Roboro6

4.0 RESULTS AND DISCUSSIONS

The Data from the interviews, waste characterizations from the RSPs, and results from the case studies were organized and analyzed to demonstrate the achievability of a regional textile recovery system, and to work towards making Los Angeles a global market center for sustainable textiles. The pilot results are presented in three sections:

1) Common challenges and experiences amongst various stakeholder groups already functioning in textile recovery and circular production systems
2) Models for textile material recovery
3) Key components for a successful program in Los Angeles

4.1 CHALLENGES FACED BY GENERATORS, COLLECTORS, PROCESSORS, AND OTHER STAKEHOLDERS

The current gaps in infrastructure for a Los Angeles textiles program include:

- Convenient collection for source separated textiles by RSPs
- Large facilities for textile sorting by quality, condition, and fiber type
- Consolidation and transportation of materials to preferred markets (repair over upcycling over recycling)
- In-state processors turning fibers into yarns or fabrics, and mechanical recycling

Key investments and policies that engage the industry can incentivize textile recovery businesses to thrive. Those key investments and policies are outlined in the recommendations.

Additionally, interviews indicated a need for education and outreach from the local and state government to guide preferred processes for unwanted textiles and identify the locations and methods to send materials that meet the processors' specifications.

4.2 MODELS FOR TEXTILE MATERIAL RECOVERY

Centralized textile recovery in the context of this project refers to adding one or more authorized facilities to receive mixed textiles from the RSPs. This includes sorting, storing, and shipping specific textiles to the designated processors. For instance, a TOMRA ™ high-tech sorting facility using infrared spectrometer technology requires at least 30,000 tons[9] a year of material feedstock to remain economically viable. Similarly, chemical recyclers often require 50,000 tons or more a year to be profitable, as claimed by recyclers in the carpet stewardship program. The volume of unwanted textiles in Los Angeles exceeds these minimum thresholds and could support several sorting facilities should additional textile products and/or residential textile waste be included. It is important that any future program does not interfere with the established collection systems for thrifts and charities and their ability to access usable clothing to provide for community use and mission-based diversion. Any residential textile collection program should support current thrift infrastructure as the established and convenient collection method. It is more important to give thrifts the support they need to divert the unusable textiles from repair, upcycling, and recycling through a commercial textile program.

LASAN's LA Industry team ran an alternative waste management model provided by USEPA to assess the potential reduction of GHG on recycling textile waste. This Waste Reduction Model (WARM) is a tool designed to help program managers understand and compare materials management options for materials commonly found in the waste stream. By comparing a baseline scenario with materials being landfilled, to an alternate scenario with materials being diverted from landfill, WARM can assess the economic, energy, and GHG implications that would occur throughout the material's life cycle.

The following assumptions were made by LASAN to run the simulation model. 1) The material stream selected was Mixed Plastics[10] 2) The baseline scenario was 75,137 tons of material landfilled annually, a combination of textile wastes from black and blue bins, 3) The alternative management scenario is selected from TOMRA's material recovery processing capacity of 30,000 tons for material recycling, and 4) The average distance traveled to landfill was 35 miles.

The WARM model results can be seen summarized in Table 4 below. With 26,851.47 MTCO2E reduced, the equivalent can be seen in Figure 10 below. Full WARM model inputs can be seen in Appendix C.

Table 4: USEPA WARM model GHG results

	Baseline (Landfilled)	**Alternative (Diverted)**	**Change (Landfill - Alternative)**
GHG Emissions (MTCO$_2$E)	1521.86	(26,851.47)	(28,373.34)

Using USEPA's GHG equivalent[11] calculator, a reduction of 26,851.47 $MTCO_2E$ is equivalent to:

Figure 10: The GHG equivalent of the number of textiles being diverted from the landfill

A new idea to consider, similar to a foodbank, would be a material bank. These would be conveniently located for businesses, small designers, and residents to access free or low-cost fabrics to produce new products. Similarly, for garments, a community closet could offer residents centralized access to free or low-cost clothing. This concept would support the equity and access issues caused when a centralized facility does not allow individuals, such as Jobbers or small designers, to participate.

Decentralized textile recovery is more indicative of what is currently happening and will continue to happen, even with the creation of a state or local program. The informal, decentralized sectors often thrive through mutual aid, self-regulating at the front lines, and collective survival. This was evident in the phone interviews with the discussion on "Jobbers" as individuals recovering fabrics for reuse utilizing their relationships with the generators and buyers. A decentralized model can also look like online mail-back and virtual resale where businesses or individuals collect materials, sort, and sell to other businesses or individuals without the government or centralized program involved. This might be more applicable for materials with value.

Temporary collection events are common in recovering many hard-to-manage product types, such as household hazardous waste, or seasonal waste like Christmas trees. Textile recovery could find success in temporary collection events as the material volumes and types vary throughout the year. Mobile events, such as those hosted by a local designer Threadhaus, offer a temporary collection of donated materials with on-site sorting as the materials come in.

Mixed model recovery efforts will be the reality of any future program at the state or local levels, since there are many variables in the collection process from commercial generators, from the types of fabrics, to volumes, and timing. Therefore, a mixed model approach will allow for flexible adaptations for collectors to ensure maximized recovery volumes and to send to preferred processors.

A mixed model approach is recommended with at least two authorized recycLA textile facilities, who also conduct temporary events and provide free or low-cost, convenient access to businesses in the decentralized channels doing reuse, repair, and upcycling.

4.3 KEY COMPONENTS FOR A SUCCESSFUL TEXTILE RECOVERY PROGRAM IN LOS ANGELES

The development of a thoughtful program would ensure that textile recovery in Los Angeles is equitable and accessible with minimal human and environmental impacts; for example, a landfill ban without a funded management plan can be a cost burden for government, generators, and processors, if not readily prepared to manage the large volumes of mixed, unidentified fabrics at varying sizes and volumes. Based on the feedback from generator and processor interviews, the following suggestions would be the key for the success of a future program in Los Angeles:

<u>The collection of unwanted textiles</u> needs to be accessible and convenient for everyone participating, but is not the main barrier to establishing a program. Commercial haulers should offer mixed-textile collection given that space and pre-sorting are major challenges for many large generators. At this time there are no locations where commercial waste haulers could take mixed fabric scraps for cost-effective sorting and processing. To incentivize investments in sorting and recycling technologies, processors need assurances they will be guaranteed access to the most cost-efficient volume of feedstock. It should be noted that a commercial landfill ban may be detrimental for the newly developing infrastructure without funding to address the challenges and ongoing operational costs, such as storage and transportation of materials.

<u>Education and outreach</u> should be prioritized, even in the absence of a centralized collection program. Across the board, textile waste generators don't have many alternatives in managing their unwanted fabrics, scraps, and canceled garments. As a result, they are discarded in the black or blue bins. Because textiles tangle, absorb, and combust, they are not fit for current curbside collection systems. Currently, there are decentralized opportunities to divert valuable materials to jobbers, online resale, or donations which can be bolstered with an information campaign connecting generators with established collection opportunities. For example, companies like Queen of Raw, Roboro6, and student sew shops can be outlets for unwanted materials that are still usable. For unusable materials, generators need to know where the best and easiest alternatives to ensure they will not end up in a landfill in California, or elsewhere. Education coupled with a strategic recovery program roll out will prevent high contamination rates in the blue bins, and diversion from the black bins.

<u>Ongoing funding</u> is needed to address the challenges and operational costs, such as sorting, storage, and transportation costs. The biggest barriers to expanding collection for the processors engaged with this pilot were the large volume and mixed nature of the textiles coming from the larger generators. These costs are typically covered under an Extended Producer Responsibility (EPR), or product stewardship program where the nonprofit program operator funds material flows from eligible generators to contracted processors, funded by the producers creating the products. A recommendation is to provide financial incentives to design the products greener and easier to manage at their end-of-life. The best way to do that is to internalize the costs to the manufacturers, which have traditionally been externalized by including the cost of end-of-life management through the garbage collection rates. For example, brands will be incentivized to design with recyclable materials if they are expected to pay more into the EPR program for having mixed fiber blends or harmful chemicals impeding circularity.

<u>Shared infrastructure</u> with established programs will save all participating programs money and incentivize more collection and processing of covered materials. The California carpet and mattress stewardship programs have laid groundwork for fiber and textile recycling as those are both material components of the covered products in those established programs. A new textile stewardship or EPR program in Los Angeles would provide the pooled funding sources to address the challenges and key components described above, which are unique to textiles and clothing. This program would also be unique globally and be built on the learned experiences with passing EPR programs at the local level. Successful stewardship and EPR programs include producer payments, performance standards, and reporting requirements to allow a nonprofit stewardship organization to run the program with government oversight and

enforcement. There are 13 EPR and product stewardship programs at the State level with varying program requirements and performance measures.

The infrastructure for textile collecting, sorting, and recycling is still new and needs support for processing collected materials into pellets or yarns to create new fabrics. These additional steps pose additional opportunities for domestic manufacturing and job creation. Especially with large state investments in regenerative agriculture, it is not just about creating the fibers, but also building the facilities and infrastructure to manufacture fibers into yarns and fabrics, and then reintroduce into usable products. There is a huge need for mechanical textile recycling processors in California to introduce scraps back into yarns for textile-to-textile recycling.

5.0 LESSONS LEARNED

At the conclusion of the pilot, LASAN documented the lessons learned in the following key areas.

1. Leadership and Investment
2. Shared Infrastructure with Stewardship and Composting Programs
3. Green Design
4. Green Purchasing

5.1 LEADERSHIP AND INVESTMENT

The participants selected for this pilot have invested time and resources in developing their own textile recovery models, which made them good candidates to showcase different collection models and key components for a future program.

- *Nature USA* is the first textile manufacturer in the United States certified by the global organic textile standard (GOTS) and subscribes to several other certifications to verify their sustainability efforts. Going above and beyond, Nature USA has a self-funded collection of fabric scraps, shipped to mechanical recyclers in Spain and India, and completed the necessary process to ship as scraps and return as thread.
- *California Cloth Foundry* has built their business model on regional sourcing and traceability for their all-natural garments. With their deep connections to California-based fiber and yarn producers, they have been collecting all the scraps from their production and using similar materials rooted in biocompatibility.
- *Roboro6* offers zero waste designs and access to diverted deadstock fabrics. The warehouse extra fabric with plans to develop an app that allows designers and consumers more accessibility to review the inventory of diverted fabrics. Even with their established networks, it is extremely challenging to find garment applications for fabrics ten yards or less, which includes deadstock, fabric headers, cutting scraps, and other remnants.
- *Upcycle-it-now* has been working with large brands for many years on their repair and upcycled product collections. Despite many brands promoting reuse and repair, it has not translated to consistent contracts for Upcycle-it-now, which specializes in zero-waste designs and has the capacity to offer services and retail to more businesses.
- *Suay Sew Shop* did not participate in the pilot study at this time. Suay's owner was appointed to the Los Angeles Climate Emergency Mobilization Office's Advisory Board. Suay's business model is consumer based, and has quickly grown to process a large capacity of unwanted textiles and clothing as a 100 percent vertical sewing and production shop that specializes in repair, redye, upcycle, and community-based services, such as sewing lessons and free garment racks. They offer a community dye bath with monthly colors for participants to re-color textiles for reuse.

5.2 SHARED INFRASTRUCTURE WITH STEWARDSHIP AND COMPOSTING PROGRAMS

California already has two stewardship programs that offer infrastructure support for textile recovery for mattresses and carpet, both funded by consumer fees. Adding a textiles stewardship or EPR program will save money for the established programs to have more covered product types sharing the costs for sorting, storing, transporting, and processing unwanted materials. The two established stewardship programs operate with legislated requirements to cover operational costs and market development for collection, sorting, and processing covered products, which include fibers and textiles similar to garments. Several recyclers participating in the established carpet and mattress programs participated in this textile pilot project under the agreement that CPSC would ensure materials were pre-sorted to their specifications and transportation costs were covered. Similarly, California is in the middle of major investments in composting infrastructure that could support soil-to-soil circularity for natural fibers, if they are designed without synthetic fibers or additives that could contaminate the compost with microplastics and harmful chemicals, like per- and polyfluoroalkyl substances (PFAS[12]).

- *Circular Polymers and Aquafil* are carpet fiber recyclers who participate in the California carpet stewardship program. Aquafil can take Nylon 6 without hardware or labels for their depolymerization process. They currently have three locations in California, including collection and sorting facilities in Chula Vista and Santa Ana. Their Woodland facility employs the carpet preparation technology before the carpet is recycled at the main recycling plant in Georgia. Circular Polymers, working with Purecycle, can take 96% or higher PET with or without hardware and labels, as they have access to additional technology to purify the feedstock. Circular Polymers has a collection, sorting, and preparation facility in Lincoln, CA and sends the prepared materials to their respective recyclers. As participants in the established stewardship program, both processors get priority access to feedstock from the program and added financial incentives per pound processed, as well as transportation and storage costs. Their biggest challenge at this time is getting enough carpet to run their technologies at full capacity.
- *Ambercycle* is a chemical recycler taking in polyester-rich materials, preferably free of pigmentation and hardware and labels. Ambercycle works with the California Mattress Stewardship Program to recycle some of the PET mattress materials coming from the established program that covers transportation and storage costs, and additional financial incentives for processors.
- *CompostableLA* is a commercial composter involved with recovering food waste and delivering it to urban farms for composting. It is extremely important that any material added to the compost pile is free of synthetic fibers and additives, so partnering with California Cloth Foundry provided the transparency and tracing necessary to understand what was in the fabric scraps down to the chemical level. The final steps of the process include a lab test at the end of the compost cycle to verify the biological makeup of the pile.

5.3 GREEN DESIGN

In order for any textile recovery program to be successful at the local or state levels, brands must engage in green design as seen in Figure 11 with the end-of-life in mind to make the ease of collecting, sorting, and processing materials more cost-effective. For starters, advocating for better labeling of the product, as fabrics with fewer fibers blended are easier to recycle for many processors. Dyes, embellishments, and other finishing chemicals can also impact recycling. Natural fibers sourced from California maximize opportunities for soil-to-soil circularity, economic development and climate mitigation. Developing more capacity for in-state fiber processing will create jobs and reduce the carbon footprint of our textile stream. With recent record-setting investments in Climate Smart Agriculture by the California Legislature, these fibers will increasingly be produced within biodiverse agricultural systems. This is increasingly important as microfibers[13] and toxins, such as per-and polyfluoroalkyl substances (PFAS), are increasingly linked to textile sources.

Figure 11: Green design steps for fabrics

- *Nature USA and CSU Northridge* were selected for upcycling uses for untreated greige fabrics coming from the manufacturing facility that were in small quantities and not enough for production runs. Since they are untreated and all natural, the materials were best used for student initiatives, such as reusable menstrual pads and practicing coloration and finishing processes on the unfinished materials.

- *California Cloth Foundry, Compostable LA, and CSU Northridge* specifically worked with organic, all natural, untreated fabric scraps that were best used for composting. California Cloth Foundry tracks all dyes and mordants, dye fixatives that are used to set and bind dyes on fabrics, added to the fabrics and their fiber sources used in the textiles, which were provided to the processors. Fibershed, an NGO specializing in regional fiber production connected California Cloth Foundry with the pilot project and identified them as a potential case study for composting.
- *Ambercycle, Circular Polymers, and Aquafil* can only take in materials that meet their specifications down to the polymer level. Ambercycle prefers 70% Polyester content or higher without hardware or labels. Circular Polymers can only take 96% Polyester content or higher, but can accept hardware and labels because of their high-tech removal process. Aquafil prefers 85% Nylon-6 or higher, but most fabric producers do not differentiate through labels if the nylon fabric is nylon-6 or Nylon-66, an important detail for recyclers, nor do they label dyes and other additives.

5.4 GREEN PURCHASING

LASAN's Environmentally Preferred Purchasing (EPP) incentivizes market demand by requiring covered entities to buy products utilizing desired production methods and raw materials. Purchasing policies can be set by the government, and also act as a tool for businesses to guide their own consumption. EPP is a good model for large-scale buyers and government agencies to develop markets for products that promote circularity. For example, universities often have purchasing policies that require collegiate garments to be made in sweatshop-free factories. Another example would be to require uniforms to be made of cotton or recycled materials to support organic farmers and recyclers. EPP programs can take commitment to sustainability to the next level by finding ways to include repair and reuse in their purchasing decisions.

- *Nature USA, Roboro, and California Cloth Foundry* have all invested in materials that are more "recyclable" due to their green design for less blends, fewer synthetic fibers and additives, and low-impact finishing processes. If more brands were using materials that were easy to identify and process at their end-of-life, the program would ultimately be more cost-effective and circular.
- *Peerless* is a wiping cloth company that takes cotton-rich materials from many of the generators in the City and County of Los Angeles. They make wiping cloths in their production facility in Vernon, California, and ship worldwide. Very few of the businesses and government agencies who generate the textiles waste for Peerless actually buy the wiping cloths from them. Currently, the City's and County's purchases cleaning cloths made from virgin fibers and/or single-use materials. Switching wiping cloth purchases to those diverted directly from textile waste generated in Los Angeles would be a major step towards regional circularity, especially with more recycling opportunities on the horizon for the wiping cloths once they reach their true end-of-life.
- *Public contracts* for textile purchases, including uniforms, jumpsuits, and other garments the City and County can set an example by giving higher ratings to products made of cotton or recycled materials. Additionally, they could require the contractor to provide take-back of the products when they are no longer suitable for their intended use, implement recycling mandates for what they take back, and reporting requirements to ensure transparency. Another effective step toward source reduction would be to provide repair services for all government purchased uniforms.

6.0 RECOMMENDATIONS

The following section describes the following recommendations and next steps.

1. Expansion of the program to include more business types and regions
2. Acquire technical support for Website/App Development
3. Secure and scale sorting site and test efficiency
4. Coalesce a textile recovery working group to pass a meaningful ordinance

6.1 PROGRAM EXPANSION

LASAN will request additional funding to expand the program to more processors, including a budget for education and outreach to promote the open call to join. Additional funds are also needed for processors to take more material volume and service more recycLA zones and LA City Departments. Project partners should include microprocessors, which align with the decentralized model of textile recovery and can address limitations from the insurance and licensing requirements. More processors are needed who can take in blended fiber-content fabrics and mixed fabric scraps and mechanical recyclers for textile-to-textile recycling.

There is also great potential to look at other commercially generated textiles. The businesses listed in Table 5 generate textile waste, but were outside the scope of this project. There are opportunities to reduce the use of virgin plastic and GHG emission generation by expanding textile recovery to more types of commercial generators to share the cost burden for expanding textile recovery and recycling infrastructure.

Another opportunity to expand the scope of work would be to focus on uniforms since state and local government agencies purchase them regularly. The total costs and recycling potential for publicly purchased uniforms have never been assessed. EPP by public agencies would support textile recovery if agencies began requesting manufacturers to produce uniforms that were either compostable or recyclable and offered uniform take-back programs that prioritized reuse and repair over recycling.

There are many business types as seen in Table 5 that use nonwoven textile products and other underappreciated sources of textiles, like masks, medical textiles, and single-use wipes.

Table 5: Summary of Business Types in Relevant Textile Generators

Business Type	**Number of Businesses Reporting Textile Waste to RecycLA**	Color Codes	Very Likely	Likely	Unlikely
		Sharable Infrastructure			
		Organics	Carpet	Mattress	Textiles
Assisted Living	68	Very Likely	Very Likely	Very Likely	Very Likely
Film - TV Production	380	Very Likely	Very Likely	Unlikely	Very Likely
Food - Processor/Manuf.	144	Very Likely	Unlikely	Unlikely	Very Likely
Hospital/Doctor Offices	1,096	Unlikely	Very Likely	Very Likely	Very Likely
Hospitality	531	Very Likely	Very Likely	Very Likely	Very Likely
Large Venue	479	Very Likely	Very Likely	Likely	Very Likely
Manuf./Industrial	1,834	Very Likely	Very Likely	Likely	Very Likely
Restaurants	2,874	Very Likely	Likely	Unlikely	Very Likely
Retail Mall	4,481	Very Likely	Likely	Likely	Very Likely
Warehousing	926	Likely	Likely	Likely	Likely
Wholesale	1,317	Likely	Likely	Likely	Likely
Total Number of Textile Generating Facilities	**14,130**				

6.2 TECHNICAL SUPPORT FOR WEBSITE/APP DEVELOPMENT

More technical support is needed to facilitate communication and connection of generators and processors that incorporate current database concepts with material matching technology (website/app/database) that offers functionality to the level of detail necessary for textile handlers, such as searching unwanted textiles by fiber blends, color, or available volume. Current examples, such as Fab Scrap, Queen of Raw, or Platform-E have great features, but lack the material matching algorithm that designers, upcyclers, and recyclers need to ensure the materials they receive meet their specifications.

6.3 SORTING SITE AND TEST EFFICIENCY

An expanded scope will be able to test large scale sorting sites and technologies to determine the efficiency differences between manual sorting and infrared spectrometer devices. To show proof of concept for high-tech sorting, with material matching opportunities connecting unwanted materials with textile processors. The expanded scope could also include testing new labeling, like scannable QR codes and radio frequency identification (RFID). TOMRA, leading one of the world's largest recycling technology companies with two functional textile sort lines in Sweden and Belgium, has communicated their interest in bringing their technology to Los Angeles

6.4 COALESCE A TEXTILE RECOVERY WORKING GROUP TO PASS A MEANINGFUL ORDINANCE

Los Angeles should establish a regional working group to review the results of this pilot and future extensions. Establishing a regional coalition will create a platform to effectively share these pilot project results so other stakeholders and industry leaders can weigh in on future program development. Any future programs should engage the multiple industries contributing to the textile waste stream for co-funding to avoid detrimental risks and costs for small businesses, local government, and environmental justice communities. The largest externalized costs currently are storage and transportation of textile waste, which are typically covered expenditures in an EPR or Stewardship program.

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APPENDIX

APPENDIX A: WASTE CHARACTERIZATIONS

Table A 1: Commercial Textiles Waste Totals in the City of Los Angeles' recycLA Zones from 2019-2021

No.	recycLA Zone	Total Reported Commercial Black Bin Waste (Tons)	Total Textiles in the Commercial Black Bin Stream (Tons)	Total Reported Commercial Blue Bin (Tons)	Total Textiles in the Commercial Blue Bin Stream (Tons)
1	F-SE	108,981	45,258	6,646	54
2	F-SLA	399,954	28,597	49,241	1,697
3	F-DT	233,066	21,786	31,275	620
4	F-NEV	512,933	20,426	52,077	1,016
5	F-WV	525,113	20,265	80,365	1,029
6	F-NC	503,555	16,001	67,346	1,757
7	F-WLA	428,192	15,989	72,627	1,393
8	F-EDT	74,473	15,426	8,845	196
9	F-NE	331,910	12,346	39,043	806
10	F-SEV	282,309	10,297	47,269	538
11	F-HB	188,497	8,558	17,396	567
12	Studio-F-NC	11,899	394	1,218	31
13	Studio-F-WLA	5,726	221	247	5
14	Studio-F-SEV	5,002	107	968	5
15	Studio-F-NE	651	25	104	2
-	**Grand Total**	**3,612,261**	**215,695**	**474,667**	**9,717**

Table A 2: City of LA Commercial Textile Calculations in the Black Bin from 2019-2021

Total Commercial Textiles in the Black Bin			
Year	Total Commercial Waste (Tons)	Percentage of textiles in the commercial waste stream	Total Commercial Textile Waste (Tons)
2019	1,526,683.06	5.35%	81,815.26
2020	1,305,140.70	6.59%	86,171.89
2021	780,437.73	6.10%	47,707.83
Grand Total	**3,612,261.49**	-	**215,694.97**
Average	**1,204,087.16**	**6.02%**	**71,898.32**

Table A 3: City of LA Commercial Textile Calculations in the Blue Bin from 2019-2021

Total Textiles in the Blue Bin			
Year	Total Commercial Waste (Tons)	Percentage of textiles in the commercial waste stream	Total Commercial Textile Waste (Tons)
2019	181,789.21	1.73%	3,152.14
2020	182,093.21	1.98%	3,603.09
2021	110,784.58	2.67%	2,961.47
Grand Total	**474,667.00**	**-**	**9,716.70**
Average	**158,222.33**	**2.13%**	**3,238.90**

NATURE USA

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Above: Nature USA spent over $9,000 to pre-sort and ship textile scraps to a recycler in India to be shredded and twisted into a new yarn.

Below: Nature USA sorted griege deadstock fabric to supply two students sew shops and campus sustainability initiatives

Description

Nature USA was created on the idea that sustainable fashion should be the norm, not the exception. They help brands and retailers develop, source, and manufacture their products in a socially responsible and environmentally sustainable manner. Nature USA offers full-service product development and manufacturing (private label) using eco-friendly fibers, less water, and energy, as well as local manufacturing. They are committed to domestic manufacturing, creating local jobs, and supporting underserved communities. Nature USA was the first GOTS-certified producer in the United States and continues as a leader.

Available Services

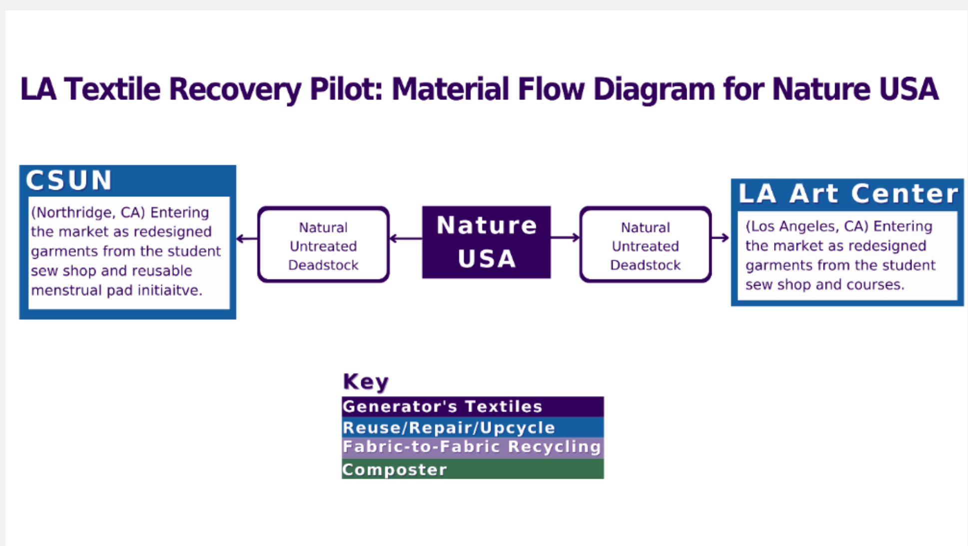
- Full-service product development
- Pattern design, cut, and sew
- Fabric Sourcing
- On-site textile waste sorting

Materials Generated

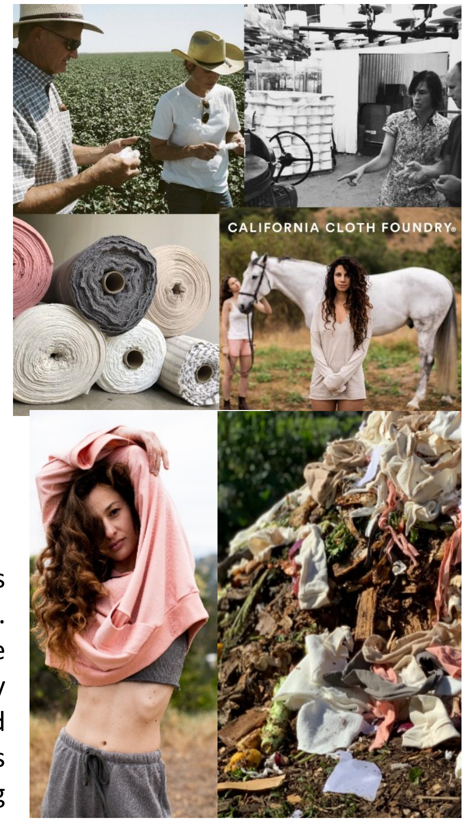
- 100% Cotton
- 50% Polyester blends
- Spandex/Cotton/Poly blends
- Cotton/Spandex blends
- Greige/Unfinished fabric

Case Study

For this case study, 379 lbs. of greige good rolls were knitted but not dyed & finished. The deadstock fabrics were 100% cotton or 50/50 poly-cotton blends. They were shipped to California State University, Northridge, for their sustainability Institute to supply the student sew shop and reusable menstrual pad initiative and the LA Art Center for their student sew shop and sustainability initiatives. Greige good give the students experience with the coloration and finishing processes. The CSUN and LA Art Center case study contains more details on the final outcomes for these materials.



CALIF ORNIA CLOTH FOUND -RY-



Contact information: Lydia Wendt, Founder and Design Director, lydia@clothesfoundry.com
Company Address: 712 S Los Angeles St, Los Angeles, CA 90014
Company Website: www.clothfoundry.com

Description

CA Cloth Foundry is a cloth & clothing brand based in downtown LA that makes textiles and apparel from sustainable natural fibers and natural dyes and colors. Using only sustainable plant-based packaging and ensuring all their fabrics are fully compostable, they avoid all petrol-based fibers, treatments, and dyes. They focus on "Slow Fashion," where pieces are meant to be timeless in design and high quality for longevity. In addition, they work exclusively in the United States and ensure they work with manufacturers and partner vendors who pay living wages.

Above: CA Cloth Foundry purchases the finest materials bought directly from their farmers.

Below: CA Cloth Foundry organic-cotton clothes; compost feedstock composed of recipe below made by Compostable LA at the Future Foods Farm.

Available Services

- Branded Apparel & Home Linens
- Custom Fabric Manufacturing
- Fiber and Yarn Sourcing & Development
- Assist neighboring businesses with managing waste

Materials Generated

- USDA Organic, Sustainable, and Naturally Treated Cotton
- Certified Lenzing® Modal from Forest Stewardship Council (FSC) cellulosic materials

Case Study

For this case study, 210 lbs. of organic cotton and modal scraps were provided to two compost processors, Compostable LA received 180 lbs., and CSUN received 30 lbs. The California Cloth Foundry provided details on the origins and certificates for each fiber source and MSDS sheets for the natural dyes and mineral mordants. Compostable LA used a lasagna composting method in a windrow system at the Future Foods Urban Farm. The compost pile consisted, 471 pounds (N) of food scraps, 21 pounds (N) of chicken manure, 180 pounds of fabric (C), and 360 pounds (C) of mulch. CSUN used a similar composting system at the sustainability center and had similar proportions of scraps in the compost mix.

Contact information: Jillian Clark, Founder, and Creative Director, jillian@roboro6.com
Company Address: N/A
Company Website: www.roboro6.com

Above: Deadstock fabric still on the bolts provided to CSUN.

Description

Roboro6 is an upcycle and design studio that turns textile waste into one-of-a-kind garments for both men and women and lifestyle goods and accessories. They partner with other small businesses to help repair clothes, such as their partnership with Hole Lotta Love Denim Repair for their Denim Repair Lab. Additionally, their upcycling services have helped companies upcycle their signages and banners into custom branded products.

Available Services

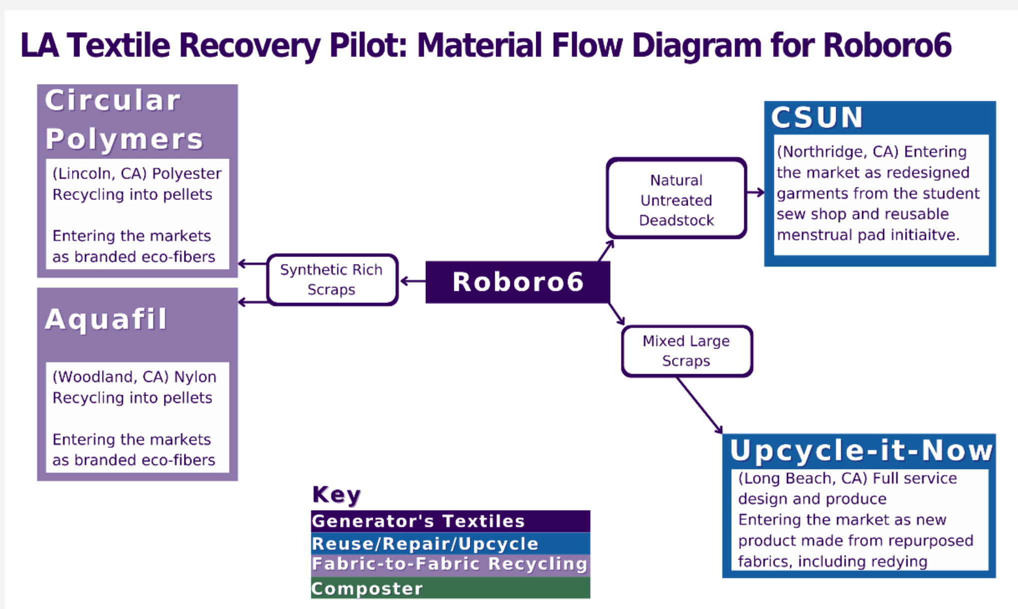
- Upcycling
- Take back used textile products for recycling or disposal
- Design services

Materials Generated

- 50 lbs. of PET scraps to Circular Polymers/Purecycle
- 50 lbs. of nylon scraps to Aquafil USA
- 150 lbs. of deadstock fabric to CSUN
- 300 lbs. of denim fabric scraps to Upcycle-it-now

Case Study

For this case study, 50 lbs. of Polyethylene terephthalate (PET) scraps were sent to Circular Polymers/Purecycle, 50 lbs. of nylon scraps were sent to Aquafil USA, 150 lbs. of deadstock fabric were sent to to CSUN's student sew shop, and 300 lbs. of denim fabric scraps to Upcycle-it-now.



UPCYCLE IT NOW

MADE IN USA

Contact information: Christina Johnson, Creative Director, info@upcycleitnow.com
Company Address: 12882 Valley View St, Suite 6, Garden Grove, CA
Company Website: https: www.upcycleitnow.com

Description

Upcycle It Now is a mother/daughter design and manufacturing company that educates and helps businesses on upcycling. They work with companies such as Patagonia, Arc Teryx, Cotopaxi, and even small businesses, like Park Project. Upcycle It Now will take the waste from companies, fix it and send it back to the companies.

Available Services

- Upcycling
- Material Sourcing
- Design services

Materials Generated

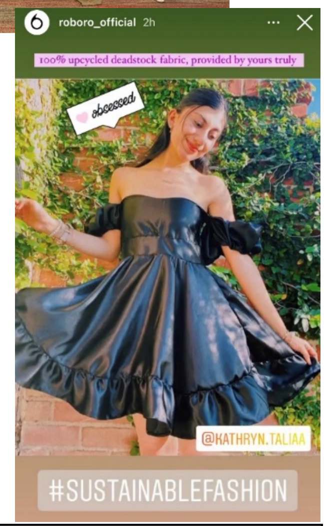
- Cotton woven
- Canvas
- Outdoor fabrics

Case Study

Upcycle-it-now received 300 lbs. of recovered deadstock and scrap fabric from Roboro6. The materials are carried in color, texture, and pattern. The recovered textiles were used to create totes and pouches for donation to LASAN to use in upcoming outreach events, including youth engagement opportunities. LASAN received these denim totes in June 2022.

Company Name: CSUN Institute for Sustainability, Art Center College of Design
Contact information: Dr. Natale Zappia, Director, natale.zappia@csun.edu; Rita Blaik, Adjunct Faculty, Rita.Blaik@artcenter.edu
Company Address:

- **CSUN:** 18111 Nordhoff St, Northridge CA 91330
- **LA Art Center:** 114 W. 4th Street Los Angeles, CA 90013



Above: Student fashion designs on display at the Expo which Roboro presented at. Below: The winner of the student fashion design competition featured on the Roboro social media.

Description

CSUN Institute for Sustainability's mission is to address local, regional, and global ecological challenges, as well as environmental and food justice through education, research, programming, and community integration. They have projects running independently and in collaboration with other universities and student organizations, including fashion sustainability programs, free thrift pop-up shops, on-campus bio-digester, and more.
Founded in 1930, ArtCenter College of Design is a global leader in art and design education. Their vision is based on their conservatory-style approach to teaching and learning, a desire for rich, intercultural, and transdisciplinary dialogue, and a mandate to provide students with innovative learning and making spaces.

Available Services

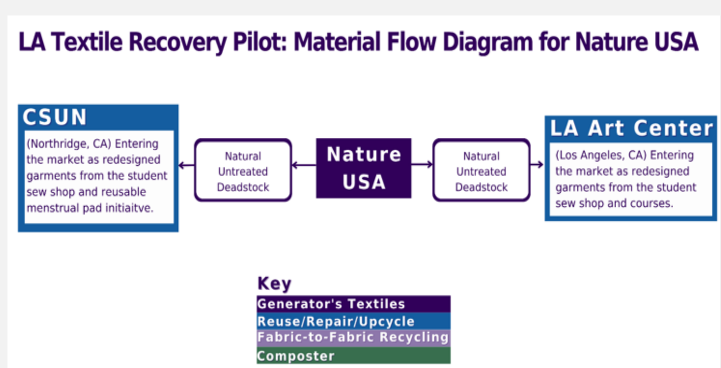
- Green Waste Composting (PILE, Proactive Integrating Landscape Ecology
- On-campus sewing shop (collects and generates textiles)
- Product design (Intersection LA, student organization)
- Sustainable Ambassador Program
- Agro-Ecology Program (Grows sustainable cellulosic textile fibers)

Materials Generated

- LA Art center received 182 lbs. of natural greige goods from NatureUSA for the student sew shop and design curriculum.
- CSUN received 30 lbs. of untreated natural scraps from CA Cloth Foundry for a small compost trial. They also received 197 lbs. of natural greige goods from Nature USA and 150 lbs. of deadstock from Roboro6 for the student sew shop and design curriculum.

Case Study

The diverted testiles were provided to the students free of charge as part of a design competition, DIY reusable menstrual pad workshop, student fashion design projects, and cotton compost experimentation. The student designs were deatures at the Reuse Culture Expo in May 2022. Design Institutions are a great local market for recovered materials as with ongoing sustainability curriculums and inititiatives. A note from one of the campus program organizers, "The impact of these programs was awesome and we're so grateful for your partnership and support!"



Above: CompostableLA staff and CA Cloth Foundry staff spreading fabric scraps in the compost pile.

Company Name: Compostable LA
Contact information: Monique Figueiredo, Owner, and Founder, monique@compostablela.com
Company Address: 136 W 1st St, Los Angeles, CA 90012
Company Website: www.compostablela.com

Description

Compostable LA is a women and BIPOC-owned company that aims to transform former 'waste' into future nutrients to close the loop in our food systems. They currently work with a network of partners and urban farms for small and medium compost processors. In addition, they offer a residential and commercial food waste pick-up service in the LA area that provides weekly or bi-weekly pick-ups and a sealable bin.

Available Services

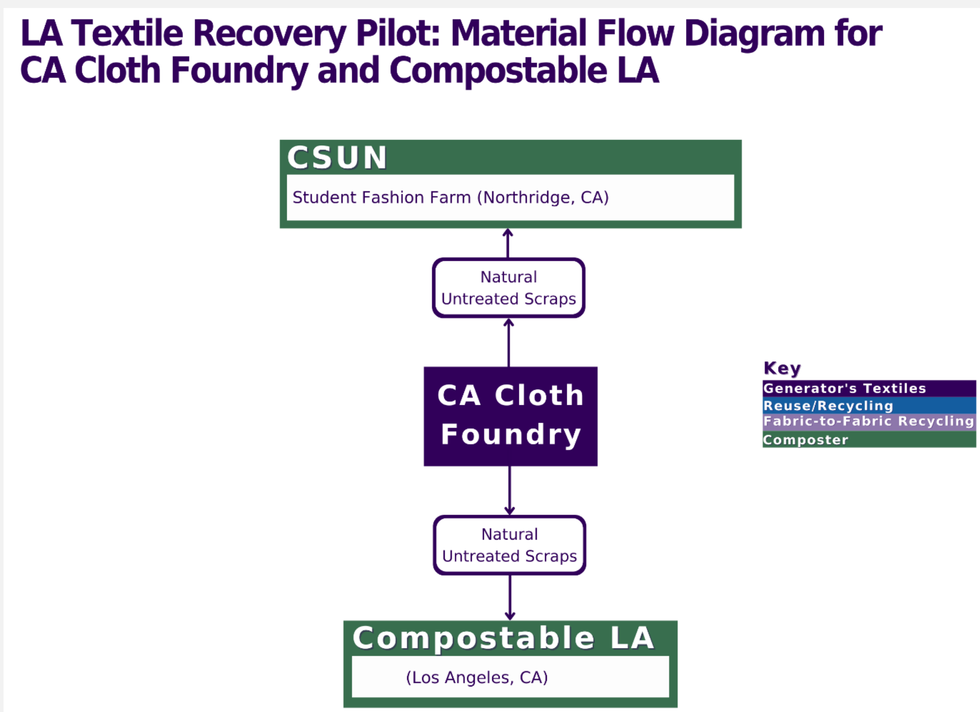
- Food waste pick-up
- Composting
- Shredding (sawdust)

Materials Generated

- Compostable Materials

Case Study

On January 28th, Compostable LA made the compost pile containing the fabric scrap sample (180 lbs.) from the California Cloth Foundry of organic, all-natural fabric scraps using a lasagna composting method in a windrow system. The fabric scraps contained 100% organic, untreated cotton, and untreated modal. The MSDS sheets were provided for the natural dyes and mordants used to color the fabric, as well as sourcing details for each fiber used in the fabrics.



Fabrics varied in size; some were shredded into small pieces while others were wide or long. This is a realistic cut floor scenario. Some of the larger pieces may need to go through the process twice in order to completely break down (that is often the case for larger pieces of mulch). Fabrics were piled together and pulled mostly apart. If any clumps stay compact throughout the process, these also may need to go through the process twice to fully break down.

Future Food Farms/Compostable will tend to the pile every Thursday – check its temperature, aerate if it's time to do so, balance out feedstock if the ratio is off, etc., and be sure to document this process and any observations gleaned.

The pile composting process is predicted to be complete in May. At which time, a lab test will be conducted to see what the biological makeup is of the pile and reported back to the grant partners

Compost Feedstock Recipe
Food Scraps: 471 pounds (N)
Chicken Manure: 21 pounds (N)
Fabric: 180 pounds (C)
Mulch: 360 pounds (C)
Total lbs.: 1,032
Total (%) fabric: 17%

The pile was monitored, turned, and maintained from the end of February, until the end of April, then began curing. After 4 weeks of curing (sitting untouched) the pile was sifted and the 'end product' looks pretty nice according to the compost vendor.

There ended up with two end products, the first is the sifted compost - roughly 60 gallons. The second is what's called "overs" - these are the solids that have been sifted out and put aside as a resource for future piles. The overs are mostly partially broken-down fabric and wood chip.

CompostableLA will continue to use these overs in regular pile batches moving forward so your CCF fabric will eventually break down over the course of many rounds of decomposition. The sifted material was fed to the onsite vermicompost system (worm farm) where it will be processed a second time and turned into highly valuable planting material.

CCF retained a sample of the compost and overs for testing that will show the nutrition of material and give a better-rounded view of how adding CCF fabrics to compost affects the outcome and possible end uses.

The project scope did not cover funds for getting material tested, so CCF paid out of pocket. A compost webinar with project participants is planned for Fall/Winter 2022.



Above: Pictures provided by CompostableLA of the windrow piles, sifting, and final outputs from the textile composting pilot.

ambercycle AQUAFIL synthetic fibres and polymers Circular Polymers™

Company Names: Ambercycle, Circular Polymers, Aquafil

Contact information:

- Shay Sethi, CEO, shay@ambercycle.com
- David Bender, President, dbender@circularpolymers.com
- Franco Rossi, President, franco.rossi@aquafil.com

Company Addresses:

- Ambercycle: 3045 E 11th St Los Angeles, CA 90023
- Circular Polymers: 3390 Venture Dr, Lincoln, CA 95648
- Aquafil: 550 N Pioneer Ave, Woodland, CA 95776

Company Websites:
www.ambercycle.com; www.aquafil.com; wwww.circularpolymers.com

Description

Ambercycle is a textile company and operator that converts end-of-life textile 'waste' into new yarns for apparel brands and manufacturers. Their unique Ambercycling processes go as follows: end-of-life textiles are intercepted from landfill, textiles are shredded and fed into series of reactors, polyester is separated, and other components are recovered as pulp, polyester is purified and reconstituted as pellets or cycora, cycora pellets are spun into new fibers and yarns.

Aquafil is one of the leading players globally in the production of polyamide 6, as well as a manufacturer of Nylon 6 fibers, polymers, Nylon 6,6, and Dryarn. Aquafil has led the way for doing business with sustainability and circular economy at the core of its values and development strategy. They are also a leader in the research of new production models for sustainable development.

Circular Polymers supplies post-consumer resin to various industries and produce a high-quality feedstock for the chemical recycling industry by manufacturing Nylon 6,6, PET, and Polypropylene from post-consumer carpet waste. They have exclusive rights to the Broadview Group's rotary impact separator technology which efficiently separates shredded post-consumer carpet into the face fiber, backing, and calcium carbonate.

Available Services

- Chemical Recycling
- Automated garment separation
- Yarns

Materials Generated

- Textile Waste
- Polyester-rich blends
- Nylon-rich blends

Case Study

Circular Polymers received 50 lbs. of PET scraps from Roboro6. The processor reported that the materials work for the recycling technology, but were too “clean” to test the separation technology as large scraps without buttons, zippers, or pattern paper. Processor requests more materials in Phase 2 that have hardware in need of removal to properly test the separation technology and larger volumes of the clean materials for recycling.

Ambercycle received 0 lbs. of PET scraps due to issues around disclosing process details.

Aquafil received 50 lbs. of nylon scraps from Roboro6. The processor verified the materials were Nylon-6 and not Nylon-66 since fabric labeling requirements only state “Nylon” in general. The materials will work for the recycling technology. The processor requests larger volumes for Phase 2.

APPENDIX C: EPA WARM MODEL[14-17]

WARM Version 15 Inputs

Version 15

Waste Reduction Model (WARM) -- Inputs

Use this worksheet to describe the baseline and alternative waste management scenarios that you want to compare. The blue shaded areas indicate where you need to enter information.
Please enter data in short tons (1 short ton = 2,000 lbs.)

1. Describe the baseline generation and management for the waste materials listed below. If the material is not generated in your community or you do not want to analyze it, leave it blank or enter 0. Make sure that the total quantity generated equals the total quantity managed.

2. Describe the alternative management scenario for the waste materials generated in the baseline. Any decrease in generation should be entered in the Source Reduction column. Any increase in generation should be entered in the Source Reduction column as a negative value. Make sure that the total quantity generated equals the total quantity managed.

Material Type	Material	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Tons Anaerobically Digested	Tons Generated	Tons Source Reduced	Tons Recycled	Tons Landfilled	Tons Combusted	Tons Composted	Tons Anaerobically Digested
Mixed Plastics	PET				NA	NA	0.00					NA	NA
	LLDPE	NA			NA	NA	0.00		NA			NA	NA
	PP				NA	NA	0.00					NA	NA
	PS	NA			NA	NA	0.00		NA			NA	NA
	PVC	NA			NA	NA	0.00		NA			NA	NA
	Mixed Plastics		75,137.00		NA	NA	75,137.00		30,000.00	45,137.00		NA	NA
Bioplastics	PLA	NA				NA	0.00		NA				NA
Electronics	Desktop CPUs				NA	NA	0.00					NA	NA
	Portable Electronic Devices				NA	NA	0.00					NA	NA
	Flat-Panel Displays				NA	NA	0.00					NA	NA
	CRT Displays				NA	NA	0.00	NA				NA	NA
	Electronic Peripherals				NA	NA	0.00					NA	NA
	Hard-Copy Devices				NA	NA	0.00					NA	NA
	Mixed Electronics				NA	NA	0.00	NA				NA	NA
Metals	Aluminum Cans				NA	NA	0.00					NA	NA
	Aluminum Ingot				NA	NA	0.00					NA	NA
	Steel Cans				NA	NA	0.00					NA	NA
	Copper Wire				NA	NA	0.00					NA	NA
	Mixed Metals				NA	NA	0.00					NA	NA
Glass	Glass				NA	NA	0.00					NA	NA
Construction Materials	Asphalt Concrete			NA	NA	NA	0.00				NA	NA	NA
	Asphalt Shingles				NA	NA	0.00					NA	NA
	Carpet				NA	NA	0.00					NA	NA
	Clay Bricks	NA		NA	NA	NA	0.00		NA		NA	NA	NA
	Concrete			NA	NA	NA	0.00	NA			NA	NA	NA
	Dimensional Lumber				NA	NA	0.00					NA	NA
	Drywall			NA	NA	NA	0.00				NA	NA	NA
	Fiberglass Insulation	NA		NA	NA	NA	0.00		NA		NA	NA	NA
	Fly Ash			NA	NA	NA	0.00	NA			NA	NA	NA
	Medium-density Fiberboard	NA			NA	NA	0.00		NA			NA	NA
	Structural Steel			NA	NA	NA	0.00				NA	NA	NA
	Vinyl Flooring	NA			NA	NA	0.00		NA			NA	NA
	Wood Flooring	NA			NA	NA	0.00		NA			NA	NA
Tires	Tires				NA	NA	0.00					NA	NA
Mixed Materials	Mixed Recyclables				NA	NA	0.00	NA				NA	NA
	Mixed Organics	NA					0.00	NA	NA				
	Mixed MSW	NA			NA	NA	0.00	NA	NA			NA	NA

3. In order to account for the avoided electricity-related emissions in the landfilling and combustion pathways, EPA assigns the appropriate regional "marginal" electricity grid mix emission factor based on your location.
Select state for which you are conducting this analysis.

Please select state or select national average:	California
Region Location:	Pacific

4. To estimate the benefits from source reduction, EPA usually assumes that the material that is source reduced would have been manufactured from the current mix of virgin and recycled inputs. However, you may choose to estimate the emission reductions from source reduction under the assumption that the material would have been manufactured from 100% virgin inputs in order to obtain an upper bound estimate of the benefits from source reduction. Select which assumption you want to use in the analysis. Note that for materials for which information on the share of recycled inputs used in production is unavailable or is not a common practice; EPA assumes that the current mix is comprised of 100% virgin inputs. Consequently, the source reduction benefits of both the "Current mix" and "100% virgin" inputs are the same.

- ○ Current Mix
- ● 100% Virgin

5. The emissions from landfilling depends on whether the landfill where your waste is disposed has a landfill gas (LFG) control system. If you do not know whether your landfill has LFG control, select "National Average" to calculate emissions based on the estimated proportions of landfills with LFG control in 2012 and proceed to question 7. If your landfill does not have a LFG system, select "No LFG Recovery" and proceed to question 8. If a LFG system is in place at your landfill, select "LFG Recovery" and click one of the options in 6a to indicate whether LFG is recovered for energy or flared.

- ○ National Average
- ● LFG Recovery
- ○ No LFG Recovery

6a. If your landfill has gas recovery, does it recover the methane for energy or flare it?

- ● Recover for energy
- ○ Flare

6b. For landfills that recover gas, the landfill gas collection efficiency will vary throughout the life of the landfill. Based on a literature review of field measurements and expert discussion, a range of collection efficiencies was estimated for a series of different landfill scenarios. The "typical" landfill is judged to represent the average U.S. landfill, although it must be recognized that every landfill is unique and a typical landfill is an approximation of reality. The worst-case collection scenario represents a landfill that is in compliance with EPA's New Source Performance Standards (NSPS). The aggressive gas collection scenario includes landfills where the operator is aggressive in gas collection relative to a typical landfill. Bioreactor landfills, which are operated to accelerate decomposition, are assumed to collect gas aggressively. The California regulatory collection scenario allows users to estimate and view landfill management results based on California regulatory requirements.

- ○ Typical operation - DEFAULT
- ○ Worst-case collection
- ○ Aggressive gas collection
- ● California regulatory collection

	Landfill gas collection efficiency (%) assumptions
Typical	*Years 0-1: 0%; Years 2-4: 50%; Years 5-14: 75%; Years 15 to 1 year before final cover: 82.5%; Final cover: 90%*
Worst-case	*Years 0-4: 0%; Years 5-9: 50%; Years 10-14: 75%; Years 15 to 1 year before final cover: 82.5%; Final cover: 90%*
Aggressive	*Year 0: 0%; Years 0.5-2: 50%; Years 3-14: 75%; Years 15 to 1 year before final cover: 82.5%; Final cover: 90%*
California	*Year 0: 0%; Year 1: 50%; Years 2-7: 80%; Years 8 to 1 year before final cover: 85%; Final cover: 90%*

7. Which of the following moisture conditions and associated bulk MSW decay rate (k) most accurately describes the average conditions at the landfill?
The decay rates, also referred to as k values, describe the rate of change per year (yr-1) for the decomposition of organic waste in landfills. A higher average decay rate means that waste decomposes faster in the landfill.

- ○ National average - DEFAULT
- ● Dry (k=0.02)
- ○ Moderate (k = 0.04)
- ○ Wet (k = 0.06)
- ○ Bioreactor (k = 0.12)

	Moisture condition assumptions
Dry (k=0.02)	*Less than 20 inches of precipitation per year*
Moderate (k=0.04)	*Between 20 and 40 inches of precipitation per year*
Wet (k=0.06)	*Greater than 40 inches of precipitation per year*
Bioreactor (k=0.12)	*Water is added until the moisture content reaches 40 percent moisture on a wet weight basis*
National average	*Weighted average based on the share of waste received at each landfill type*

8a. For anaerobic digestion of food waste materials (including beef, poultry, grains, bread, fruits and vegetables, and dairy products), please choose the appropriate type of anaerobic digestion process used.
Note that for grass, leaves, branches, yard trimmings and mixed organics, wet digestion is not applicable based on current technology and practices in the United States. Therefore, dry digestion is the only digestion type modeled in WARM for these materials.
Only one type of digestion process (wet or dry) can be modeled at a time in WARM.

- ● Wet Digestion
- ○ Dry Digestion

8b. WARM assumes that digestate resulting from anaerobic digestion processes will be applied to land. In many cases, the digestate is cured before land application.
When digestate is cured, the digestate is dewatered and any liquids are recovered and returned to the reactor (when using a wet digester). Next, the digestate is aerobically cured in turned windrows, then screened and applied to agricultural fields.
Select whether the digestate resulting from your anaerobic digester is cured before land application.

- ● Cured - DEFAULT
- ○ Not cured

9a. Emissions that occur during transport of materials to the management facility are included in this model. You may use default transport distances, indicated in the table below, or provide information on the transport distances for the various MSW management options.

- ● Use Default Distances
- ○ Provide Information

9b. If you have chosen to provide information, please fill in the table below. Distances should be from the curb to the landfill, combustor, or material recovery facility (MRF).
*Please note that if you chose to provide information, you must provide distances for both the baseline and the alternative scenarios.

Management Option	Default Distance	Distance (Miles)
Landfill	20	35.00
Combustion	20	
Recycling	20	
Composting	20	
Anaerobic Digestion	20	

10. If you wish to personalize your results report, input your name & organization, and also specify the project period corresponding to the data you entered above.

Name	
Organization	

Project Period	From		to	

Congratulations! You have finished all the inputs.
A summary of your results awaits you on the sheet(s) titled "Summary Report."
For more detailed analyses of results, see the sheet(s) titled "Analysis Results."

For an explanation of methodology, see the EPA WARM Documentation*: Documentation Chapters for Greenhouse Gas Emission and Energy Factors Used in the Waste Reduction Model (WARM)

*Emission estimates provided by this model are intended to support voluntary GHG measurements and measurement initiatives. This model ran off the assumption of using mixed plastics as the input material due to the lack of option for selecting a material input that would be inclusive of textiles comprised of natural fibers. A more accurate input including textiles of both organic and synthetic origins would be more inclusive and representative of the current textile waste in the City of Los Angeles. Had there been a more accurate option for the material input, it may have resulted in a reduced amount of GHG output being calculated.

Waste Reduction Model (WARM) -- Results

Total GHG Emissions from Baseline MSW Generation and Management ($MTCO_2E$):	1,521.86
Total GHG Emissions from Alternative MSW Generation and Management ($MTCO_2E$):	(26,851.47)
Incremental GHG Emissions ($MTCO_2E$):	(28,373.34)

$MTCO_2E$ = metric tons of carbon dioxide equivalent

Per Ton Estimates of GHG Emissions for Baseline and Alternative Management Scenarios

Material	per Ton of Material Produced ($MTCO_2E$)	per Ton of Material Source Reduced ($MTCO_2E$)	per Ton of Material Recycled ($MTCO_2E$)	per Ton of Material Landfilled ($MTCO_2E$)	per Ton of Material Combusted ($MTCO_2E$)	per Ton of Material Composted ($MTCO_2E$)	per Ton of Material Anaerobically Digested
Corrugated Containers	8.09	(8.09)	(3.14)	(0.52)	(0.31)	NA	NA
Magazines/third-class mail	8.86	(8.86)	(3.07)	(0.69)	(0.22)	NA	NA
Newspaper	5.74	(5.74)	(2.71)	(1.10)	(0.36)	NA	NA
Office Paper	8.23	(8.23)	(2.86)	0.18	(0.30)	NA	NA
Phonebooks	6.17	(6.17)	(2.62)	(1.10)	(0.36)	NA	NA
Textbooks	9.32	(9.32)	(3.10)	0.18	(0.30)	NA	NA
Mixed Paper (general)	7.61	(7.61)	(3.55)	(0.53)	(0.32)	NA	NA
Mixed Paper (primarily residential)	7.64	(7.64)	(3.55)	(0.56)	(0.31)	NA	NA
Mixed Paper (primarily from offices)	7.93	(7.93)	(3.58)	(0.42)	(0.29)	NA	NA
Food Waste	3.66	(3.66)	NA	0.13	(0.08)	(0.12)	(0.02)
Food Waste (non-meat)	0.76	(0.76)	NA	0.13	(0.08)	(0.12)	(0.02)
Food Waste (meat only)	15.10	(15.10)	NA	0.13	(0.08)	(0.12)	(0.02)
Beef	30.09	(30.09)	NA	0.13	(0.08)	(0.12)	(0.02)
Poultry	2.45	(2.45)	NA	0.13	(0.08)	(0.12)	(0.02)
Grains	0.62	(0.62)	NA	0.13	(0.08)	(0.12)	(0.02)
Bread	0.66	(0.66)	NA	0.13	(0.08)	(0.12)	(0.02)
Fruits and Vegetables	0.44	(0.44)	NA	0.13	(0.08)	(0.12)	(0.02)
Dairy Products	1.75	(1.75)	NA	0.13	(0.08)	(0.12)	(0.02)
Yard Trimmings	NA	NA	NA	(0.40)	(0.10)	(0.05)	NA
Grass	NA	NA	NA	(0.02)	(0.10)	(0.05)	NA
Leaves	NA	NA	NA	(0.68)	(0.10)	(0.05)	NA
Branches	NA	NA	NA	(0.94)	(0.10)	(0.05)	NA
HDPE	1.52	(1.52)	(0.76)	0.02	1.78	NA	NA
LDPE	1.80	(1.80)	NA	0.02	1.79	NA	NA
PET	2.21	(2.21)	(1.04)	0.02	1.50	NA	NA
LLDPE	1.58	(1.58)	NA	0.02	1.78	NA	NA
PP	1.54	(1.54)	(0.79)	0.02	1.78	NA	NA
PS	2.50	(2.50)	NA	0.02	2.10	NA	NA
PVC	1.93	(1.93)	NA	0.02	0.86	NA	NA
Mixed Plastics	1.94	(1.94)	(0.93)	0.02	1.61	NA	NA
PLA	2.45	(2.45)	NA	(1.64)	(0.42)	(0.09)	NA
Desktop CPUs	20.86	(20.86)	(1.49)	0.02	(0.62)	NA	NA
Portable Electronic Devices	29.83	(29.83)	(1.06)	0.02	0.69	NA	NA
Flat-Panel Displays	24.19	(24.19)	(0.99)	0.02	0.06	NA	NA
CRT Displays	NA	NA	(0.57)	0.02	0.49	NA	NA
Electronic Peripherals	10.32	(10.32)	(0.36)	0.02	2.12	NA	NA
Hard-Copy Devices	7.65	(7.65)	(0.56)	0.02	1.24	NA	NA
Mixed Electronics	NA	NA	(0.79)	0.02	0.42	NA	NA
Aluminum Cans	10.99	(10.99)	(9.13)	0.02	0.03	NA	NA
Aluminum Ingot	7.48	(7.48)	(7.20)	0.02	0.03	NA	NA
Steel Cans	3.64	(3.64)	(1.83)	0.02	(1.60)	NA	NA
Copper Wire	6.78	(6.78)	(4.49)	0.02	0.02	NA	NA
Mixed Metals	6.22	(6.22)	(4.39)	0.02	(1.03)	NA	NA
Glass	0.60	(0.60)	(0.28)	0.02	0.02	NA	NA
Asphalt Concrete	0.11	(0.11)	(0.08)	0.02	NA	NA	NA
Asphalt Shingles	0.19	(0.19)	(0.09)	0.02	(0.35)	NA	NA
Carpet	3.68	(3.68)	(2.38)	0.02	1.29	NA	NA
Clay Bricks	0.27	(0.27)	NA	0.02	NA	NA	NA
Concrete	NA	NA	(0.01)	0.02	NA	NA	NA
Dimensional Lumber	2.13	(2.13)	(2.66)	(1.05)	(0.38)	NA	NA
Drywall	0.22	(0.22)	0.03	(0.06)	NA	NA	NA
Fiberglass Insulation	0.48	(0.48)	NA	0.02	NA	NA	NA
Fly Ash	NA	NA	(0.87)	0.02	NA	NA	NA
Medium-density Fiberboard	2.41	(2.41)	NA	(0.90)	(0.38)	NA	NA
Structural Steel	3.42	(3.42)	(1.93)	0.02	NA	NA	NA
Vinyl Flooring	0.58	(0.58)	NA	0.02	(0.11)	NA	NA
Wood Flooring	4.03	(4.03)	NA	(0.86)	(0.47)	NA	NA
Tires	4.46	(4.46)	(0.38)	0.02	0.50	NA	NA
Mixed Recyclables	NA	NA	(2.85)	(0.50)	(0.26)	NA	NA
Mixed Organics	NA	NA	NA	(0.11)	(0.09)	(0.09)	NA
Mixed MSW	NA	NA	NA	(0.07)	0.13	NA	NA

APPENDIX D: PILOT CASE STUDY MATERIAL DESCRIPTIONS

Greige Goods: Raw fabric before undergoing dying or bleaching

PET Scraps: Polyethylene Terephthalate scraps

Deadstock Fabric: Leftover fabric that cannot be used for its original purpose or order fulfilment anymore

Natural Scraps: Comprised of fibers that occur in the natural world from an animal, vegetable, or mineral source

Contact Us

LASAN is dedicated to protecting public health and the environment for all Angelenos. For more information about the **Textile Recovery Project**, please contact **san.iwmd@lacity.org.**

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