Maryland
Department of
the Environment

HDR

FINAL NEEDS ASSESSMENT

MARYLAND STATEWIDE
RECYCLING NEEDS ASSESSMENT

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Contents

Tables

Figures

Appendices

Appendix A: Waste Characterization Study

Appendix B: Residential Recycling Stream Analysis

Appendix C: Infrastructure and Capacity

Appendix D: Worker Conditions, Wages, and Benefits

Appendix E: Opportunities for MWBE

Appendix F: Multi-Family and Commercial Recycling Services

Appendix G: Recycling Economic Opportunities

Appendix H: Equity Within Recycling Systems

Appendix I: Review and Analysis of Packaging EPR Programs

Executive Summary

In 2023, Governor Moore and the Maryland General Assembly enacted Senate Bill 222 Statewide Recycling Needs Assessment and Producer Responsibility for Packaging Materials, which established the Extended Producer Responsibility (EPR) Advisory Council and mandated a statewide Recycling Needs Assessment (Needs Assessment).

The Maryland Department of the Environment (MDE) selected HDR to develop this assessment in Summer 2024. The Project Team also includes Eunomia Research and Consulting, Ltd. (Eunomia), MSW Consultants, Straughn Environmental, Vision Planning and Consulting (VPC), and Assedo Consulting. The team is composed of circularity experts, solid waste and recycling system design and operations experts, local stakeholder engagement professionals, equity specialists, and environmental analysts that combine a breadth of national EPR experience and depth of local Maryland understanding. To inform the development and implementation of EPR for packaging legislation, the Needs Assessment presents an evaluation intended to develop realistic, data-driven goals for waste reduction and recycling in alignment with key environmental and economic considerations on a regional basis.

The following key takeaways present the themes and conclusions from the Needs Assessment that are intended to inform the EPR for packaging legislation in the State and future program planning:

- EPR for packaging can play a pivotal role in advancing long-term climate action planning and zero waste initiatives in the State. MDE estimates that a well-designed program could increase the State's recycling rate for Paper and Packaging Products (PPP) from 34% to 50% or greater.

- Benefits under the modelled EPR system include $202 million of material value captured (an increase of $53 million from the baseline), a reduction of more than 1 million metric tons of carbon dioxide equivalent (CO2E), and the creation of 2,075 additional jobs. Additionally, the increased investment in infrastructure and local jobs would occur without significant impacts to state capital or operations budgets.

- While this analysis estimates that the sector wide costs of EPR for packaging implementation are approximately 20% higher than baseline recycling costs, those costs decrease per unit recycled as volume of material recycled increases.

- Aligning future EPR program targets with existing operations, harmonizing education and outreach, and justifying future investments in infrastructure on a regional basis has potential to increase the State's recycling rate of PPP from 34% to 50% or greater.

- As the State coordinates with the PRO to plan for implementation of EPR, it is critical to support communities to increase participation, and quality and volume of recycling while minimizing negative environmental impacts.

- Clearly defined expectations during program design and implementation for the PRO are essential to expand recycling access, investment in recycling infrastructure, and detailing the responsibility of multiple parties (e.g., MDE's role in the program).

- Lessons from other EPR programs, such as those for tires and batteries, highlight the importance of balancing policy mechanisms with administrative feasibility.

- Program implementation should balance the quality of dual-stream or multi-stream collection and processing systems with the convenience and increased volume generated by single-stream collection.

- EPR for packaging will improve recycling rates across the state, while increasing recycling access in currently underserved communities.

The following executive summary provides an overview of the background, approach, and key findings for each component of the Needs Assessment. The assessment provides a comprehensive analysis of the State of Maryland's (State) current recycling system, identifying gaps and opportunities for improvement through EPR for packaging.

1. Waste Characterization

Accurate waste composition data is foundational to this Needs Assessment. The composition of the disposed waste stream is constantly changing due to a variety of macroeconomic factors including, but not limited to, the migration from print to digital media, online shopping, lightweighting of packaging materials, and efforts to divert hard-to-recycle materials from the landfill. As part of the Needs Assessment, a waste characterization study was performed in November 2024 (2024 WCS) across Maryland to collect aggregated disposed waste composition data. The 2024 WCS updates and largely replicates a statewide waste characterization study conducted in 2016 but includes an expanded list of material categories to capture baseline data about disposed packaging materials for incorporation in the broader Needs Assessment analysis.[1]

The 2024 WCS included a single season sampling and sorting effort. Across ten days of field work from November 4 through November 15, 2024, sampling was performed at nine (9) disposal facilities in Maryland. Waste composition results were analyzed by generator sectors (Residential and commercial) and demographic regions (Suburban, Urban, and Rural).

The material categories for the 2024 WCS were designed to be consistent with Maryland's 2016 waste characterization study but included some additions to accommodate the EPR packaging focus of the Needs Assessment. The 2024 WCS assigned "divertibility" classifications to each material category to provide additional perspective on the ability to reduce wastes sent to landfill. The detailed results of the 2024 WCS also incorporated the findings of two (2) recent composition studies from Prince George's County and Montgomery County, both classified as Suburban, in an "adjusted" analysis. See **Section 2** for additional details.

High level findings from the 2024 WCS include:

- As compared to 2016, the State's current disposed waste stream contains a higher percent composition of plastics, organics, paper, glass, HHW and other wastes, while C&D materials mixed with MSW experienced a significant decrease.

- On a percentage basis, the incidence of Curbside Recyclable materials and Other Non-Curbside Recyclable materials in disposed wastes have decreased since 2016, while the incidence of Not Currently/Widely Recyclable materials has increased. On an absolute tonnage basis, disposal of MSW across all divertibility classes has increased.

- The percent composition of disposed wastes by material group is mostly consistent across demographic regions. However, the Urban disposed wastes have a significantly higher proportion of C&D materials and the lowest proportion of Organics materials.

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[1] Maryland Department of Environment, Northeast Maryland Waste Disposal Authority (2017). 2016 Maryland Statewide Waste Characterization Study. mde.maryland.gov/programs/Land/SolidWaste/Documents/2016 Maryland Statewide WCS Study.pdf

- On a percentage basis, commercial waste contains a higher incidence of Paper, while the residential sector contains a higher percentage of Organics.
- The most prevalent material in both generator sectors is Food Waste, although the percent composition of the other most prevalent items differs for Residential and commercial wastes.
- The divertibility of disposed materials in the Residential and Commercial sectors are similar, with the Residential sector having a higher occurrence of Not Currently/Widely Recyclable and Compostables/Mulchables categories in the disposed waste stream.

2. Stakeholder Engagement

The Project Team conducted stakeholder engagement through survey and interview efforts that informed the analysis of the current recycling system in this Needs Assessment. The data obtained through these surveys and interviews builds upon the county-provided data that MDE receives via annual reporting. The Project Team distributed electronic surveys to stakeholder groups, excluding strategic partners who were only interviewed. **Table ES-1** shows the Project Team engaged with the following groups:

Table ES-1: Stakeholder Groups Engaged for the Needs Assessment Report

Stakeholders	Respondents
Counties and Select Municipalities: The 24 Maryland Counties (including the City of Baltimore) and select municipalities as identified by MDE were engaged to participate in the survey. Municipalities included in the survey efforts include those that provide solid waste and recycling collection, generate high volumes of recyclables, have seasonal fluctuations in volume, and/or have challenging and unique collection geographies.	- 23 Counties - 18 Municipalities
Material Recovery Facilities (MRFs): Each recycling processing facility in Maryland, as well as select out of state facilities that receive Maryland's material were engaged through survey and interview.	9 Material Recovery Facilities (MRFs)[1]
Recycling Haulers: Haulers were identified by National Waste and Recycling Association (NWRA) and were engaged through survey.	Confidential[2]
Composting Facilities: Tier 1 and Tier II composting facilities were engaged through survey.	10 Composting Facilities
Strategic Partners: Various organizations and government entities identified by MDE covering environmental advocacy, economic development, waste management, urban planning, and the packaging industry were engaged through an interview process.	17 strategic partner organizations

1. This includes two (2) out of state MRFs that receive Maryland's recyclables and four (4) additional facilities that bale source separated commodities.
2. Number of haulers engaged is subject to confidentiality under non-disclosure agreement.

Responses from stakeholders included consistent themes, but each group has its own challenges and needs. The following presents a high-level summary of the key

opportunities and challenges of potential EPR for packaging identified through the process:

- County and municipality respondents indicated that there is general support for EPR for packaging to bolster existing recycling programs and support upstream waste prevention efforts, such as redesign of packaging, encouraging reuse, and minimizing environmental impacts; however, there is a concern about mandates that may disrupt existing operations, program implementation requirements, or additional costs to counties and municipalities that are not covered by the program. Stakeholders expressed support for aligning future EPR program targets with existing operations, harmonizing education and outreach, and justifying investments in infrastructure on a regional basis to support ongoing County and municipality initiatives. However, feedback suggested that the EPR program should not prohibit the autonomy of a County or municipality to determine how to balance its own environmental, economic, and operational priorities.

- Haulers, MRFs, and composting facility owners and operators manage the systems that support existing recycling programs in the State and would be impacted by any EPR for packaging program. These entities appreciate the opportunity to increase recycling in the State but are concerned about reporting requirements and operational impacts related to the management of additional material streams that may be required by EPR for packaging. Working closely with these entities as part of program planning and providing financial support for necessary investments in infrastructure, equipment, and personnel could streamline program implementation and build collaboration with these groups.

- Strategic partners ranged from a wide set of organizations including regional authorities, economic development groups, environmental advocates, organizations for recycling operators, and packaging producers. Generally, these organizations recognize that EPR for packaging could have a wide-ranging positive impact for their constituents, but caution against unintended consequences. Strategic partners encourage the State to craft EPR for packaging legislation that empowers the Producer Responsibility Organization (PRO) to establish a program plan that balances the needs of packaging producers, engages economic development initiatives, leverages existing regional contracting mechanisms, and achieves environmental goals.

3.   Recycling Programs

The Maryland Recycling Act (MRA) defines the types of waste that count toward the State's recycling rate. Counties with more than 150,000 residents are required to recycle at least 35% of generated waste, and counties with less than 150,000 residents are required to recycle at least 20% of generated waste.

Based on analysis of the data collected as part of the stakeholder engagement process, the Project Team evaluated the program performance of recycling of each generator sector

including single-family, multi-family, and commercial. This included analysis of how programs operate on a regional basis across the State.

Recycling rates, which include only materials sent to recycling markets, vary by generator sector. The State's commercial sector has the highest recycling rate of PPP at 39%. Single-family households achieve an average recycling rate of 30%, with rates ranging from 8% to 39%. Twenty out of 24 counties report having access to curbside recycling service for single-family residential customers, and all counties have at least one drop-off location. Multi-family households have a lower recycling rate of 16%. Materials with the highest recycling rates across all sectors include glass and old corrugated cardboard (OCC).

Commercial recycling participation ranges from counties reporting that less than 25% of businesses engage in recycling, to others achieving over 75% compliance due to municipal ordinances requiring specific container size ratios for recycling and trash. These ordinances appear to encourage higher recycling rates in jurisdictions where they are enforced. However, the lack of uniform commercial recycling requirements and enforcement mechanisms suggests room for improvement in aligning commercial recycling efforts statewide.

Effective consumer education plays a pivotal role in enhancing recycling program success, as counties with robust education efforts demonstrate higher diversion rates. Challenges persist in multi-family recycling, with limited enforcement programs and compliance efforts. Participation in multi-family recycling programs remains primarily below 50%, and Western Maryland, Southern Maryland, and the Lower Eastern Shore Regions have programs without dedicated recycling education, outreach, and compliance staff, which minimizes recycling program effectiveness.

4.   Infrastructure and Capacity

The Project Team developed the evaluation of recycling capacity and infrastructure based on surveys and interviews with facility operators. These provided key data and insights into existing infrastructure capacity and future development plans. A comprehensive identification of in-state and out-of-state facilities assessed the current recycling system's reach and efficiency. This included an evaluation of equipment, operational practices, and planned expansions at MRFs, transfer stations, and composting facilities to determine potential improvements and modernization needs. Additionally, opportunities for developing new facilities were explored and reuse and refill infrastructure outlets were evaluated to address capacity gaps.

Aging single-stream and dual-stream MRFs in the State require equipment upgrades and modernization. Outdated equipment leads to increased downtime, repair challenges, and poor sorting of materials. Upgrading the equipment at these facilities could add approximately 190,150 tons per year (TPY) of recycling capacity at an estimated cost of $9.2 million to $10.3 million. Enhancements like magnets and eddy current separators could also improve material recovery rates by reducing losses and improving material quality. Push and bale MRFs and MRFs with ongoing construction or capital improvement

projects, though not included in the current cost estimates, present additional opportunities to optimize material flow efficiency statewide.

Maryland has 42 transfer stations, with 38 located in-state and 4 in neighboring jurisdictions (Washington D.C. and Delaware). Of these, 22 facilities accept recyclables, providing essential logistical support for connecting materials to end markets. Leveraging these transfer stations strategically could enhance the efficiency of Maryland's recycling system and reduce transportation costs, ensuring better alignment between collection points and processing facilities.

The State's Tier I and Tier II organics processing facilities have a combined capacity of approximately 978,600 tons, with nearly 800,000 tons allocated for Tier II and anaerobic digestion facilities. Upgrading infrastructure at these facilities could range between $1.8 million and $25.5 million per facility, depending on size (not including anaerobic digestion upgrades). These upgrades would improve processing capacity and efficiency, enabling the State to handle a larger volume of organic materials and reducing landfill dependency.

The Project Team reviewed opportunities where new facilities were reported for development. Proximity to freight rail lines is critical for future recycling facility siting, with the City of Baltimore and Washington County offering strong potential for development due to rail connectivity and redevelopment opportunities. Freight and rail transportation lines are concentrated along the I-95 corridor. Therefore, brownfields along the I-95 corridor and along other key transportation corridors are ideal locations for eco parks supporting recycling, reuse, and remanufacturing businesses. Initiatives like Baltimore's Camp Small and Second Chance demonstrate how such facilities can foster innovation, create jobs, and expand recycling capacity while aligning with state growth priorities. Other areas of the State may be best fit for a hub-and-spoke collection system to increase recycling performance.

Maryland has nearly 300 reuse organizations, 19% of which accept packaging-related materials. These programs, along with those at colleges, universities, and state agencies, provide opportunities to expand sustainable practices across the State. Eco parks and business reuse initiatives, particularly along the I-95 corridor, could further enhance Maryland's reuse economy by fostering collaboration, driving environmental innovation, and creating new economic opportunities. These efforts align closely with state goals to promote sustainability and reduce waste.

5.   Workers Conditions, Wages, and Benefits

The solid waste and recycling industry involves demanding and hazardous jobs that require workers to collect, process, and manage materials under challenging conditions. Workers face risks from handling potentially dangerous materials, operating heavy machinery, and performing physically strenuous tasks. Safety concerns are exacerbated by incidents such as facility fires, and extreme weather. In 2023, the industry reported an injury rate of 4.3 cases per 100 Full-Time Equivalent (FTE) employees, with 24 of 35 worker fatalities attributed to transportation incidents. Curbside collection workers, in particular, contend

with difficult working environments, including challenging alley pickups, extreme heat, and traffic impacts.

Despite the high demand for solid waste and recycling jobs, the industry faces ongoing difficulties in recruitment and retention. An aging workforce, coupled with competition from other industries like delivery services (e.g., Amazon and FedEx), has limited labor availability. These recruitment challenges persist even as workforce development becomes increasingly critical, particularly with the implementation of EPR programs. Current labor forces must be considered in future workforce planning to ensure sustainable operations.

Additionally, many public and private waste management companies offer non-cash compensation benefits, such as healthcare, retirement plans, and insurance policies, the value and types of benefits vary widely. Such benefits play a key role in employee retention and satisfaction but may not fully address the industry's recruitment challenges. Addressing disparities in compensation and improving working conditions could enhance job attractiveness and support workforce stability in this essential yet demanding sector.

6.   Opportunities for MWBE

EPR for packaging legislation has the potential to create significant business opportunities in Maryland, including the expansion of jobs and the incentivization of Minority and Women-owned Business Enterprise (MWBE) participation. By incorporating MWBEs into the State's solid waste system, both the industry and the broader community could benefit from increased diversity and inclusion, fostering economic growth and innovation within the sector.

Recent years have seen increased efforts by major waste industry companies to make their operations more diverse and inclusive, aiming to improve corporate culture and recruitment. Despite these efforts, the Equal Employment Opportunity Commission (EEOC) reported in 2018 that over half of employees in waste management remediation services were White, and over 80% were male. Expanding MWBE participation in the solid waste and recycling sectors could help address these disparities while strengthening workforce representation and inclusion.

Minority-owned businesses account for 25.4% of companies in Maryland, with over half (56.6%) of these businesses operating for six years or more—a figure slightly higher than the national average. This established presence highlights the potential for MWBEs to play a larger role in the solid waste and recycling industry, particularly as EPR programs and other policy initiatives create new opportunities for growth and investment in this sector.

Maryland offers various resources to support MWBE businesses, including assistance with funding access, procurement processes, and participation in key industries like recycling. These resources, combined with equitable procurement policies, aim to level the playing field for small businesses, including MWBEs, enabling them to compete for contracts in the waste and recycling sectors. Leveraging these programs will be critical to ensuring MWBE inclusion as EPR legislation is implemented.

Despite the State's robust support for MWBEs, the certification process remains complex and varies significantly by community. Establishing centralized resources and streamlining the certification process could reduce barriers for MWBEs, saving time and increasing access to opportunities. Potential EPR legislation could play a key role in addressing these inefficiencies, creating a more collaborative and efficient system to help MWBEs engage in the solid waste and recycling industry effectively.

7. Economic Opportunities/End Markets

Recyclable materials disposed of in landfills represent significant lost economic and environmental opportunities. These materials could generate revenue through recycling markets, support recycling systems, and provide resources for manufacturing new products. In 2022, the annual value of recyclable materials disposed of in Maryland landfills was substantial. It was estimated to range from $189 million to $248 million, underscoring an opportunity for recovery of these valuable commodities.

Maryland's recycling industry supports approximately 5,000 jobs, generating $3.4 million in wages and $1.6 billion in total economic output from the collection and processing of recyclable materials. Expanding the State's recycling system could recover the value of currently disposed materials while creating additional economic benefits, including new jobs, increased wages, and higher revenue for existing companies.

Robust end markets for recycled materials are essential for driving the remanufacturing process and reducing barriers to recycling. EPR legislation could help stabilize pricing, increase demand for post-consumer feedstocks, and strengthen the remanufacturing sector. By fostering efficient and accessible end markets, Maryland could improve the economic sustainability of its recycling system and incentivize higher material recovery rates.

The distance between MRFs and end markets presents financial challenges for recycling operations, as transportation costs can outweigh material value. Increasing the volume of recyclable materials processed could spread fixed costs across larger volumes, justifying investments in facility automation and infrastructure improvements. These enhancements would increase efficiency and recovery rates, making improved recycling operations more cost-effective and sustainable.

8. Environmental Justice

It is critical to the State that program planning prioritizes support for overburdened and underserved areas. Maryland's existing environmental justice (EJ) policies, including the use of EJ screening tools and collaboration with the Commission on Environmental Justice and Sustainable Communities (CEJSC), aim to identify communities disproportionately affected by climate impacts and greenhouse gas (GHG) emissions.

In the Washington Metro Region, urban census tracts near Washington D.C. and rural areas in southern Prince George's County have the highest EJ scores. Urban areas are overburdened due to higher pollution exposure and may be disproportionally impacted by environmental effects. The Baltimore Metro Region, particularly the City of Baltimore and

the I-95 corridor, exhibits high EJ scores due to urban pollution risks and concentrations of underserved populations. Program planning must balance the need for targeted interventions to reduce pollution exposure and improve environmental conditions while improving program performance.

The Lower Eastern Shore Region faces some of the highest EJ concerns in the State which are driven by low-income populations, high unemployment rates, and pollution burdens from industry specific to the region. Improving recycling performance in these areas would require strategic investments in infrastructure and services that account for the unique socioeconomic and environmental conditions of the region.

Expanding recycling infrastructure in rural areas requires careful consideration of the challenges posed by geography, such as mountainous terrain or water barriers. Infrastructure development must focus on achieving economies of scale to minimize environmental and financial impacts. This approach is critical to ensuring low-income rural communities are not disproportionately affected by the costs or consequences of waste management and recycling programs.

In densely populated regions, such as Baltimore and the Washington Metro Area, improving recycling performance must include measures to minimize tailpipe emissions, traffic congestion, and roadway degradation. These enhancements will help reduce the additional burdens placed on historically underserved communities, ensuring that recycling infrastructure development aligns with environmental justice priorities and supports healthier living conditions for all residents.

9.   Baseline System

This Needs Assessment estimated the baseline performance and cost of recycling PPP in Maryland in 2022. This analysis found the following key results.

- Maryland generated approximately 2.9 million tons of covered PPP in 2022. Approximately 60% were generated in the commercial sector, 30% by single-family households, and 10% by multi-family households.

- The materials that make up the largest share of the composition of covered PPP include OCC/cardboard (35%), paper (27%), and flexible plastic (14%). The materials which make up smaller shares are rigid plastic (11%), glass (8%), metal (4%), and cartons (1%).

- Approximately 34%, or 984,400 tons, of covered PPP is recycled in Maryland.

- The commercial sector has the highest recycling rate (39%) followed by single-family households (30%), and multi-family households (16%).

- The covered PPP materials with the highest recycling rates include OCC/cardboard (52%) and paper (37%). Materials with lower recycling rates include metal (30%), rigid plastics (27%), and glass (24%). The materials with the lowest recycling rates include cartons (8%) and flexible plastics which is essentially 0%.

- The collection and sorting of covered PPP in Maryland in 2022 is estimated to cost approximately $406 million. Approximately 65% of the cost is from residential curbside collection, 32% is from commercial curbside collection, and 3% is from drop-off collection.

10. Future State

This Needs Assessment estimated a possible future performance and cost of recycling covered PPP in Maryland under a theoretical EPR for packaging system design. This analysis found the following key results.

- Active curbside recycling service for single family households could increase from 89% to 96%, multi-family households could increase from 49% to 100%, and total active service for residential households could increase from 78% to 97%. An additional 450,000 households could have curbside recycling under EPR.

- The overall PPP recycling rate would improve from about 34% to 50%. This increases the total volume of material collected from an estimated 984,400 tons to 1,445,000 tons.

- The following PPP recycling rate increases would be delivered for each sector:
    - The single-family household PPP recycling rate would increase from 30% to 48%
    - The multi-family household PPP recycling rate would increase from 16% to 34%
    - The commercial property recycling rate for PPP would increase from 39% to 53%

- Recycling rates for all covered packaging materials would increase as detailed:
    - Flexible plastic would increase from 0% to 9%
    - Glass would increase from 24% to 43%
    - Paper would increase from 37% to 59%
    - OCC/Cardboard would increase from 52% to 69%
    - Cartons would increase from 8% to 17%
    - Metal would increase from 30% to 44%
    - Rigid plastic would increase from 27% to 33%

The estimated cost of PPP EPR that delivers the above benefits is approximately $550 million, which is an increase of $144 million from the cost of the baseline system. The cost per ton recycled is estimated to be $412 at baseline and could fall to $378 per ton under EPR.

1. Introduction

In May 2023 the Maryland Legislature signed Senate Bill 222 - Statewide Recycling Needs Assessment and Producer Responsibility for Packaging Materials into law initiating the development of an Extended Producer Responsibility (EPR) Advisory Committee and development of a statewide Recycling Needs Assessment (Needs Assessment). The State released a Request for Proposal (Solicitation No: U00R4600021) and selected the HDR Project Team (Project Team). The Project Team includes circularity experts, solid waste and recycling system operations experts, local stakeholder engagement professionals, equity, and environmental analysts to provide a comprehensive analysis of the State's current recycling capacity and a detailed evaluation of the impact EPR for packaging may have.

Figure 1: HDR Project Team

HDR	HDR Engineering, Inc. (HDR) led the development of the Needs Assessment by coordinating efforts among the multi-disciplinary Project Team and providing strategic direction in coordination with MDE. HDR's facility engineers, solid waste planners, and operational experts provided critical analysis, validating key technical and financial inputs to support the robust modeling effort.
eunomia	Eunomia Research & Consulting, Inc. (Eunomia) led the development of the **baseline and future state modeling** effort, leveraging unique **EPR-focused expertise** to support the development of programs and policies in Canada and needs assessments in other states.
MSW CONSULTANTS	MSW Consultants led the **field work and data analysis** for the Waste Characterization Study (WCS) and developed a **comparative analysis** to the prior 2016 WCS while analyzing an **expanded list of materials to include key packaging materials**.
STRAUGHAN ENVIRONMENTAL	Straughan Environmental, Inc. (Straughan)* provided a **strong local understanding of the State** and provided detailed Geographic Information Systems (GIS) analysis, **visualizing data** on demographics, Environmental Justice (EJ), and recycling infrastructure.
ASSEDO CONSULTING	Assedo Consulting, LLC (Assedo)* supported the **public engagement** and **equity analysis**, leveraging their depth of experience working in the Washington and Baltimore Metro Regions to make contact and interview key stakeholders. Assedo also provided timely **research on wages, benefits, and working conditions** and learned experiences as an African American, woman-owned business on the **challenges and opportunities for Minority and Women-Owned Business Enterprise (MWBE) businesses in State**.
VPC VISION PLANNING AND CONSULTING	Vision and Planning Consulting, LLC (VPC)* supported the **public engagement**, leveraging their experience working for Maryland state agencies to make contact and interview with key stakeholders. As a small, minority, and woman-owned business, VPC compiled extensive research on **packaging reuse and waste reduction infrastructure** in the State.

Note: *Sub is MWBE subcontractor

This Needs Assessment is a vital step in supporting the development of comprehensive legislation that supports the recycling programs and infrastructure in the State of Maryland (State) and presents critical data and analysis that can be used to initiate program planning. It provides a comprehensive analysis of the current recycling system, identifying gaps, and opportunities for improvement to develop an EPR program to address specific challenges on a regional basis that can establish realistic, data-driven goals for waste reduction and recycling in alignment with key environmental and economic considerations. Through a robust stakeholder engagement process, the Project Team coordinated collaboration and transparency among participants of the State's recycling system, building a foundation for successful implementation of an equitable long-term policy initiative.

The following provides background information, describes the geographical scope of the State, presents supporting equity and demographic information, and provides an overview of the structure of the Needs Assessment report.

1.1 Background

EPR for packaging has the potential to enhance the State's progress toward meeting its waste reduction, recycling, and net-zero goals. By engaging producers to support paper and packaging products (PPP) management in the post-consumer phase, EPR for packaging legislation can shift the financial burden away from taxpayers and local governments, incentivizing companies to design more sustainable, recyclable, and reusable packaging.

This approach aligns with Maryland's commitment to reducing landfill waste and greenhouse gas emissions. As the state works toward achieving its net-zero targets, EPR promotes a more efficient, circular economy that minimizes environmental impact, fosters innovation, and supports local recycling infrastructure.

EPR for packaging is gaining momentum across the United States, with states like Oregon, Maine, and Colorado adopting legislation and initiating program planning. Maryland is in a unique position to learn from these ongoing efforts while tailoring solutions to the State's unique recycling infrastructure, collection programs, and local community needs. An important first step identified by the State was the EPR for Packaging Study Bill.

Senate Bill 222 (SB 222), enacted during Maryland's 2023 legislative session, aims to enhance recycling and establish a producer responsibility program for packaging materials.[2] This study bill instructs the Maryland Department of the Environment (MDE) to conduct a comprehensive assessment of the State's recycling infrastructure. This assessment analyzes current solid waste and recycling programs, evaluates the potential environmental impact of an EPR program for packaging, and recommends best practices from successful EPR initiatives in other regions.

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[2] Maryland General Assembly. 2023. Senate Bill 222 Reducing Packaging Materials – Producer Responsibility. 2023 Regular Session - Senate Bill 222 Third Reader

MDE was required to approve a Producer Responsibility Organization (PRO) to represent the interests of producers of packaging materials. The PRO is intended to play a central role in the development and implementation of the state's producer responsibility program. Additionally, the bill established the method to organize an EPR Advisory Committee to provide guidance and recommendations on establishing and implementing an EPR program for packaging materials.

The bill took effect on July 1, 2023, and represents a significant step toward implementing an extended producer responsibility program in Maryland, aligning with broader efforts to reduce waste and enhance recycling across the United States.

MDE selected Circular Action Alliance (CAA) as the PRO and convened an Advisory Committee with diverse stakeholders to guide implementation. The committee holds regular public meetings, focusing on waste reduction, recycling infrastructure, and legislative recommendations. Advisory Committee includes representatives from local governments, recyclers, processors, producers, retailers, trade groups, non-profits, environmental advocates, and public members.

There are several other initiatives that are important to consider as they are related or have potential impact on future EPR for packaging legislation. Brief descriptions of these laws, proposed bills, and grant funded projects are summarized below:

- **Climate Solutions Now Act of 2022:** Established greenhouse gas (GHG) emissions reduction goals for Maryland, requiring a 60% reduction from 2006 levels by 2031 and net-zero statewide GHG emissions by 2045.[3] The law places strong emphasis on climate justice, requiring State agencies to account for climate impacts and equity in their decision-making. As such, MDE is charged with identifying communities disproportionately affected by climate change, develop strategies to address their needs, and set funding goals so benefits flow to these communities. The law seeks to support workforce development, small business revitalization, energy infrastructure, and recycling. Together, these initiatives reinforce Maryland's leadership in addressing climate change while prioritizing equity, innovation, and sustainable economic growth.

- **Solid Waste Infrastructure for Recycling (SWIFR) Grant Program.** This grant focus on enhancing post-consumer materials management infrastructure, supporting the State to advance its food residual diversion and organics recycling efforts.[4] The State's project focuses on assessing and improving its recycling infrastructure to achieve waste diversion goals and foster a sustainable circular economy. Key initiatives include an organics assessment to identify potential infrastructure placement, perform outreach in areas with high organics diversion potential, and address barriers to recycling through education and public engagement with a focus on urban environments to support a circular economy and

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[3] Department of Legislative Services. 2022. Climate Solutions Now Act of 2022 Fiscal and Policy Note. [2022 Regular Session - Fiscal and Policy Note for Senate Bill 528](#)

[4] Environmental Protection Agency (EPA). 2023. Grant Recipient Information. [Maryland SWIFR](#)

reduce waste in disadvantaged communities. The information gathered and analyzed in this Needs Assessment is meant to support the ongoing efforts by MDE to further evaluate the needs for organics processing and composting infrastructure across the State and provide a deeper understanding of the impact of compostable packaging at these facilities.

- **Beverage Container Recycling Refund and Litter Reduction Program:** In the current 2025 legislative session, the Maryland General Assembly introduced the Beverage Container Recycling Refund and Litter Reduction Program Bill[5] (HB 0232 and SB 0346). This type of bottle bill or Deposit Return System (DRS) has been introduced in previous legislative sessions and proposes a refund mechanism to increase the recycling of beverage containers. The District of Columbia is considering a similar proposal called the Recycling, Refund, and Litter Reduction Amendment Act of 2025 which would require a 10-cent deposit on beverage containers to encourage consumers to return their beverage containers. [6] Bottle bills have shown strong results in increasing recycling rates. States with existing bottle bills and more details provided by the Container Recycling Institute are shown in **Table 1**.

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[5] Maryland General Assembly: HB0232, Maryland Beverage Container Recycling Refund and Litter Reduction Program, Legislation - HB0232

[6] NBC Washington. 2025. DC Considers 10-Cent Bottle and Can Deposit to Cut Littering. DC considers 10-cent bottle and can deposit to cut littering – NBC4 Washington

Table 1: States with Bottle Bills: Redemption and Recycling Rates

State	Redemption Rates (2023)	Estimated Percent of Deposit Beverage Sales Recycled Via Curbside Programs	Amount of Deposit	Population with Curbside Access
California	68%	Curbside and drop-off collected 10.6% of California Redemption Value (CRV) beverages sold (2023).	<24 ounces: 5¢ ≥24 ounces: 10¢ Wine & Distilled Spirits in a box, bladder, or pouch: 25¢	95%
Connecticut	52%	12%	10¢	91%
Hawaii	66%	Deposit containers collected at curbside (in Honolulu only) are included in reported statewide redemption rates; deducted here to show true refund redemption.	5¢	64%
Iowa	64%	An estimated 11.5% of containers sold are recycled through curbside & drop-off programs.	5¢	64%
Maine	84%	9%	Wine & liquor ≥ 50mL: 15¢ All others: 5¢	78%
Massachusetts	57%	13%	5¢	82%
Michigan	91%	9%	10¢	68%
New York	70%	10%	5¢	89%
Oregon	87%	4%	10¢	89%
Vermont	78%	10%	Liquor: 15¢ All others: 5¢	92%

Source: "Redemption Rates and Other Features of 10 U.S. State Beverage Container Deposit Programs," Container Recycling Institute, 2024. This table has been condensed from its original source for the purposes of this Needs Assessment

As presented in **Table 1,** States with bottle bills have high redemption rates, ranging from 52% to 91%. These states also have curbside collection programs in place. Based on modeling conducted for Washington State, comprehensive policies of both EPR for

packaging paired with bottle bills or similar deposit return programs combine to result in higher recycling rates for rigid plastic, aluminum, and glass.[7]

In Maryland, glass has a 44% recovery rate and glass at MRFs is often used for landfill alternative daily cover or in roadbeds. According to the Glass Packaging Institute (GPI), implementing EPR and a bottle bill has the potential to increase glass recovery from 44% to 74% in the State.[8]

Although bottle bills present the promise of a clean, separated material stream, there are other approaches to accomplishing this goal (e.g., Fairfax County, Virginia's purple container program) that minimize the challenges associated with the logistical and accounting complexities of establishing redemption centers.

Additionally, while bottle bills and EPR for packaging programs may complement each other, it is important to consider their timing and implementation so that they do compete with each other for high-value materials or face other unintended consequences.

> **Impact Of Bottle Bills on Packaging Recycling**
>
> Collecting glass, metal, and plastic bottle packaging via retailers or redemption locations creates a cleaner stream with less contamination and a higher value and recyclability for glass packaging.
>
> EPR and bottle bills complement each other by incentivizing materials management in a way that results in a high quality feedstock, which allow materials to be utilized at their highest and best use.
>
> Importantly, bottle bills are able to effectively drive demand for recycled feedstock which ultimately results in increased recycling performance.

1.2 Statewide Community Profile

The Needs Assessment evaluates the State's diversity of geography, population centers, and recycling programs at the local and regional level. Findings are presented based on Regions, determined by the socioeconomic, geographic, and demographic characteristics that can support the development of equitable and effective EPR program targets, metrics, and reporting mechanisms. The approach to increasing the quality and quantity of recycling materials while considering cost and environmental impacts can vary widely between Regions due to variation in infrastructure, population density, and available services. **Figure 2** shows the six (6) Regions that make up the State of Maryland. [9]

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[7] Ball Corporation. 2023. The 50 States of Recycling: A State-by-State Assessment of US Packaging Recycling Rates. 50-STATES_2023-V14.pdf

[8] Glass Recycling in Maryland; Current State & Opportunities Through EPR Policy, GPI Presented to Maryland PER Advisory Board, October 24, 2024

[9] There are various regional delineations among agencies of the State. For the purposes of this Needs Assessment, the regional borders are consistent with the Maryland Business Express. More information on Maryland Business Express can be found at the following hyperlink: Regional Resources - Maryland Business Express

Figure 2: Map of Maryland Regions
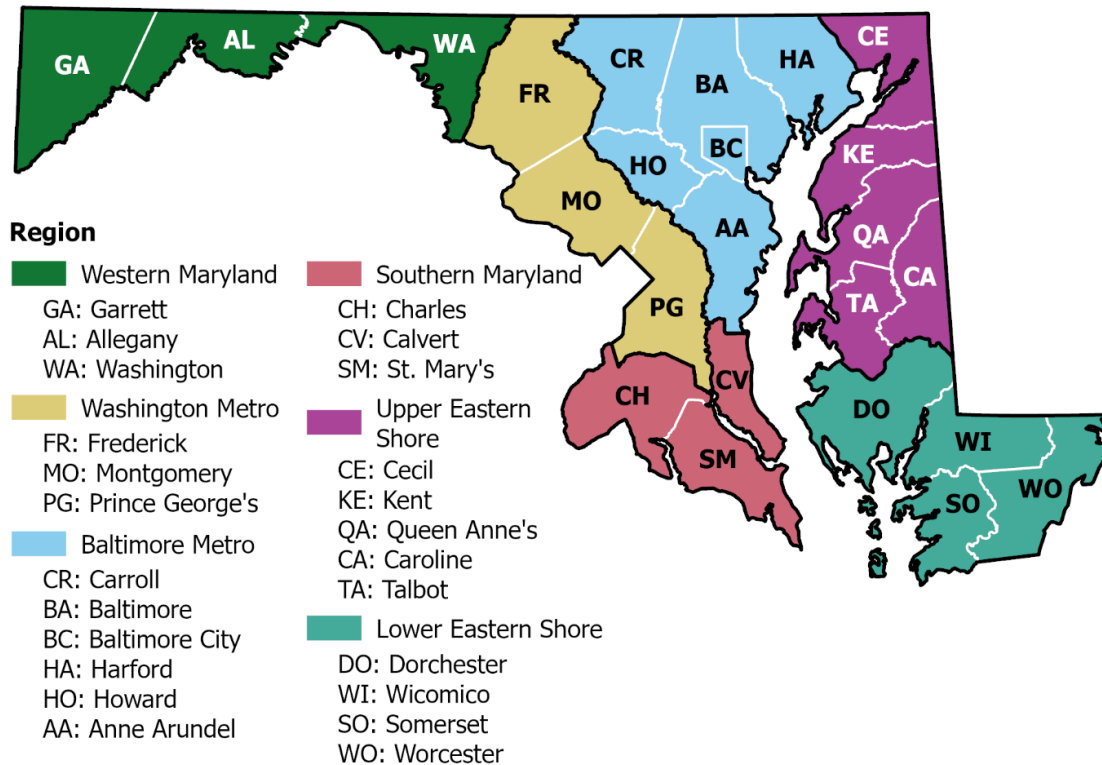
Variations in geography (e.g., roadway networks, bodies of water, and elevation changes), housing density (e.g., recycling generators per square mile), and local community priorities (e.g., health and human services needs for underserved areas) influence recycling behaviors, participation rates, and material streams.

The following provides a brief description of the regional demographic and equity considerations in the State.

1.2.1 Demographics

The State's demographic variations impact recycling programs, planning, and potential system improvements. Higher population and housing density have higher generation rates of waste and recycling; however, higher density areas have different needs for collecting and processing materials due to the increased concentration of dwelling units in a smaller geographic area. The following presents select data analysis demonstrating the State's demographic variations. **Table 2** shows the population density in each region and the breakdown of that population by rural, suburban, and urban designations. [10]

---

[10] For the purposes of the demographic and equity analysis and future program planning, the Regions of the State have been categorized into rural, urban, and suburban areas based on the 2020 census data. a different basis is used for designations of Counties as part of the waste characterization in Section 1 to provide a comparative analysis to the results of the 2016 waste characterization.

Table 2: Rural, Suburban, and Urban Population by Region[11]

Region	Population Density	Population	Rural	Suburban	Urban
Western Maryland	165	251,617	49.3%	16.8%	33.9%
Washington Metro	1,400	2,300,979	13.5%	15.7%	70.9%
Baltimore Metro	1,251	2,794,636	19.2%	17.3%	63.4%
Southern Maryland	364	373,177	50.0%	22.5%	27.5%
Upper Eastern Shore	154	243,616	55.1%	21.1%	23.8%
Lower Eastern Shore	126	213,199	42.6%	22.5%	34.9%

Demographic factors can help identify opportunities to deploy resources equitably and develop recycling systems that are effective in increasing access to curbside collection services or drop-off locations, program participation, and capture rate of post-consumer PPP products on a regional basis.

The Project Team evaluated a wide range of demographic data as part of the Needs Assessment including population density, race and ethnicity, English proficiency, housing density, income per capita, disability characteristics, levels of education, and digital access. These demographic factors provide insight into the State's current equity landscape and how potential EPR for packaging legislation can improve program performance at the local, regional, and statewide levels by minimizing barriers to recycling (e.g., communicating education materials in multiple languages, limited accessibility, etc.). and establish data-driven targets.

Demographic analysis presented in the Needs Assessment is intended to assist in developing data-driven targets as part of program implementation. **Figure 3** presents the race and ethnicity and **Figure 4** presents the languages spoken in the six Regions of the State based on data sourced from the U.S. Census 2022 American Community Survey (populations over 65,000).

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[11] Rural is categorized as areas of the state with population of fewer than 1,000 per square mile, suburban as areas with population between 1,000 and 3,000 per square mile, and urban as more than 3,000 per square mile. The data presented is at the Census block group level, utilizing 2020 data as the most recently available.

Figure 3: Statewide Race and Ethnicity Identification Data by Region (2022)

Legend: White, Black, Native, Asian, Islander, Other, Two or More Races, Hispanic/ Latino
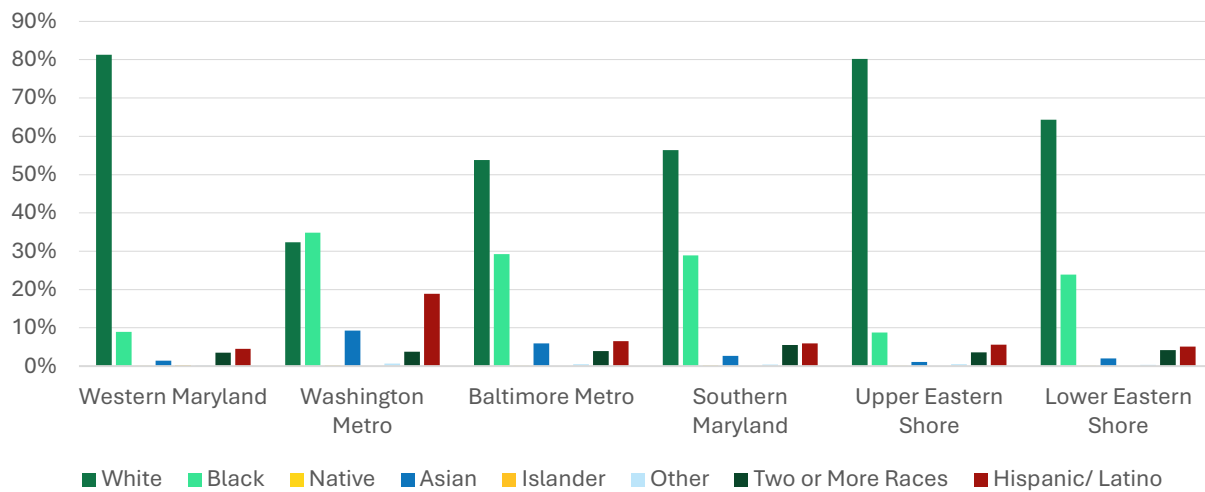
Figure 4: Language Breakdown by Region (2022)

Legend: English, Spanish, Other Indo-European, Asian and Pacific Island, Other, Limited English Speaking
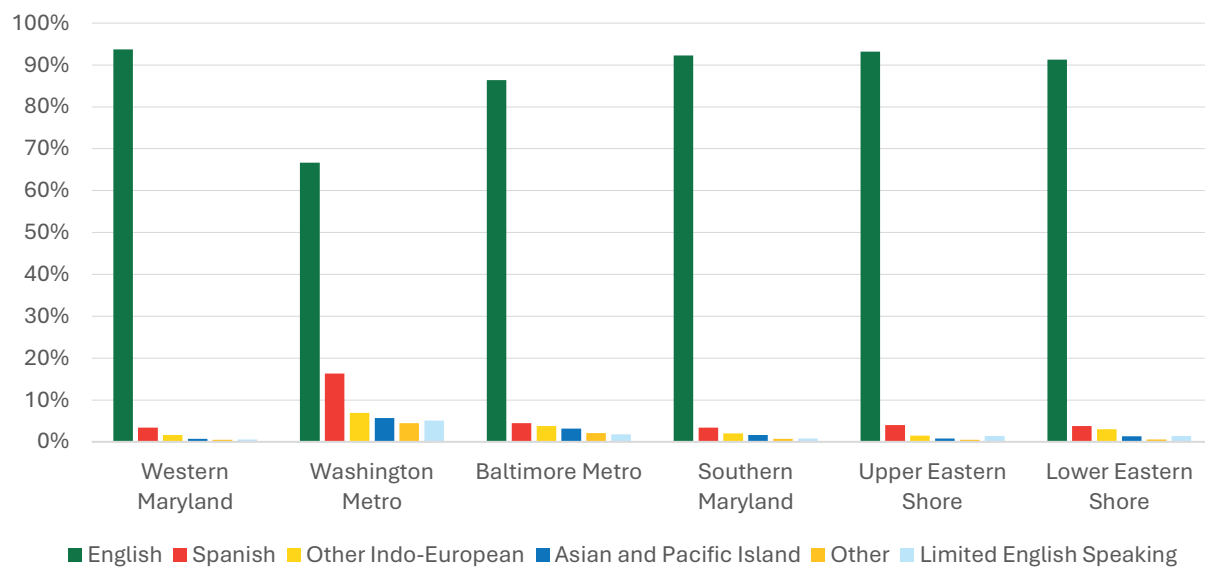
Reducing Barriers to Recycling

Education and outreach about proper recycling should consider demographic information, such as the language spoken by households and culturally specific information about race and ethnicity. The same type of outreach should not be applied to all regions of the State and must account for the varying languages, cultures, income, and economic factors present. Understanding audiences and what their specific needs are related to recycling education and outreach can result in a more equitable system. Equitable outreach is not the same as equal outreach, because not all communities have the same needs or will respond in the same ways. Understanding demographics can help advise future plans to create a more equitable recycling system. Further discussion regarding equity can be found in Section 1.2.2.

Table 3 shows the number of households, income per capita, percentage of population classified as low-income, and unemployment rate of the six Regions of the State.

Table 3: Household, Income, and Economic Indicators by Region

Region	Number of Households	Income per Capita	Low-Income Population	Unemployment Rate
Western Maryland	98,961	$35,667	31%	5.5%
Washington Metro	826,232	$53,043	18%	5.1%
Baltimore Metro	1,078,917	$50,354	20%	4.5%
Southern Maryland	133,700	$50,590	15%	3.9%
Upper Eastern Shore	95,347	$44,933	25%	3.9%
Lower Eastern Shore	84,967	$35,638	33%	6.5%

Note: Source of data is a combination of Census 2022 American Community Survey and the 2024 EPA EJ Screener Tool to calculate low income as a percent of the households where household income is less than or equal to the federal "poverty level"

Understanding household income and unemployment rates can help the State implement EPR with the specific needs of each region in mind. For example, areas with high unemployment rates could benefit from new facilities with the creation of high-paying jobs and offer an opportunity for increased equity in the State.

The State identified the desire, and need, for equity in the recycling system because a successful recycling program requires participation from all communities that may have a wide range of priorities, education and awareness, and resources. Balancing the service demand, cost impacts, and creation of jobs in the State is important to achieving strong recycling participation, reducing barriers to recycling and ultimately increasing recycling program performance.

1.2.2 Equity

The Needs Assessment considers disparities of income and access to recycling services regionally so future program enhancements to EPR for packaging can evaluate program performance equitably. Language barriers, cultural differences, and varying levels of environmental awareness can affect program success, making targeted communication strategies essential for boosting both participation and compliance.

Equity, equality, and Environmental Justice (EJ) are critical to the improvement of recycling programs and infrastructure in the State and setting challenging,

Applications of Equity, Equality, and Environmental Justice
Providing single-family residents with a 96-gallon recycling cart and deploying curbside collection service could provide access to recycling services equally across the State, but would not consider the increased cost burden, tailpipe emissions, and roadway damage in overburdened communities. Equity related to an improved statewide recycling system may also include providing service options to allow generators to choose which type of recycling collection works best for their household or business (e.g., collection frequency).

but achievable performance improvement targets. Programs designed to improve **equity** acknowledge that needs of Regions or communities may vary, justifying the deployment of different types or levels of resources to improve local recycling systems. **Environmental justice (EJ)** is a component of equity specifically related to the impacts on human health and the environment so that overburdened communities are not subject to a disproportionate amount of pollution (e.g., particulate matter in the air, unsafe drinking water, illegal dumping, etc.).While it is important to hold stakeholders and Regions of the State accountable to supporting statewide goals within a specified time frame, establishing a program only designed to achieve **equality** may lead to a one-dimensional, or one-size-fits-all program which may not always support the needs of the State's diverse set of communities.

Increasing the equitability of the State's recycling system is a key consideration for potential EPR for packaging legislation to meet the needs of underserved and overburdened communities. The Needs Assessment evaluates current conditions and opportunities for improvement, identifying areas among the components of the recycling system (e.g., collection, processing, end markets, education, outreach, and compliance, etc.) that demonstrate unique or increased resources to improve recycling performance.

As the State coordinates with the PRO to plan for implementation of EPR, supporting these communities to increase participation, quality, and volume of recycling while minimizing negative environmental impacts aligns with the State's commitment to environmental justice. To achieve sustained, long-term improvements in the statewide recycling rate, the State should balance the needs to deploy necessary collection and processing infrastructure while mitigating negative environmental or economic impacts associated with the implementation these equipment, facilities, and programs.

1.3 Report Structure

The Needs Assessment summarizes the results of the stakeholder engagement, analysis, and modeling conducted by the Project Team presents the results as follows:

Waste Characterization
The methodology and results of the waste characterization provide disposal information and results by demographic regions.

Stakeholder Engagement
The methodology for stakeholder engagement is provided. Engagement included surveys to county and municipal staff, MRFs, waste haulers, compost facilities, and interviews of strategic partners.

Recycling Programs
Recycling program types include single-family, multi-family, and commercial. Active recycling access, diversion rates, and ordinances are detailed for each sector.

Infrastructure and Capacity
Existing and potential capacity for recycling, transfer stations, and organics processing are provided. New facility development and reuse and waste reduction information is included.

Worker Conditions
Current worker conditions, wages, and benefits are detailed for waste collections and facilities, including details about salary, wages, benefits, unions, labor, recruitment and retention.

Opportunities for Minority and Women-owned Business Enterprises (MWBE)
The MWBE certification process, opportunities and challenges are detailed with valuable context provided by the project team's expertise in this area.

Economic Opportunities and End Markets
The economic opportunities of recycling market development, lost revenue of recyclables, employment opportunities, and barriers to increasing recycling are provided.

Environmental Justice
Information is provided about the State's current Environmental Justice (EJ) policies, considerations to EPR implementation, and the importance of identifying communities disproportionality affected by climate impacts and GHG emissions.

Current Recycling Performance and Cost
The methodology is detailed and provides the current and future scenarios for costs, benefits, and environmental impacts of EPR.

Future Recycling Performance and Cost
Provides an estimate of recycling performance and the cost of managing covered PPP in Maryland if an EPR program is implemented.

Conclusions
Finally, the report provides key findings and to the State for the future of EPR.

2 Waste Characterization

2.1 Introduction

To comprehensively evaluate recycling needs, it is first necessary to understand the quantity and types of recyclable material that are currently destined for disposal. A single-season waste characterization study was performed as a foundation for the Needs Assessment in 2024. This waste characterization study (2024 WCS) targeted the municipal solid waste (MSW) portion of disposed waste. The 2024 WCS provided an estimate of the composition of disposed MSW for the state as a whole and differentiated between Residential and Institutional/Commercial/Industrial (ICI) and Urban/Suburban/Rural wastes. The 2024 WCS data also updates Maryland's previous 2016 statewide waste characterization data and provides data for input for the modeling as described in Section 10 and 11. The 2024 WCS full report with extensive detail, including a comparison between the 2016 and 2024 results, is available in **Appendix A: Waste Characterization Study** and key elements of the study design and results are included in this chapter.

2.2 Municipal Solid Waste Disposal

MDE provided the 2023 Maryland Solid Waste and Diversion Report (using 2022 data) as a basis for statewide municipal solid waste (MSW) disposal tonnages. **Table 4** itemizes the reported MSW disposal quantities by county and includes supplemental data on county recycling and demography as defined by MDE. Data for Baltimore City is also included in the table as the State's only Urban demographic area.

Table 4: MSW Disposed by County of Origin

County	Population, 2023 [1]	MSW Destined for Disposal, 2022 (tons) [2]	Recycling Threshold	Current Recycling Rate	Demography[3]
Allegany	67,273	62,038	20%	47%	Suburban
Anne Arundel	594,582	362,825	35%	42%	Suburban
Baltimore City	565,239	455,900	35%	17%	Urban
Baltimore County	844,703	846,273	35%	24%	Suburban
Calvert	94,728	60,214	20%	36%	Suburban
Carroll	176,639	154,693	35%	25%	Suburban
Cecil	105,672	83,553	20%	65%	Suburban
Charles	171,973	76,666	35%	46%	Suburban
Dorchester	32,879	38,955	20%	33%	Rural
Frederick	293,391	164,887	35%	46%	Suburban
Garrett	28,423	21,432	20%	41%	Rural
Harford	264,644	180,777	35%	48%	Suburban
Howard	336,001	270,393	35%	45%	Suburban
Mid-Shore [4]	138,782	111,349	20%	51%	Rural
Montgomery	1,058,474	553,429	35%	40%	Suburban
Prince George's	947,430	664,151	35%	46%	Suburban
Somerset	24,910	35,518	20%	6%	Rural
St. Mary's	115,281	46,669	20%	23%	Suburban
Washington	155,813	125,693	35%	30%	Suburban
Wicomico	104,800	133,614	20%	53%	Suburban
Worcester	54,171	59,296	20%	38%	Suburban
Total	**6,175,808**	**4,508,325**			

[1] Source: U.S. Census Bureau, 2023.

[2] Source: 2023 Maryland Solid Waste Management and Diversion Report (using 2022 data).

[3] The demography classifications shown for the 2024 WCS at the County level are consistent with the 2016 effort for comparison purposes. More recent evaluation of urban, suburban, and rural classification as part of the Needs Assessment is presented in Section 1.2.1

[4] Mid-Shore Regional Recycling Program includes Caroline, Kent, Queen Anee's and Talbot Counties.

Table 5 summarizes the county-level data by demographic region. As shown, over 4.5 million tons of waste generated in Maryland were disposed of in 2022, with over 85 percent of disposed tonnage originating from Suburban areas. The amount of waste estimated from the Residential and ICI sectors were very similar. The basis for splitting Residential and ICI wastes by demographic region is further discussed in the 2024 WCS Final Report in **Appendix A: Waste Characterization Study**.

Table 5: Disposed MSW from Maryland Counties By Demographic Region

Demographic Region	MSW Destined for Disposal, 2022 (tons)[1]	Percent of Statewide	Residential/ Commercial Split [2]	Residential	Commercial
Urban	455,900	10.1%	40%/60%	182,360	273,540
Suburban	3,845,172	85.3%	50%/50%	1,922,586	1,922,586
Rural	207,254	4.6%	60%/40%	124,352	82,901
Total	**4,508,325**	**100.0%**		**2,229,298**	**2,279,027**

[1] Total MSW destined for disposal calculated by subtracting total MRA waste of 7,374,084 tons from the total MRA recyclables of 2,865,759.

[2] It was not possible to compile the breakdown of disposed waste by generator sector. These estimated percentages are consistent with other studies that have more rigorously investigated waste generation by demographic sector and were also used in Maryland's 2016 Waste Composition Study.

The tonnage breakdowns shown above serve as the basis for aggregating disposed waste composition into a Maryland statewide total. Results of the 2024 WCS were applied to these tonnages to inform the Needs Assessment about the incidence and quantity of packaging materials remaining in the disposed waste stream.

2.3 Methodology

This study captured samples of disposed MSW at nine facilities in Maryland recruited by MDE, and integrated the results of other county-level waste composition studies performed in the state in the past five years. **Figure 5** plots the location of the host facilities, as well as the six related studies completed in recent years.

Figure 5: Waste Composition Sources for Data Analysis

Host Facilities

1. Appeal Landfill/Transfer Station
2. Cecil County Central Landfill
3. Charles County Landfill
4. Forty West Municipal Landfill
5. Garrett County Solid Waste Disposal & Recovery Facility
6. Northern Landfill
7. Northwest Transfer Station
8. Quarantine Road Municipal Landfill
9. Somerset County Landfill

Recent Studies

A. Montgomery County Waste Composition Study – 2022/23
B. Baltimore County Waste Composition Study – 2022
C. Howard County Waste Characterization Study – 2023
D. City of Baltimore Recycling & Solid Waste Management Master Plan – 2019
E. Prince George's County Four-Season Waste Composition Study – 2022
F. Anne Arundel Enhanced Organics Collection & Processing Planning Study – 2023

Due to the overall project schedule, only one season of sampling and sorting occurred during this study. Ten days of field data collection initiated on Monday, November 4 and concluded on Friday, November 15, 2024. A single day of field research was performed at each facility, with the exception of the Carroll County Landfill hosting the first two days to allow for set-up, training, and verification of material definitions.

Table 6 summarizes the final allocation of samples across generator sectors and demographic regions of the state. As shown, 110 samples were captured, with good representation of both Residential and Commercial wastes. Note that there were limited opportunities to obtain Urban Commercial samples.

Table 6: Sample Detail by Generator and Demographic Region

Demographic	Residential	Commercial	Total
Urban	16	5	**21**
Suburban	38	29	**67**
Rural	12	10	**22**
Total	**66**	**44**	**110**

The material categories for the 2024 WCS were designed to be consistent with Maryland's 2016 waste characterization study but included some additions to accommodate the EPR packaging focus of the Needs Assessment. **Table 7** shows the 61 material categories used

in the 2024 WCS. Detailed material category definitions are provided in the 2024 WCS Report in **Appendix A: Waste Characterization Study**.

The 2024 WCS assigned "divertibility" classifications for each constituent to provide additional perspective on the ability to reduce wastes sent to landfill in the future. These categories are the same as were used in Maryland's 2016 study. The divertibility classifications shown in **Table 7** include the following designations:

- **Curbside Recyclables**, such as cardboard, mixed paper, and metal/glass/plastic bottles and containers.

- **Compostables/Mulchables**, such as food and yard wastes that could be processed via composting to return nutrients to the soil.

- **Other Non-Curbside Recyclables**, including certain items that have economically driven recycling opportunities.

- **Not Currently/Widely Recyclable**, which are those constituents for which no viable recycling or diversion program currently exists in Maryland.

Table 7: Material Categories List with Divertibility Class

Material Category	Material Category
Paper	**Glass**
1 Newsprint	1 Clear Glass Containers
1 Corrugated Cardboard/Kraft Paper	1 Brown Glass Containers
1 Magazines	1 Green Glass Containers
1 Paperboard/Packaging	4 Non-Container/Other Glass
4 Polycoated/Aseptic Pkg	**Organics**
1 High Grade Office Paper	3 Food Waste
2 Books	3 Grass
1 Other Recyclable Paper	3 Leaves
4 Paper Cups	3 Brush, Prunings, and Trimmings
3 Compostable Paper	4 Other/Non-Compostable Organics
4 Non-Recyclable Paper	**C&D**
Plastic	3 Wood - Clean Lumber
1 PET (#1) Bottles/Jars	4 Wood - Painted/Treated
1 PET (#1) Other	2 Wood - Pallets
1 HDPE (#2) Bottles - Natural Only	4 Non-C&D Wood
1 HDPE (#2) Bottles - Colored Only	4 Drywall/Gypsum Board
1 HDPE (#2) Non-Bottle Containers	2 Concrete, Brick, Rock, Other C&D
1 PP (#5) Bottles and Containers	4 Carpet, Carpet Padding, & Rugs
1 PS (#6) Rigid Containers	**HHW**
1 #3, #4, #7 Products	4 Medical Waste & Sharps
4 Compostable Plastic Pkg	2 Batteries - Lead Acid
1 Durable Plastic Products	2 Batteries - Other Rechargeable
4 EPS "Styrofoam" - Food Pkg	2 Batteries - All Other
4 EPS "Styrofoam" - Non-Food Pkg	2 Other Haz Waste/Other HHW
2 Clean Commercial Film	**Electronics**
2 Clean Shopping Bags	2 Computers & Electronic Products
4 Contaminated/Other Film - Mono	**Other**
4 Contaminated/Other Film - Multi	2 Textiles & Leather Products
4 Remainder/Composite Plastic	4 Diapers & Sanitary Products
Metal	4 Bulky Items
1 Aluminum Cans & Containers	2 Tires
2 Other Aluminum	4 Other/Not Elsewhere Classified
2 Other Non-Ferrous	4 Supermix - Bottom Fines & Dirt
1 Tin/Steel Containers	
2 Other Ferrous	**Total**
	Samples
1 *Curbside Recyclables*	3 *Compostables/Mulchables*
2 *Other Non-Curbside Recyclables*	4 *Not Currently/Widely Recyclable*

Field data collection methods conformed with industry best practices and are further described in the full 2024 WCS report. Generally, "grab" samples were obtained from randomly selected inbound trucks. These grab samples were delivered to the sorting team, where approximately 200 to 250 pounds of MSW were sorted into the targeted material categories. **Figure 6** shows two grab sampling photographs from the study, where a mechanical loader has removed ("grabbed") a portion of the tipped load for pre-weighing. **Figure 7** shows photographs of the sorting work area at a landfill and a transfer station.

Figure 6: Loader-Assisted Grab Sampling of Inbound MSW Sampling

Figure 7: Designated Sorting Work Area (Landfill & Transfer Station)

As a final note on the study methodology, Prince George's County and Montgomery County, both classified as Suburban, recently completed comprehensive studies capturing the Residential and Commercial generator sectors. The full 2024 WCS incorporates these two composition studies to offer an "adjusted" Maryland disposed MSW composition. These two studies were selected for the adjusted results for several reasons: a) consistency to the 2014 study; b) they conformed with best practices for waste composition sampling; c) the material categories were comparable to 2024 WCS material list; and d) Residential and Commercial waste were characterized separately.

Regardless, this Needs Assessment relies on the statistical results derived from the sampling and sorting at the nine host facilities included in the 2024 WCS to serve as the basis for recycling projections. This is because the Montgomery and Prince George's County studies each used different underlying material categorization, which prevented the Project Team's ability to disaggregate all categories identified by MDE and the Project Team that are crucial to this Needs Assessment.

2.4 Overview of Key Findings

2.4.1 Statewide Aggregate Disposed MSW Composition

Figure 8 shows the tonnage of disposed wastes in 2022 applied to the composition data from the 2024 WCS, aggregating the Residential and Commercial generator sectors. The data trends of the "adjusted" composition were comparable to the "unadjusted" composition presented in this section (see **Appendix A: Waste Characterization Study** for adjusted composition results). As shown, Organics, Paper and Plastic are the most common material groups. Compared to 2016, the State's current disposed waste stream was found to contain a higher percent composition of plastics, organics, paper, glass, HHW and other wastes, while C&D materials mixed with MSW experienced a significant decrease.

Figure 8: Statewide Disposed MSW Composition Percent
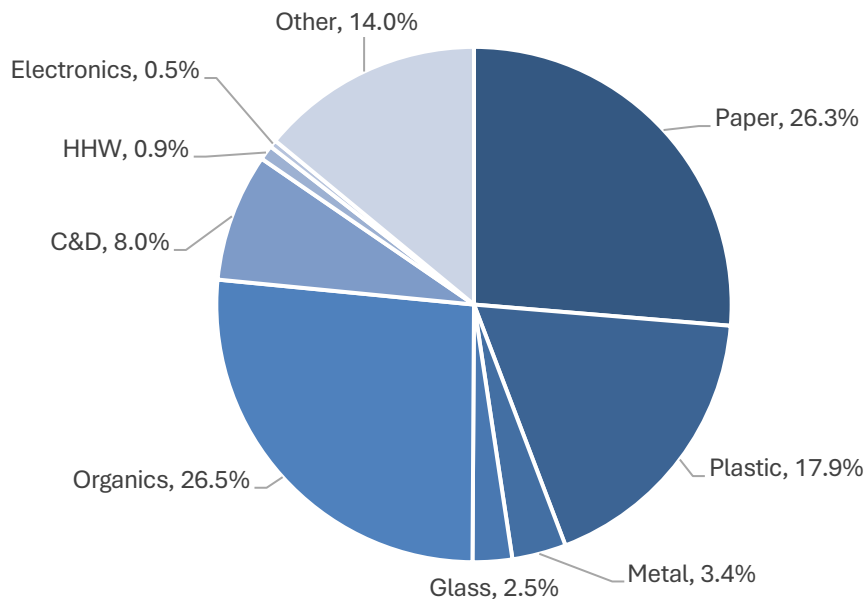
Figure 9 shows the top 10 most prevalent materials in the Maryland statewide disposed MSW stream from the 2024 WCS. As shown, Food Waste was found to be the most prevalent material at almost 19 percent of the stream. Corrugated cardboard was the second most prevalent constituent.

Figure 9: Most Prevalent Materials in Disposed MSW by Percent
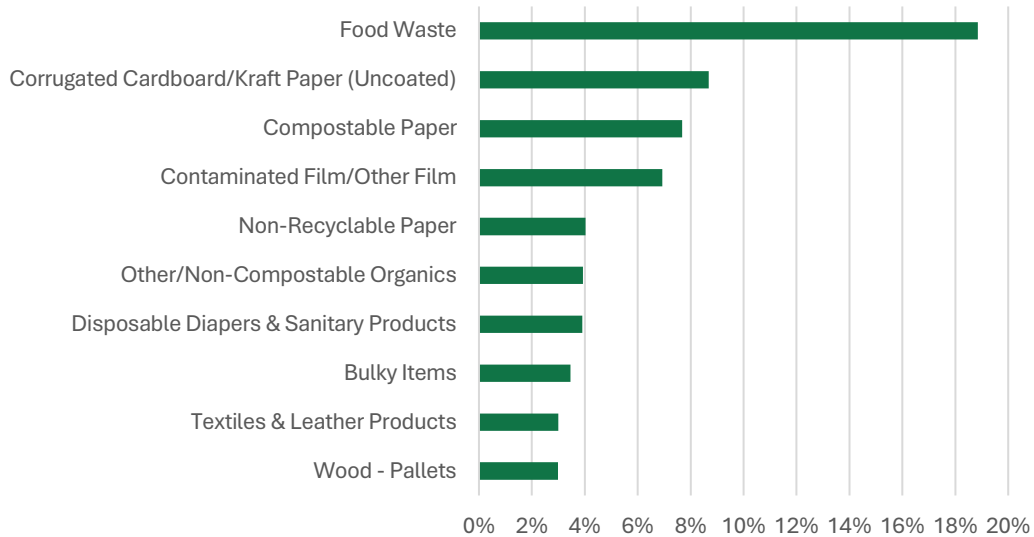
Figure 10 recasts Maryland's disposed waste composition to illustrate the divertibility of materials. On a percentage basis, the incidence of curbside recyclable materials and other recyclable materials in disposed wastes have decreased since 2016, while the incidence of compostable organics has remained roughly level. On an absolute tonnage basis, disposal of MSW across all divertibility classes has increased.

While most of the packaging that is the focus of the state's EPR program are classified as being curbside recyclables, at least some of these materials are currently not recyclable in Maryland.

Figure 10: Statewide Divertibility of Disposed MSW by Percent
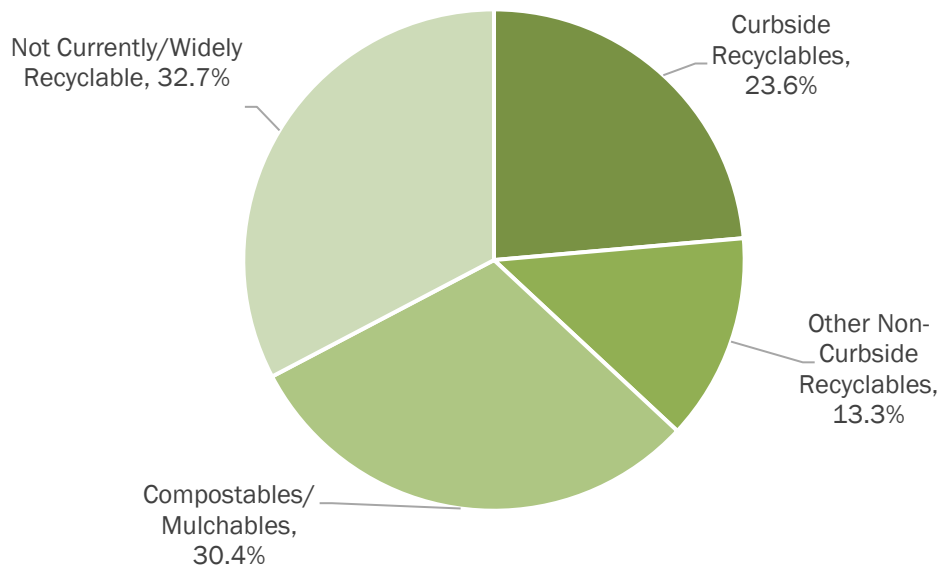
2.4.2 Disposed MSW Composition by Generator and Demographic Region

The full 2024 WCS report contains detailed statistical data about the composition of Maryland waste segregated by generator sector (Residential and Commercial) and by demographic region (Urban, Suburban and Rural). The following figures provide summary comparisons.

Figure 11 compares the percentage composition of material groups for Residential and Commercial waste. On a percentage basis, it is shown that Commercial waste contains a higher incidence of Paper, while the Residential sector contains a higher percentage of Organics.

Figure 11: Comparison of Disposed Waste Composition by Generator Sector
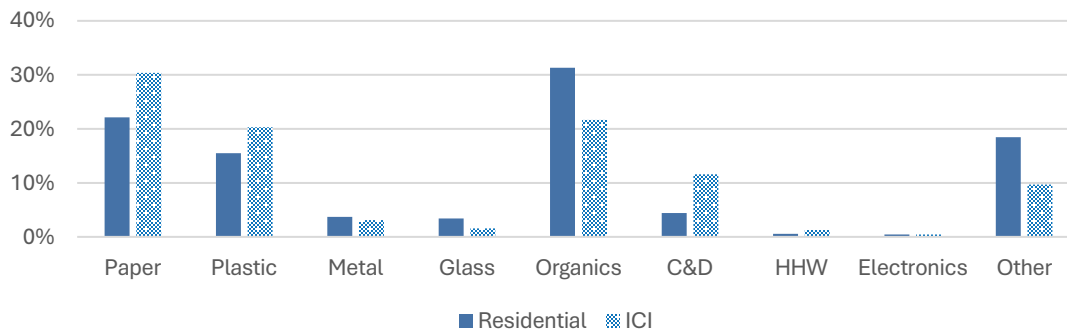
Note: ICI refers to material generated by Industrial, Commercial, and Institutional entities. These entities are referred to as just Commercial throughout the Needs Assessment.

Figure 12 shows a total of 15 material categories that are most prevalent across the Residential and Commercial sectors. The most prevalent material in both generator

sectors was Food Waste, although the order of the other most prevalent items differs for Residential and Commercial wastes.

Figure 12: Comparison of Residential and Commercial Most Prevalent Materials
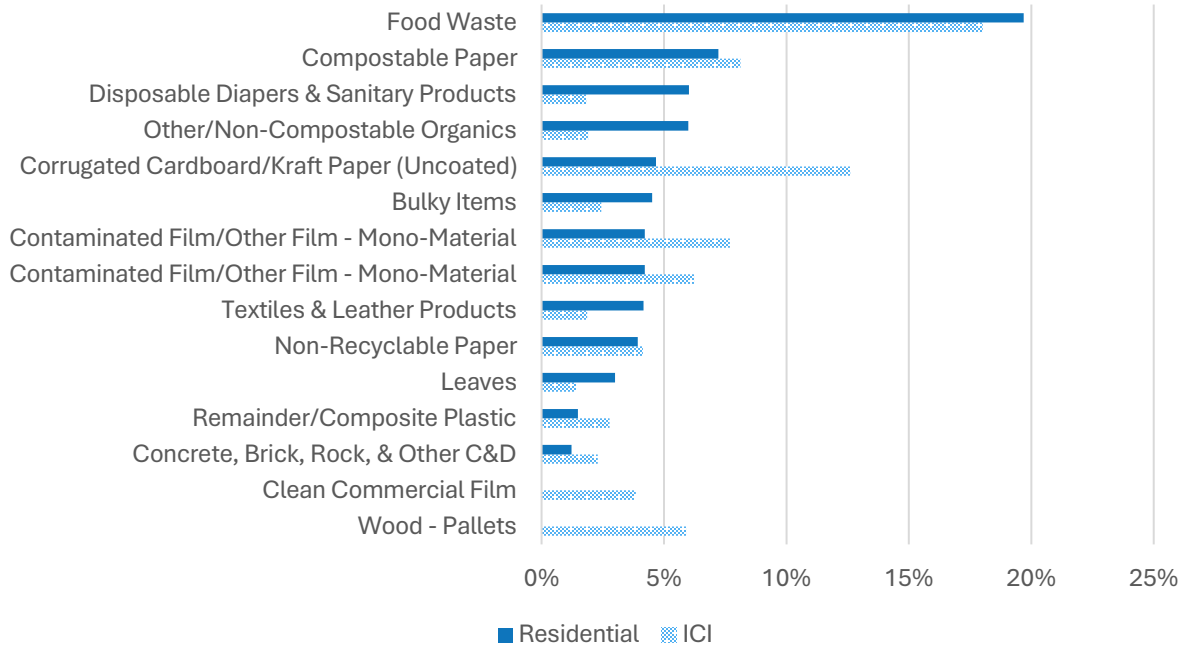
Note: ICI refers to material generated by Industrial, Commercial, and Institutional entities. These entities are referred to as just Commercial throughout the Needs Assessment.

Figure 13 compares the divertibility of wastes from each generator sector. The divertibility between the Residential and Commercial sectors are similar, with the Residential sector having a higher occurrence of Not Currently/Widely Recyclable and Compostables/Mulchables categories in the disposed waste stream compared to the Commercial sector.

Figure 13: Comparison of Divertibility by Generator Sector
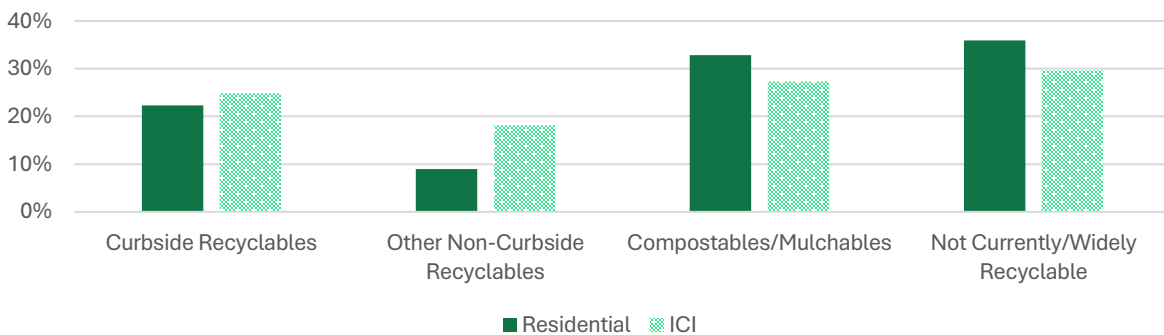
Note: ICI refers to material generated by Industrial, Commercial, and Institutional entities. These entities are referred to as just Commercial throughout the Needs Assessment.

Figure 14 compares the percentage composition of material groups in Urban, Suburban, and Rural waste. As shown, the proportion of disposed wastes by material group was

mostly consistent across demographic regions. However, there were significant differences in C&D materials, and Organics were found in significantly lower proportions in Urban disposed wastes.

Figure 14: Comparison of Composition by Demographic Region
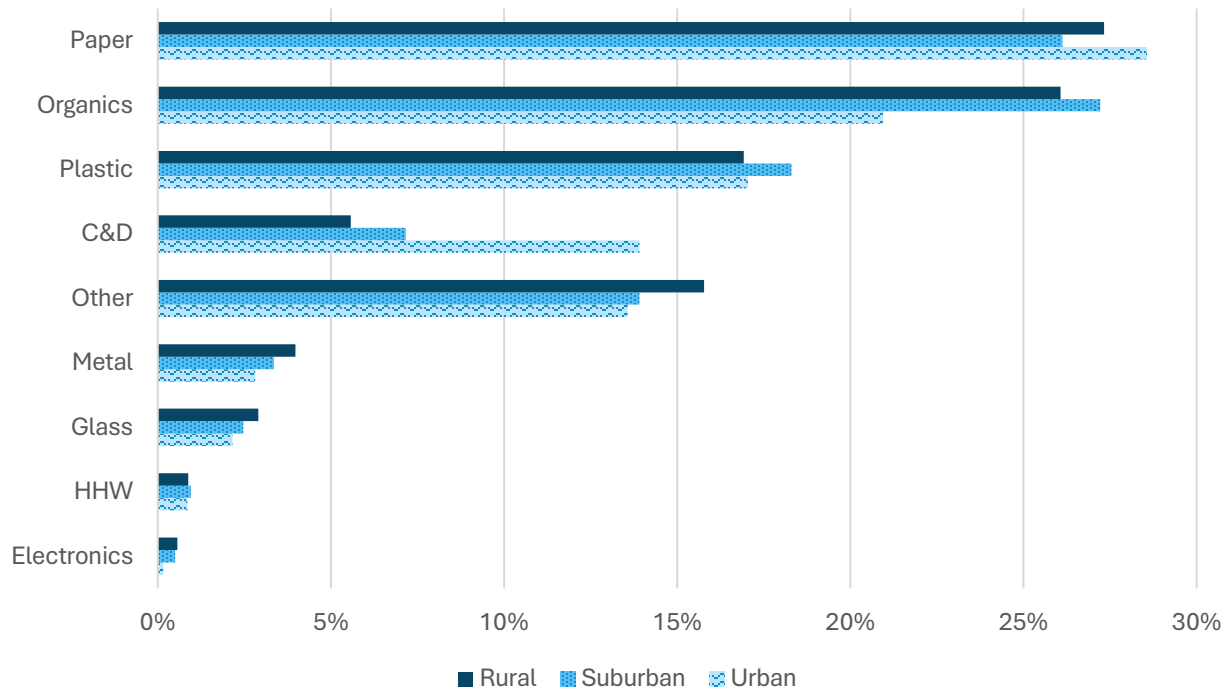
Figure 15 shows the most prevalent materials originating from each demographic region. Again, the most prevalent materials were fairly consistent across demographic region; however, disposed Urban MSW contained significantly less food, and significantly more wood pallets, leaves, and paperboard/packaging materials. Interestingly, Urban wastes also contained the highest incidence of leaves, perhaps because Urban areas typically require leaf removal, while Suburban and especially Rural areas may be able to manage leaves onsite.

Figure 15: Comparison of Urban/Suburban/Rural Most Prevalent Materials
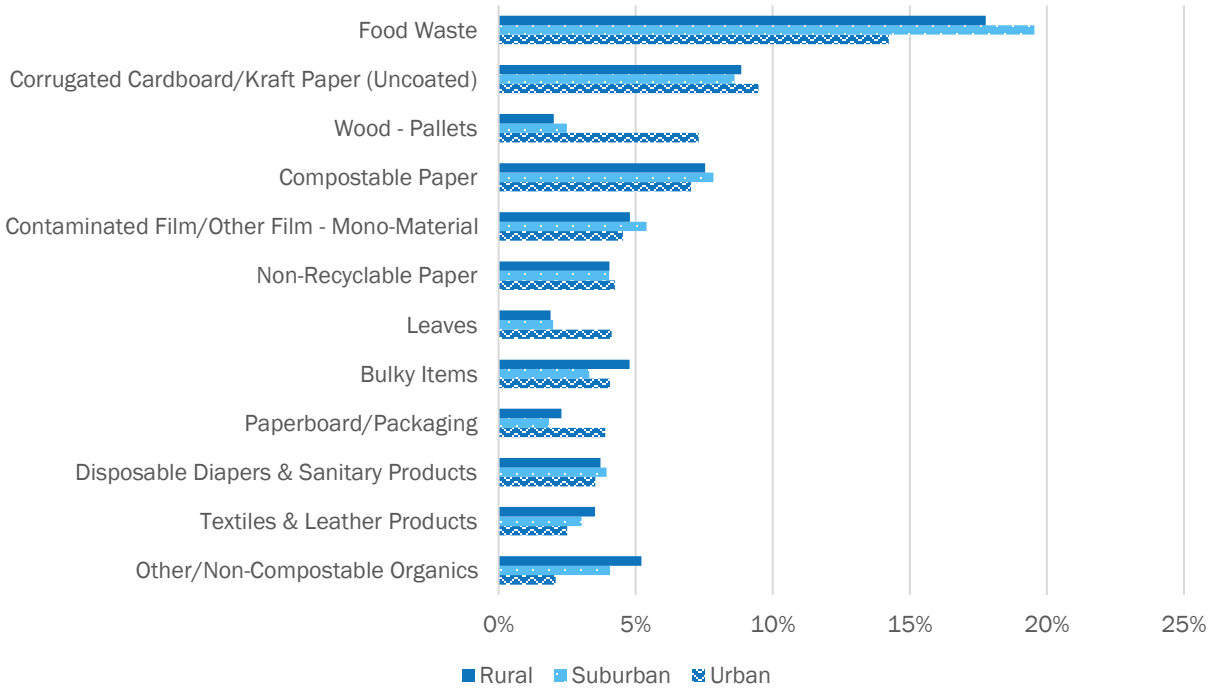
Figure 16 compares the divertibility of disposed MSW by demographic origin. This view identifies a higher percentage of curbside and non-curbside recyclables, and a lower percentage of compostables in Urban wastes. Suburban and Rural disposed wastes exhibited similar divertibility profiles for other non-curbside recyclables and not currently/widely recyclable materials.

Figure 16: Comparison of Divertibility by Demographic Region
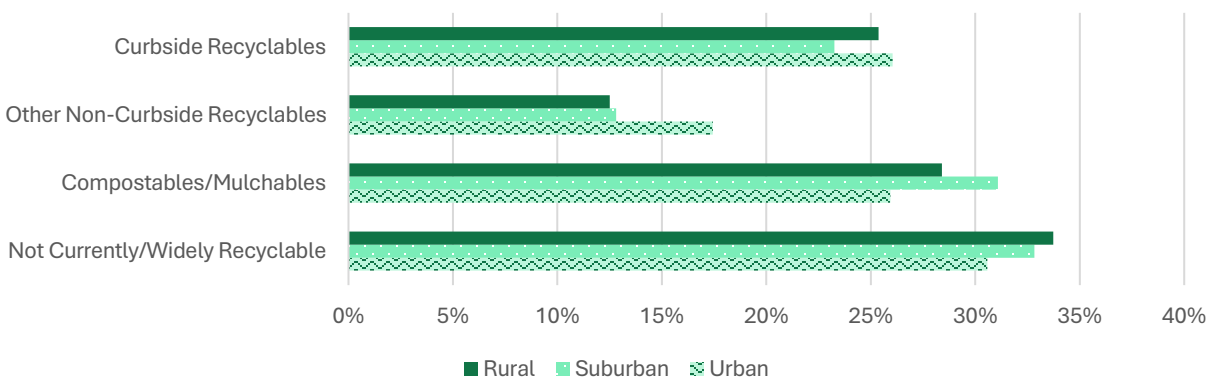
Detailed results are included in the full 2024 WCS report, included in this Needs Assessment as **Appendix A: Waste Characterization Study**.

3 Stakeholder Engagement

The following sections describe the Project Team's methodology for conducting stakeholder engagement through survey and interview efforts that informed the analysis of the current recycling system in this Needs Assessment. The data obtained through these surveys and interviews builds upon the county-provided data that MDE receives annually so that this Needs Assessment utilizes the most up to date and comprehensive information to serve as the baseline for a potential future EPR program in Maryland.

3.1 Methodology

The Project Team distributed electronic surveys to stakeholder groups, excluding strategic partners whom were interviewed only, and engaged with the groups shown in **Table 8** to prepare the analysis in the Needs Assessment Report:

Table 8: Stakeholder Groups Engaged for the Needs Assessment Report

Stakeholders	Respondents
Counties and Select Municipalities: The 24 Maryland Counties (including the City of Baltimore) and select municipalities as identified by MDE were engaged to participate in the survey. Municipalities included in the survey efforts include those that provide solid waste and recycling collection, generate high volumes of recyclables, have seasonal fluctuations in volume, and/or have challenging and unique collection geographies.	• 23 Counties • 18 Municipalities
Material Recovery Facilities (MRFs): Each recycling processing facility in Maryland, as well as select out of state facilities that receive Maryland's material were engaged through survey and interview.	9 Material Recovery Facilities (MRFs)[12]
Recycling Haulers: Haulers were identified by National Waste and Recycling Association (NWRA) and were engaged through survey.	N/A[1]
Composting Facilities: Tier 1 and Tier II composting facilities were engaged through survey.	10 Composting Facilities
Strategic Partners: Various organizations and government entities identified by MDE covering environmental advocacy, economic development, waste management, urban planning, and the packaging industry were engaged through an interview process.	17 strategic partner organizations

[1] Number of haulers engaged is subject to confidentiality under non-disclosure agreement

While the survey response rate provides valuable insights into Maryland's current recycling system, it reflects a portion of Maryland's jurisdictions and may not fully capture statewide trends.

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[12] This includes two (2) out of state MRFs that receive Maryland's recyclables and four (4) additional facilities that bale source separated commodities.

In addition to surveys, HDR conducted 17 one-hour interviews with strategic partners. The interviews involved discussions on challenges, opportunities, and recommendations for enhancing recycling education and recycling access efforts in Maryland.

Combining the qualitative interview insights with quantitative survey results provides a comprehensive analysis for evaluating the current recycling system and providing recommendations for improvement in Maryland.

3.2 County and Municipality Survey

The Project Team reviewed information received from the Counties and Select Municipalities and made clarifications as needed through desktop research and review of the County Solid Waste Management Plans (SWMPs). The information collected is organized into a database that includes the following information as available:

- Demographic Information
- Services Available (single-family, multi-family, commercial, food waste)
- Recycling Tons
- Materials Accepted for Recycling by Material Type
- Ordinances
- Solid Waste and Recycling Facilities (landfills, waste to energy, organics, MRFs, drop-offs, transfer stations)
- Recycling Costs
- Education and Outreach
- Reuse Programs

County and municipality data is compiled and combined with facility, hauler, waste characterization data. This data along with the Project Team's discussions directly with jurisdictions was used to calculate the current and future state performance and costs of Maryland's recycling system for packaging and paper products (PPP). Additionally, the Project Team received key perspective related to areas of the State that may need unique support (e.g., locations that have significant seasonal population increases, challenging collection or transportation infrastructure, etc.)

3.3 Material Recovery Facility Survey and Interviews

MRF interviews served as a follow-up to the survey as an opportunity to gather a more detailed understanding of operations and opportunities for improvement. Interviews were held with seven (7) of the in-state MRFs[13]. The Project Team gathered information on the following:

- Staffing levels

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[13] This includes facilities that bale source-separated commodities.

- Equipment age and efficiency
- Facility processing capacity, size, and technology
- Counties served by the facility
- Materials accepted
- Feedstock quantities and composition
- Residue and contamination quantities and composition
- Costs and operational impacts of contamination
- Capital and operating costs
- End markets
- Planned facility improvements or expansions including technology upgrades

The Project Team utilized MRF survey and interview data to determine the current capacity and materials processed by the existing infrastructure, which was then used to calculate potential future capacity and estimated costs based on facility improvement recommendations.

Information provided by the MRFs has been aggregated to provide anonymity at the request of the facilities. Through interviews with MRFs, the Project Team learned that the MRF landscape is changing significantly in the next three (3) years with new facility developments. The data provided in this Needs Assessment represents a present snapshot of MRF operations; however, data and operational needs will continue to evolve. Additionally, the facilities engaged as part of the Needs Assessment do not represent all recycling facilities in the State as some do not manage packaging materials (e.g., scrap metal yards, tire recycling, etc.).

> ### Planned MRF Developments
> Maryland's statewide recycling program includes significant planned investments to modernize materials recovery facilities (MRFs) and improve efficiency. A new $50 million Waste Management (WM) single-stream MRF is being developed to replace the aging Elkridge facility, with a planned capacity of 50 tons per hour (TPH). Featuring advanced automation, the facility will reduce staffing needs by 40–60% while creating higher-paying technical roles and addressing previous space constraints. In Montgomery County, upgrades to the dual-stream MRF aim to optimize throughput within the existing footprint, introducing optical sorters and robotics to handle 25 TPH more efficiently. Baltimore County's MRF, facing challenges with overcapacity, contamination, and outdated equipment, is undergoing a comprehensive review to explore facility redesigns and system upgrades to improve operations and storage capacity. These projects represent planned capital investments to enhance statewide recycling infrastructure that could potentially be supported by EPR for packaging to meet future demand for processing capacity.

3.4 Hauler Survey

The hauler survey was distributed to a list of haulers identified by NWRA; however, less than half of the haulers responded to the survey even with industry support. The survey gathered the following information about trash and recycling programs:

- Service areas
- Customers served (e.g., single-family, multi-family, commercial)
- Services provided (e.g., trash, recycle, organics)
- Materials accepted for collection
- Collection frequency
- Service fees
- Contract types (e.g., municipal contracts, open market)
- Facilities utilized (e.g., landfill, transfer station, MRF)
- Number and type of collection vehicles
- Capital and operating costs
- Contamination quantities/types

The Project Team used hauler survey information to determine the basis for evaluating the costs for collection in Maryland. While the survey responses were provided on a statewide basis, the respondents customer bases varied widely in size, service lines, and facilities utilized. The survey responses provided detailed service information at the County level and cost information related to their operations. The responses were evaluated by the Project Team and utilized to inform technical and financial assumptions related to residential and commercial collection in the state.

Information provided by the collection haulers has been aggregated to provide anonymity and protect confidential or business-sensitive information on individual hauler's customer base and operating requirements. The responses are not meant to provide a comprehensive assessment of trash and recycling hauling across the state, but present a snapshot of the types of services, frequency, and performance metrics of private collection companies' residential and commercial collection services to inform future program planning.

3.5 Compost Facility Survey

The compost facility survey was issued to Tier I and Tier II facilities. Tier II facilities are the most relevant as they are currently permitted to process food waste and compostable packaging. The project Team surveyed compost facilities for the following information:

- Service area
- Throughput quantities
- Processing technology utilized (e.g., windrow, aerated static pile, anaerobic digestion)

- Feedstock types and quantities
- Contamination composition
- Contamination and residue quantities
- Current and future compostable packaging acceptance
- Equipment utilized
- End markets
- Capital and operating costs
- Permitting process

Information provided by compost facilities is not meant to provide a comprehensive assessment of organics processing across the State. The Needs Assessment focuses on Tier II facilities and their expected needs to process compostable packaging as part of a potential EPR program.

3.6 Strategic Partner Interviews

The strategic partner interviews were conducted to gather insights and perspectives from key stakeholders who are impacted by the waste management and recycling sector, but not included in the surveying efforts described above. The purpose of these interviews was to identify current challenges, opportunities, and potential impacts of implementing an EPR program in Maryland. The scope of the interviews covered various aspects of waste management, including operational challenges, infrastructure needs, policy recommendations, and environmental concerns as they relate to the individual stakeholder. Stakeholders were asked about their views on EPR legislation and other related policies. The interviews also explored collaborations, partnerships, and potential economic impacts of improved recycling systems in Maryland.

Table 9 shows the stakeholders interviewed for this Needs Assessment organized by their subject matter expertise per organization type.

Table 9: Strategic Partners Interviewed by Organization Type

Regional Authorities, Agencies, and NGOs	Packaging Producers	Environmental Advocacy	Recycling Operators Representatives	Economic Development
• Northeast Maryland Waste Disposal Authority (NMWDA) • Maryland Department of Planning • Maryland Recycling Network (MRN) • Washington Metro Council of Governments (MWCOG) • Baltimore Metro Council (BMC)	• Constellium • American Forest and Paper Association (AFPA) • Maryland Retailers Association • American Beverage Association (ABA) • Consumer Brands Association • AMERIPEN • Glass Packaging Institute (GPI) • Biodegradable Packaging Institute (BPI)	• Sierra Club Maryland • The Association of Plastics Recyclers (APR)	• Maryland Environmental Service (MES) • National Waste and Recycling Network	• Central Maryland Chamber of Commerce • Maryland Department of Commerce (MDOC)

The strategic stakeholder interviews for the MDE EPR Statewide Recycling Needs Assessment Task provided valuable insights, allowing the Project Team to evaluate technical and operational data with a comprehensive and holistic perspective based on the needs, challenges, and opportunities discussed. The following summarizes the results of the discussions presented by organization type.

3.6.1 Regional Authorities, Agencies, and NGOs

According to the feedback received, improving recycling program performance through EPR for packaging requires addressing infrastructure and policy challenges while fostering collaboration at multiple levels. As such, regional organizations are critical stakeholders representing groups of public and private sector organizations in the recycling industry. A

Key Themes

The Project Team synthesized key themes from the strategic partner interviews for consideration as part of the 2025 legislative session. As such, the Project Team expects additional follow-up discussions may be recommended to support future program planning.

key priority is modernizing recycling facilities to enhance processing capabilities and reduce contamination while developing cost-effective hub-and-spoke systems on a regional basis to collect and transport post-consumer packaging to end markets. Supporting interstate collaboration and leveraging collective purchasing power can enable cost-effective solutions, but jurisdictional challenges complicate unified approaches across state lines.[14]

Addressing emerging trends like packaging innovations, battery disposal, and evolving waste streams will require collaboration, investment, and a harmonized approach to education, outreach, and compliance. Education and outreach are critical to boosting public participation and reducing contamination in recycling streams, and some regional entities support education and outreach on behalf of multiple member counties. Recycling messaging that results in behavior change should be consistent across all environments (e.g., including where residents live, work, and recreate) to result in high participation and capture rates.

Lessons from other EPR programs, such as those for tires and batteries, highlight the importance of balancing policy mechanisms with administrative feasibility. For example, while point-of-sale reimbursements offer potential, the significant accounting and administrative demands require careful consideration.

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[14] Virginia's Dillon Rule is a legal principle resulting in a centralized decision-making structure that can create challenges for local governments in advancing waste management or sustainability initiatives independently. For example, the state legislature must explicitly empower individual jurisdictions to proceed with EPR initiatives or pass statewide legislation enabling all localities to adopt such programs.

3.6.2 Packaging Producers

Packaging producers that may be impacted by potential EPR for packaging legislation range from small businesses to multinational corporations. Representatives for packaging producers were interviewed as part of the stakeholder engagement effort to understand how the State can develop an effective and efficient EPR system with a transparent framework that provides clear metrics, goals, and guidelines.

Representatives of packaging producers generally support EPR for packaging, but each identified that it needs to be developed collaboratively to support a wide range of packaging material priorities. Multiple representatives cited the process in Minnesota as an example of robust collaboration that balanced the need to increase recycling rates, mitigate environmental externalities, and avoid excessive burden on manufacturers or taxpayers.

Packaging producers carefully consider the impact of incentives and malices that may be included in potential EPR for packaging legislation, including post-consumer content goals and eco-modulation of fees.[15] Generally, there is support for incentives that help create consistent demand for recycled materials, support the development of end markets, and drive innovation that optimizes material management systems; however, packaging producers are sensitive to policy that would not result in a level playing field for small businesses or for specific packaging material types.

> **Leader in zero waste and net zero initiatives**
>
> Through EPR for packaging legislation, Maryland is in the position to provide a pathway to meaningful collaboration to increase recycling, waste diversion, and waste reduction efforts in-state and out-of-state. Aligning EPR with state-level authority can amplify local zero waste plans and drive meaningful progress in recycling performance. Local zero waste plans may not have the authority to implement key infrastructure or operations, EPR can support institutional will at the state level. Coordination with key entities like the Maryland Recycling Network (MRN), Maryland Department of the Environment (MDE), Northeast Maryland Waste Disposal Authority (NMWDA), Maryland Environmental Service (MES), and the Metropolitan Washington Council of Governments (MWCOG) could result in the development of contractual mechanisms that serve as a model for EPR implementation, implementing zero waste programs, and supporting broader net-zero initiatives that overcome challenges scaling across neighboring jurisdictions.

3.6.3 Environmental Advocacy

Environmental advocacy organizations support stewardship efforts to enhance recycling systems by improving material design, increasing reuse, reducing litter on roadways and waterways, and driving demand for post-consumer recycled content (PCR). They emphasize the importance of reducing and redesigning packaging to minimize environmental impact while encouraging producers to take responsibility for packaging waste. Additionally, these organizations support environmental justice in policy design,

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[15] Malices is a term that has been commonly used in EPR programs to mean disincentives, which would be captured in eco-modulation of fees.

advocating for careful consideration of impacts on overburdened and underserved communities.

Key priorities include establishing enforceable and measurable targets for waste reduction, stressing the need for public oversight to maintain accountability, avoiding exclusively producer-led target setting that could dilute environmental focus. By targeting materials prevalent in waterways, such as those contributing to litter in areas like Baltimore Harbor and the Anacostia River, EPR programs can address the concerns of environmental advocates related to pervasive issues of single-use packaging waste and pollution in the built and natural environment.

3.6.4 Recycling Operators Representatives

Recycling operators representatives (e.g., organizations representing collectors, processors, and marketers of recycling in the State) recognize that EPR for packaging legislation presents a significant opportunity to address funding and infrastructure challenges in the state's recycling system. Many operators emphasize the need for improving worker conditions, such as enhancing safety measures in MRFs and expanding access to recycling services beyond residential areas, particularly for multifamily housing, which faces infrastructure gaps and compliance issues.

Recycling operators note the aging MRF infrastructure in the State and support investment in upgrading existing facilities for owners and operators. EPR for packaging presents an opportunity to fund these improvements.

George "Walter" Taylor Act

Packaging toxicity is a significant concern in EPR for packaging programs, particularly related to the increased concerns on the ubiquitous nature of harmful chemicals like per- and polyfluoroalkyl substances (PFAS) and other known carcinogens. These substances can be used in manufacturing processes to enhance the durability, water resistance, or grease resistance of packaging and can be quintessential to meet the stricter regulatory standards such as those used for food safety, pharmaceuticals, and meat products.

These regulations often mandate specific material properties to ensure product safety, making it difficult to redesign packaging for recyclability or reduce reliance on harmful substances. Additionally, achieving compliance while meeting sustainability goals can increase costs for producers and slow innovation. Environmental advocates support program design that incentivizes reducing packaging toxicity, utilizing safer material choices, and prioritizing research and development of non-toxic alternatives to support a circular economy.

Another consideration EPR for packaging should account for is the variation in recycling collection between residential and commercial customers, which presents unique obstacles for expanding recycling access and improving program efficiency. While residential areas typically benefit from consistent curbside collection services, multifamily housing units often face infrastructure gaps and compliance issues, making it difficult to implement effective recycling programs. Additionally, commercial and industrial properties present challenges related to the variability of materials collected and the lack of standardized recycling practices.

While EPR for packaging legislation offers a potential solution for funding infrastructure upgrades, concerns persist about local control and material flow. Operators stress the

importance of evaluating EPR for packaging implementation through an EJ lens, ensuring equitable access to recycling, particularly for disadvantaged communities, expanding opportunities for MWBE businesses, and emphasizing safe working conditions and fair employment practices. There is increased priority for worker safety with a focus on achieving zero-injury shifts, especially with the frequent occurrence of truck fires and facility fires at MRFs which pose major risks to working conditions and operational efficiency. Although some recycling collection and facility operations are unionized, recruitment and retention challenges remain, but labor shortages have stabilized since the COVID-19 pandemic.

Data collection is another critical area of concern for Maryland's recycling operators as they navigate the complexities of EPR for packaging legislation. The need for thorough and accurate data on recycling rates, material flows, and the economic impact of EPR will enable measurement of program effectiveness; however, the collection of accurate, comprehensive data requires significant investment in infrastructure, technology, and training, which could place additional burden on operators. Inconsistent data collection across facilities and varying reporting standards could lead to discrepancies, making it difficult to evaluate the effectiveness of recycling efforts across the State. Standardized data collection practices and investment in technologies that enable real-time tracking of materials would help with transparency and accountability but also enable operators to identify trends, optimize processes, and adjust operations as needed to meet the evolving demands of the recycling industry.

Balancing Recycling Quality and Service Convenience

Balancing higher quality recycling material streams, such as those found in dual or multi-stream systems, with the increased convenience of single-stream systems presents challenges and trade-offs. Dual-stream and multi-stream systems, which requires residents or businesses to separate materials like paper and cardboard from plastics, metals, and glass, minimize contamination rates and increase the commodity value of recovered materials. Although there are successful examples of dual-stream and multi-stream recycling programs in the State, this approach faces logistical challenges.

Single-stream systems offer greater convenience for residents, as they allow all recyclables to be placed in one bin without the need for sorting. This convenience often leads to higher participation rates and volumes of materials collected, but the ease also results in more contamination reducing the overall efficiency and quality of the recycling process. Recycling operators recognize that single stream may be a better fit for some areas of the State while dual stream meets the needs of other areas, but this contributes to inconsistency in the education, outreach, and compliance required for programs across different jurisdictions. This ultimately creates confusion for the public and complicates efforts to increase recycling performance statewide, presenting an opportunity for EPR for packaging legislation to establish uniform approach to communicating the needs of the recycling system and streamlining collection regardless of where generators live, work, or recreate.

3.6.5 Economic Development

Economic development considerations related to EPR for packaging legislation involve a balance between fostering business growth, ensuring equitable practices, and minimizing burdens on manufacturers. One of the key priorities is to support MWBE businesses through program planning requirements, ensuring these businesses have opportunities created by EPR for packaging.

Economic development organizations stress the importance of minimizing the potential impact on manufacturing businesses, especially those in the Consumer Packaging Goods (CPG) and Food & Beverage (F&B) space that operate with tight profit margins, by designing equitable and manageable fee structures that avoid compounding cost pressures that minimize competitiveness across state lines. EPR compliance may disproportionately affect smaller businesses and MWBEs, increasing operational costs and potentially driving up packaging costs that is passed through to the consumer. Additionally, eco-modulation, which ties fees to the recyclability of materials, may increase administrative burdens and affect certain manufacturers disproportionately, particularly small and mid-sized companies that may not qualify for exemptions but still face similar financial constraints.

> **Minimizing Impact on Maryland Manufacturers**
>
> Maryland has 4,685 manufacturers as of 2023, and over 90% of these businesses are small (e.g., defined as having revenues under $25M). A smaller subset of these manufacturers are minority, women-owned, or small businesses. Economic development organizations suggest designing a program that minimizes competitive imbalances between material types, utilizing the State's available resources including Maryland Commerce EDA Resilience Project Dashboards to analyze impacted sectors and focus efforts.
>
> Economic development organizations recognize the potential for EPR for packaging legislation to drive innovation in the packaging space (e.g., process efficiencies, implementation of Smart Label Technology, printing QR codes on packaging, etc.) can enhance product re-design efforts and help packaging manufactures build trust with consumers by ensuring that recycling instructions are clear and consistent

Many packaging suppliers and manufacturers are already focused on sustainability efforts, such as increasing the use of PCR materials and meeting corporate Environmental, Social, and Governance (ESG) goals. Retailers, especially grocers, are increasingly driving demand for sustainable packaging, providing manufacturers with opportunities to innovate and meet consumer preferences for eco-friendly products. However, the cost implications of EPR may need to be managed carefully to avoid undue burdens on smaller manufacturers and MWBE businesses.

Economic development organizations support clear and transparent framework for packaging manufacturers to meet program compliance needs. Establishing measurable performance metrics and maintaining open communication with stakeholders will help address concerns about the financial and operational impacts of EPR for packaging through program design, development and implementation. Larger manufacturers, with greater capacity to absorb compliance costs, are better positioned to manage these requirements, and may opt to spread EPR for packaging-related costs across their entire

footprint, rather than concentrating them in Maryland, which could help reduce financial strain on local businesses.

4 Recycling Programs

This section describes the current state of Maryland's residential and commercial recycling programs based on desktop research and direct outreach to municipalities, haulers, and MRFs.

The Maryland Recycling Act (MRA) defines the types of waste that count toward the State's recycling rate. MRA waste includes the following material types:

- Compostables
- Glass
- Metals
- Paper
- Plastic
- Select other materials (i.e., laser toner cartridges, lead-acid batteries, oil filters, wood pallets)

Based on the outreach conducted by the Project Team, there were key themes that emerged about the accepted materials in recycling programs, and those that are generally not allowed or less preferred. **Figure 17** shows this list which is presented for informational purposes only and does not reflect an accepted materials list.

Figure 17: Statewide Accepted and Less Preferred Materials

Most counties and municipalities reported accepting the following materials:

Plastic Containers
- #1 Polyethylene terephthalate (PET) Bottles
- #2 High-Density Polyethylene (HDPE) Bottles
- #5 Polypropylene (PP) Rigid Containers

Cardboard and Paper
- Old Corrugated Cardboard (OCC)
- Mixed Paper (office paper, newspaper)
- Chipboard/boxboard
- Magazines

Glass Bottles and Jars

Metals
- Used Beverage Cans (UBC)
- Steel cans

A few counties and municipalities accept the following materials:

PET Thermoforms
Coffee Cups
Cartons

Counties and municipalities did not report processing the following materials:

Film Plastic
Nursery Containers

Based on a combination of review of MRF surveys and county/municipal survey, and does not reflect an accepted materials list, is meant to provide direction for program planning only

Counties with more than 150,000 residents are required to recycle at least 35% of generated waste, and counties with less than 150,000 residents are required to recycle at least 20% of generated waste.

4.1 Program Types

Recycling can be provided with a variety of service types. The following service types are provided in the State:

- Open Market: Individual homeowners select and contract with a hauler in their area to provide services to their home.
- Municipal Contract: Municipalities manage single-family recycling contracts for households in their jurisdictions. Municipalities contract with at least one hauler to provide recycling services to residents and the fee for services is often covered within property taxes or through other utility fee assessment mechanisms (e.g., system benefit charge).
- County Contract: Counties manage single-family recycling contracts for households in their jurisdictions. Counties contract with at least one hauler to provide recycling services to residents and the fee for services is often covered within property taxes or through a per capita fee.
- Municipal Collection: Municipalities provide collection services with a municipally owned collection fleet, and the fee for services is often covered within property taxes or through a per capita fee.

4.1.1 Single-Family Recycling Program Types

The types of recycling collection services for single-family households by Region and county are shown in **Table 10** below.

Table 10: Single Family Curbside Recycling Collection Service Types

Region	County	Service Providers
Western Maryland	Allegany	Municipal Contract(s) and Open Market
	Garrett	Open Market
	Washington	Municipal Contract(s) and Open Market
Washington Metro	Prince George's	County Contract(s), Municipal Contract(s), and Open Market
	Frederick	County Contract(s)
	Montgomery	County Contract(s) and Open Market
Baltimore Metro	Anne Arundel	County Contract(s) and Open Market
	Baltimore	County Contract(s)
	Carroll	Municipal Contract(s) and Open Market
	City of Baltimore	Municipal Contract(s) and Municipal Collection
	Harford	Municipal Collection and Open Market
	Howard	County Contract(s)

Region	County	Service Providers
Southern Maryland	Calvert	Open Market
	Charles	County Contract(s), Municipal Contract(s), Municipal Collection, and Open Market
	St. Mary's	None
Upper Eastern Shore	Cecil	Municipal Contract(s) and Open Market
	Caroline	Open Market
	Kent	Open Market
	Queen Anne's	County Contract(s) and Open Market
	Talbot	Open Market
Lower Eastern Shore	Dorchester	N/A
	Somerset	N/A
	Wicomico	Municipal Contract(s), Municipal Collection, and Open Market
	Worcester	Municipal Collection and Open Market

Note: N/A indicates that information was not received by the County or could not be verified.

In addition to recycling collection services, residents can drop off recyclables at drop-off sites. Recycling drop-off infrastructure is strong across Maryland with each county having at least one (1) drop-off site. These sites are typically free of charge and open to the public.

4.1.2 Multi-Family Recycling Program Types

The types of recycling collection services for single-family households by Region and county are shown in **Table 11** below.

Table 11: Multi-Family Curbside Recycling Collection Services

Region	County	Services Provided
Western Maryland	Allegany[1]	Open Market, Municipal Contract(s)
	Garrett	Open Market
	Washington	Open Market, Municipal Contract(s)
Washington Metro	Prince George's[2]	Open Market
	Frederick	Open Market
	Montgomery [3]	Open Market, County Contract(s)
Baltimore Metro	Anne Arundel	Open Market
	Baltimore	County Contract
	Carroll	Open Market
	City of Baltimore	Open Market
	Harford	Municipal Collection, Open Market
	Howard	Open Market
Southern Maryland	Calvert	Open Market
	Charles	Open Market
	St. Mary's	N/A
Upper Eastern Shore	Cecil	Open Market, Municipal Contract(s)
	Caroline[5]	Open Market
	Kent [6]	Open Market
	Queen Anne's	Open Market
	Talbot	Open Market

Region	County	Services Provided
Lower Eastern Shore	Dorchester	Open Market
	Somerset [7]	N/A
	Wicomico [8]	Open Market
	Worcester [9]	Open Market, Municipal Collection

Notes:

1. City of Cumberland provides collection for single-family residents and manages a contract for recycling collection from multi-family units. City of Frostburg indicated that multi-family units receive service through the open market.
2. City of College Park and Greenbelt indicated the multi-family collection is provided by open market and City of Laurel provides municipal collection to service multi-family customers.
3. Montgomery County identified that there are 145,000 multi-family dwelling units in the County. City of Rockville and Takoma Park indicated that multi-family collection is provided by open market.
4. The Town of Elkton provides municipal collection to multi-family complexes.
5. The Town of Denton administers a contract with a private sector hauler that that services multi-family complexes.
6. The Town of Chestertown indicated that multi-family dwellings are serviced by open market.
7. The Town of Princess Anne indicated that while trash from multi-family units is serviced by municipal collection, recycling from multi-family is provided on the open market.
8. Wicomico County indicated that the County's staff engage with multi-family complexes to encourage compliance with the ABCR program, and that currently about 5 of 25 multi-family properties provide recycling service The City of Salisbury indicated municipal collection services are provided to some multi-family properties.
9. The Town of Snow Hill indicated that multi-family recycling is serviced by municipal collection.
10. N/A indicates that information was not received by the County or could not be verified.

Multi-Family Cost Impacts

Given the variations in infrastructure types at multi-family properties, there may be an inequitable impact in terms of cost to implement recycling, where requirements for multi-family recycling would increase costs for property managers and may be passed through to residents.

4.1.3 Commercial Recycling Program Types

Commercial generators in the State can be serviced in different ways. Commercial recycling service is typically provided via the open market. Businesses contract directly with commercial haulers. Cardboard-only collection is a common service option provided by commercial haulers across Maryland counties and municipalities for commercial properties.

4.1.4 Recycling Education

Effective consumer education is a critical component of successful recycling programs. Education activities are associated with higher diversion rates in Maryland counties. By providing clear and concise information, promoting best practices, and addressing common misconceptions, education efforts can:

- <u>Increase recycling participation rates:</u> Educate and empower individuals to make informed choices about waste disposal.

- <u>Reduce contamination rates:</u> Educate households and businesses about proper sorting and disposal methods.

- <u>Enhance the quality of recyclable materials:</u> Examine ways to reduce the amount of non-recyclable items.

- <u>Promote environmental stewardship:</u> Foster a sense of responsibility and commitment to sustainable practices.

There are opportunities to provide increased staffing among Counties in the State to direct additional effort towards education, outreach, and compliance programs statewide. The Baltimore Metro and Washington Metro Regions have higher staffing, consistent with the larger population and programmatic needs; however, other Regions do not have enough staff to implement programs. Jurisdictions with two or more recycling-focused full-time employees consistently had higher recycling rates, suggesting that adequate staffing is essential to support impactful recycling programs. Increasing educational staff enhances the capacity of local governments to conduct personalized outreach and address unique community needs.

Education best practices include:

- <u>Targeted public education campaigns to increase capture rates and reduce contamination.</u> Multimedia campaigns address common contaminants in recycling streams (e.g., plastic films, food waste) and can utilize clear visuals and messaging to educate consumers on what can and cannot be recycled.

- <u>Multilingual recycling resources to encourage inclusivity and equitable access to recycling information and increase participation among diverse communities.</u> Providing recycling education materials in multiple languages across jurisdictions builds on efforts like Montgomery County's extensive multilingual outreach.

- <u>Leveraging technology for recycling education and service information that is more equitable and engaging.</u> Phone applications are increasingly more popular and accessible for conveying information to residents and customers.

- <u>Introducing curbside feedback programs to educate households on better sorting habits to reduce contamination.</u> Implementing programs where residents receive direct feedback on their recycling practices (e.g., tagging bins with contamination notices) helps to change behavior by intervening at the point of decision making.

- <u>Strengthening School-Based Recycling Initiatives to instill lifelong recycling habits in younger generations.</u> Programs like Charles County's iRecycle Smart is applicable in other counties. This may include hands-on activities, classroom signage, and student-led collection efforts.

- <u>Establishing regional recycling hubs to reduce contamination in curbside containers by diverting problematic materials to specialized facilities.</u> Create centralized Drop-off locations for hard-to-recycle items like plastic films or Styrofoam with clear signage and staff assistance

- <u>Conducting pilot programs for innovative solutions. Test new approaches such as innovative bin technology that automatically detects contamination or community-based repair/reuse workshops.</u> Pilot programs can help identify scalable solutions to improve Maryland's recycling

4.2 Active Recycling Access

Equitable access to recycling services for residents is critical to meeting and exceeding diversion targets. For the purposes of this study, recycling access refers to whether recycling services are *available* to residents, not necessarily subscription rates or participation rates.

4.2.1 Single-Family Recycling Access

County and municipal survey results indicate that 20 out of 24 Maryland counties have access to curbside recycling services for single-family residential customers, and all counties have at least one drop-off location for recycling services, as shown in **Table 12** below.

Table 12: Availability of Single-Family Recycling and Composting Collection Services by Region

Region	County	Curbside Recycling	Curbside Food Waste	Curbside Yard Waste	Drop-off Recycling	Drop-off Food Waste	Drop-off Yard Waste
Western Maryland	Allegany	X			X		X
	Garrett	X		X	X		
	Washington	X		X	X		
Washington Metro	Prince George's	X	X	X	X		X
	Frederick	X	X	X	X		X
	Montgomery	X	X	X	X		X
Baltimore Metro	Anne Arundel	X	X	X	X	X	X
	Baltimore	X	X	X	X		X
	Carroll	X		X	X		X
	City of Baltimore	X	X	X	X	X	X
	Harford	X			X		X
	Howard	X	X	X	X		X
Southern Maryland	Calvert	X			X		
	Charles	X		X	X		X
	St. Mary's				X		
Upper Eastern Shore	Cecil	X			X		X
	Caroline				X		
	Kent	X			X		
	Queen Anne's	X			X		
	Talbot	X			X		
Lower Eastern Shore	Dorchester				X		
	Somerset				X		
	Wicomico	X			X		
	Worcester	X			X		X

<u>Note</u>: An "X" indicates that service is provided.

The Washington Metro Region is the only Region where all counties have curbside access to recycling, food waste, and yard waste curbside collection. Food waste collection is only currently available in the Washington Metro and Baltimore Metro Regions. The Upper and Lower Eastern Shore Regions have the fewest service options for residential customers compared to other Regions in the state with three (3) of the nine (9) counties not having access to curbside recycling. In most cases, curbside recycling programs offer single stream services, as shown in **Figure 18**. However, approximately 30% of counties offer dual or multi-stream services.

Figure 18: Access to Recycling Collection Program Types by County
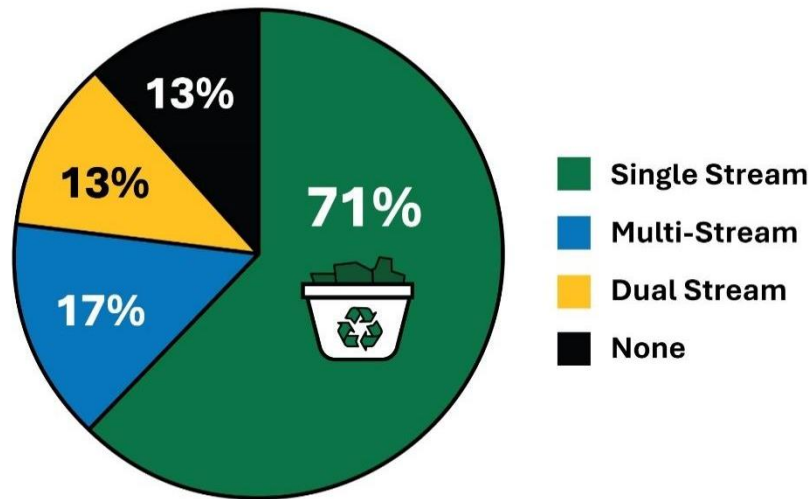
Table 13 below shows the breakdown of curbside recycling access by region and service type. Overall, 89% of single-family households are estimated to have active curbside recycling service. The majority of this service (66%) is provided by counties. Single-family households in the Lower Eastern Shore have the lowest rate of curbside recycling access at 28% overall, followed by Western Maryland at 53% and Southern Maryland at 61%. The Washington Metro, Baltimore Metro, and Upper Eastern Shore Regions have active access rates of 99%, 96% and 88%, respectively.

Table 13: Statewide Curbside Recycling Access Rates - by Region and Service Type

Region	County Provided	Municipality Provided	Open Market Provided	Total Active Service	No Service
Western Maryland	0%	26%	27%	**53%**	47%
Washington Metro	80%	19%	1%	**99%**	1%
Baltimore Metro	81%	3%	11%	**96%**	4%
Southern Maryland	40%	6%	14%	**61%**	39%
Upper Eastern Shore	0%	8%	81%	**88%**	12%
Lower Eastern Shore	0%	18%	10%	**28%**	72%
Statewide	**66%**	**10%**	**12%**	**89%**	**11%**

4.2.2 Multi-Family Recycling Access

Multi-family housing options span a diverse range of structures, catering to various residential needs. These can include duplexes, which are two (2)-unit homes often side-by-side or stacked, and triplexes or quadplexes, which offer three (3) or four (4) units within a single building. Townhomes or rowhouses, common in the urban areas of the State and featuring multiple connected units with shared walls but private entrances, were also included as multi-family units. Other multi-family units include senior living communities, student housing, and mixed-use developments, blending residential and commercial or retail space for convenience and accessibility.

> **Collection Program**
> There are various approaches to incorporating equity in the future of the State's recycling collection systems. Vehicle route optimization, transitioning to clean fleets, and establishing and promoting employment opportunities. **Vehicle route optimization** minimizes noise, air pollution, and traffic disruptions. **Clean burning fuels** (e.g., compressed natural gas, electric vehicles) can minimize tailpipe emissions. **Job training programs** focusing on positions like CDL truck drivers, mechanics, and logistics planners can support EJ communities and support recycling program performance.

Table 13 presents the number of multi-family dwelling units by Region. Urban Regions like Baltimore Metro and Washington Metro have significantly more multi-family units, particularly in higher density categories, compared to Rural areas like Western Maryland or the Eastern Shore.

Table 13: Number of Multi-Family Dwelling Units by Region

Region/County	2 units	3 or 4 units	5 to 9 units	10 to 19 units	20 or more units	Total
Western Maryland	3,900	3,500	4,300	3,800	4,200	19,700
Washington Metro	6,000	13,900	49,100	85,200	122,400	276,600
Baltimore Metro	22,200	30,000	60,100	88,600	98,700	299,600
Southern Maryland	700	1,200	2,400	4,400	5,200	13,900
Upper Eastern Shore	2,100	2,600	4,500	1,900	2,600	13,700
Lower Eastern Shore	1,800	3,900	5,800	8,100	17,800	37,400
Total	**36,700**	**55,100**	**126,200**	**192,000**	**250,900**	**660,900**

Source: Census 2022 ACS 5 YR (most recent 5 YR ACS available that incorporate places with populations over 65,000)

Multi-family recycling collection differs from single-family curbside collection: instead of carts, multi-family properties typically use larger containers such as open top roll-off, dumpsters, or compactors to collect recycling. In general, multi-family households have less access to recycling compared to their counterparts that live in single-family households. Statewide, 49% of multi-family households have access to recycling services, as shown in **Table 14** below.

Table 14: Percentage of Multi-Family Households with Active Recycling Collection Service Type by Region

Region	County Provided	Municipality Provided	Open Market Provided	Total Active Service	No Service
Western Maryland	0%	0%	18%	37%	63%
Washington Metro	0%	0%	64%	64%	36%
Baltimore Metro	0%	0%	11%	39%	61%
Southern Maryland	28%	0%	58%	58%	41%
Upper Eastern Shore	0%	0%	75%	75%	25%
Lower Eastern Shore	0%	0%	23%	23%	77%
Statewide	**13%**	**0%**	**36%**	**49%**	**51%**

4.3 Recycling Diversion Rate

Maryland's counties are required to recycle at least 20%-35% of their generated waste, depending on each county's population. MDE tracks annual waste diversion to assess whether counties are achieving required targets.

Table 15 shows the MRA recycling rate by Region and County. As shown in the table below, **single-family recycling rates range from 6% in Somerset County to 65% in Cecil County. Statewide, Maryland's recycling rate for MRA materials is 39%.**

Table 15: MRA Recycling Rate by Region and County (2022)

Region	County	MRA Recycling Rate (%)
Western Maryland	Allegany	47%
	Garrett	41%
	Washington	30%
Washington Metro	Prince George's	46%
	Frederick	46%
	Montgomery	40%
Baltimore Metro	Anne Arundel	42%
	Baltimore	24%
	Carroll	25%
	City of Baltimore	17%
	Harford	48%
	Howard	45%
Southern Maryland	Calvert	36%
	Charles	46%
	St. Mary's	23%
Upper Eastern Shore	Cecil	65%
	Mid-Shore[1]	51%

Region	County	MRA Recycling Rate (%)
Lower Eastern Shore	Dorchester	33%
	Somerset	6%
	Wicomico	53%
	Worcester	38%
Maryland Totals		**39%**

Mid-Shore represents Caroline County, Kent County, Queen Anne's County and Talbot County data on a combined basis.

4.3.1 Single-Family Residential Recycling Rates

Recycling rates for single-family households were estimated using the Statewide waste characterization study, recycling tonnage data collected by MDE, and data obtained via MRF surveys. The recycling rate of single-family recyclables by Region and material type are shown in **Table 16** below.

Table 16: Recycling Rate of Single-Family Recyclables by Material Type

Region	Metal	Rigid Plastic	Flexible Plastic	Glass	Paper	OCC	Cartons	Total
Western Maryland	29%	23%	0%	40%	4%	15%	2%	15%
Washington Metro	40%	31%	0%	72%	47%	55%	21%	45%
Baltimore Metro	28%	39%	0%	45%	28%	45%	7%	31%
Southern Maryland	20%	19%	0%	53%	26%	30%	6%	25%
Upper Eastern Shore	20%	34%	0%	46%	19%	32%	5%	25%
Lower Eastern Shore	12%	11%	0%	39%	5%	19%	2%	12%
Statewide	**30%**	**33%**	**0%**	**57%**	**32%**	**44%**	**9%**	**33%**

The average recycling rate of single-family materials is 33%. **Materials with the highest recycling rates are glass and old corrugated cardboard (OCC).**

4.3.2 Multifamily Residential Recycling Rates

Multi-family dwellings generate approximately 243,600 tons of recyclable materials annually, and approximately 46,400 tons are recycled. Recycling rates for multi-family households were estimated using the Statewide waste characterization study, recycling tonnage data collected by MDE, and data obtained via MRF surveys. Recycling rate of multi-family recyclables by Region and material type are shown in **Table 17** below. The State's multi-family recycling rate is 19%, which is lower than the recycling rate for single-family households. **Materials with the highest multi-family recycling rates are glass and OCC, which is consistent with single-family recycling rates.**

Impacts of Increasing Recycling Rates

Increasing recycling rates is important for improving recycling program performance, but deploying equipment and developing infrastructure may increase health and human impacts on overburdened communities. Increased collection vehicle or facility emissions, roadway damage, and property damage may require additional attention in these areas such as financial support, technology upgrades, education/outreach support, contracting support, fueling infrastructure, hiring local MWBE individuals or businesses.

Table 17: Recycling Rate for Multi-Family Sector by Material Type (2022)

Region	Metal	Rigid Plastic	Flexible Plastic	Glass	Paper	OCC	Cartons	Total
Western Maryland	18%	14%	0%	24%	2%	8%	1%	9%
Washington Metro	26%	20%	0%	44%	29%	33%	14%	28%
Baltimore Metro	11%	18%	0%	19%	12%	20%	3%	14%
Southern Maryland	12%	12%	0%	33%	17%	17%	4%	15%
Upper Eastern Shore	16%	22%	0%	31%	15%	21%	3%	17%
Lower Eastern Shore	6%	7%	0%	18%	4%	12%	1%	7%
Statewide	**16%**	**18%**	**0%**	**34%**	**19%**	**24%**	**6%**	**19%**

4.3.3 Commercial Recycling Rates

Commercial entities generate approximately 1,756,400 tons of recyclable materials annually, and approximately 707,000 tons are recycled. Recycling rates for commercial entities were estimated using the Statewide waste characterization study and recycling tonnage data collected by MDE. The recycling rate of commercial recyclables by Region and material type are shown in **Table 18** below. **The State's commercial recycling rate is 40%, which is higher than recycling rates for single-family and multi-family households. Materials with the highest recycling rates are glass, paper, and OCC, which is consistent with single-family and multi-family recycling rates.**

Table 18: Recycling Rate for Commercial Material (2022)

Region	Metal	Rigid Plastic	Flexible Plastic	Glass	Paper	OCC	Cartons	Total
Western Maryland	42%	5%	0%	12%	50%	68%	10%	48%
Washington Metro	43%	33%	0%	74%	51%	61%	10%	48%
Baltimore Metro	18%	8%	0%	22%	34%	47%	5%	30%
Southern Maryland	76%	36%	0%	77%	54%	62%	13%	52%
Upper Eastern Shore	22%	73%	0%	44%	56%	78%	12%	63%
Lower Eastern Shore	25%	20%	0%	48%	16%	27%	2%	19%
Statewide	**35%**	**26%**	**0%**	**55%**	**43%**	**56%**	**8%**	**40%**

4.4 Ordinances

4.4.1 Multi-Family Recycling Ordinances

The State has an Apartment Building and Condominium Recycling (ABCR) law in place which requires that recycling is offered in apartment buildings and condominiums that contain ten or more units. Property owners or managers are not required to provide recycling for smaller complexes. Some counties and municipalities, such as Prince George's County and Montgomery County, have local ordinances to promote recycling at multi-family properties.

However, most counties reported that they do not have enforcement programs in place for multi-family recycling compliance. Specifically, there are no multi-family property compliance programs (e.g., programs with dedicated compliance staff) in Western Maryland, Southern Maryland, or Lower Eastern Shore Regions. Eight (8) counties have compliance program; however, not all of them have dedicated staff for the effort.

Feedback received via surveying efforts indicates that participation in the multi-family recycling program is lower than 50%.

When counties do have enforcement mechanisms in place, they typically rely on the following strategies:

- Resident complaints
- Reporting from haulers
- Reporting from multi-family property owners or managers
- Site visits conducted by County staff
- Reporting from recycling facilities who receive loads with high levels of contamination

The limited enforcement at multi-family properties presents an opportunity for EPR program funding to improve the statewide recycling rate. Counties need additional financial support to employ enforcement staff, such as inspectors and educators; manage the reporting from multi-family property managers or owners; and bring properties into compliance.

4.4.2 Commercial Recycling Ordinances

Respondents to the municipal survey indicated some areas require recycling for small businesses and hospitality locations. Commercial recycling ordinances are in place primarily in the Washington Metro, Baltimore Metro, and Upper Eastern Shore Regions. At the county level, these ordinances are enforced via haulers. Prince George's, Harford, Montgomery (including a separate requirement for City of Takoma Park), and Howard Counties utilize municipal staff and inspectors to enforce these ordinances.

Communities that require commercial recycling in the State often require that the recycling container be a certain proportion as compared to trash container, such as 33% or 50% of the size of the trash container. Based on municipality survey responses, the amount of commercial recycling activity can vary widely. Many jurisdictions believe that less than 25% of their businesses are recycling. Some counties with commercial ordinances responded that over 75% of their businesses are recycling.

5 Infrastructure and Capacity

MRFs, compost facilities, and transfer stations were reviewed to assess current and potential recycling and composting capacity in the state. Owners and operators of MRFs and composting facilities were surveyed for this Needs Assessment. Owners and operators of transfer stations were not interviewed for this study; however, transfer infrastructure is essential to expanding recycling services in Maryland, and therefore the locations of waste and recycling transfer stations are discussed in this section.

5.1 Recycling Processing

Recycling processing facilities, known as MRFs, sort recyclables into commodities that can then be sold to end markets. Some facilities accept recyclable materials that are separated at the source by material type, process those materials into bales, and ship them to end markets, while other facilities have equipment that sorts a mix of materials (also known as commingled recyclables) before baling them and shipping them to end markets. The following types of MRFs process Maryland's recyclable materials:

- Push/Bale: Facilities that bale certain source-separated commodities onsite while shipping the rest of the commingled recyclables to another facility to be sorted further. Maryland's push and bale facilities feed material to in and out of state MRFs for further processing.

- Paper Only: Facilities that accept and process source-separated paper for shipment to end markets.

- Single Stream: Facilities that sort commingled recyclables.

- Dual Stream: Facilities that receive source-separated containers and paper.

- Multi-Stream: Facilities that accept source-separated commodities and ship baled commodities to end markets.

5.1.1 Recycling Facility Overview

As shown in **Figure 19**, there are sixteen (16) MRFs that accept recyclables generated in Maryland, including out-of-state facilities. There are thirteen (13) MRFs in the State. In addition, MRFs in Delaware, Virginia, and Pennsylvania accept recyclable materials from Maryland.

Figure 19: Material Recovery Facilities in Maryland (2024)
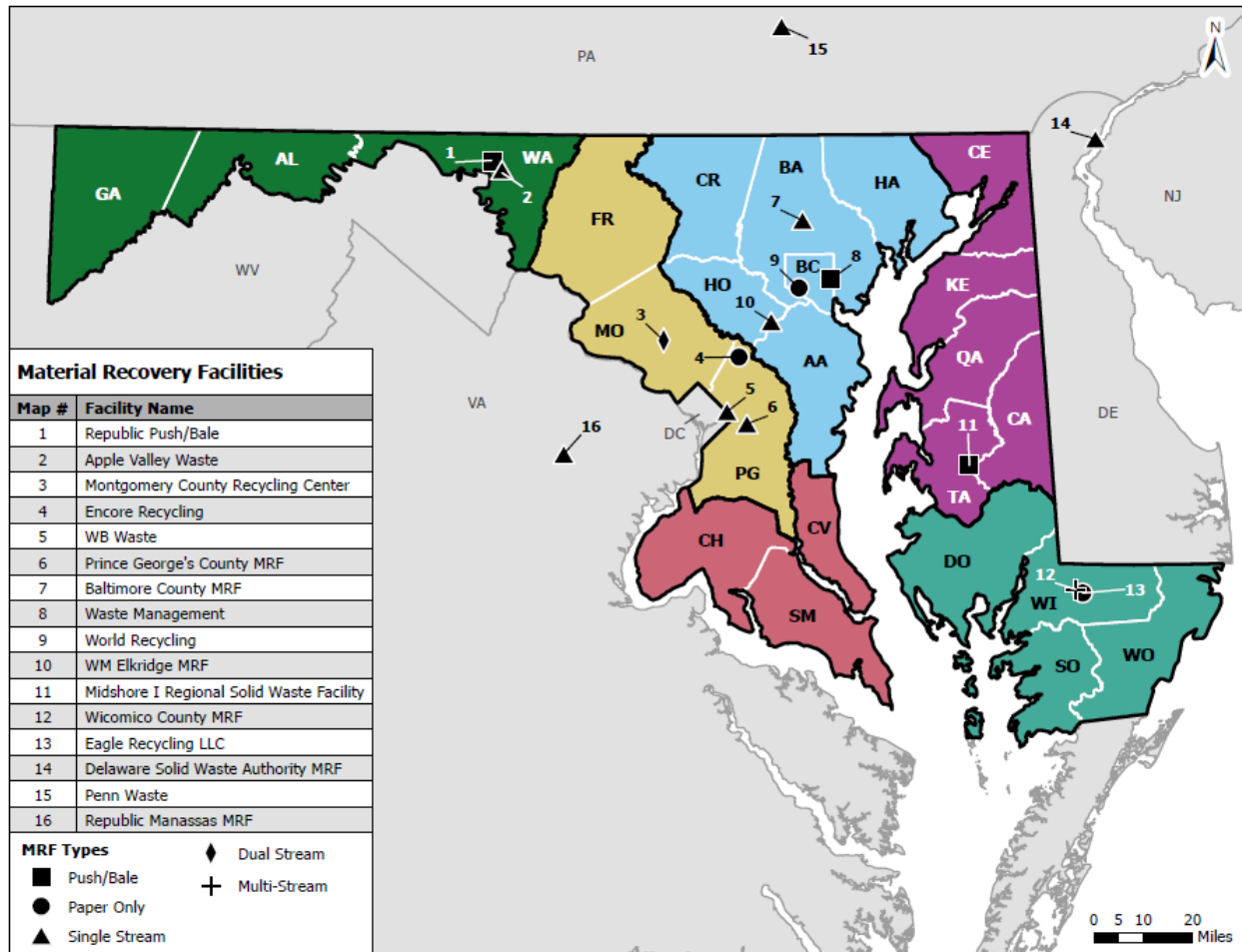
The Upper and Lower Eastern Shore Regions are geographically isolated from the rest of Maryland; therefore, their materials are sent to different facilities compared to the rest of the state. Single stream materials collected in the Upper and Lower Eastern Shore Regions are sent to Republic's Delaware MRF. Multi-stream materials collected in the Lower Eastern Shore are sent to Wicomico's MRF or Eagle Recycling (paper only). MRFs tend to be located in central Maryland near larger population centers.

Tipping fees at MRFs range from less than $25 per ton in Montgomery, Baltimore, and Harford Counties to more than $100 per ton in Carroll, Howard, St. Mary's, and Cecil Counties.

5.1.2 Existing Recycling Capacity

Based on the most recently available data, existing MRFs currently process approximately 439,000 tons per year (TPY) of material, as shown in **Table 19**. If existing MRFs operated at their maximum design capacity, an additional 71,400 TPY could be processed.

Facilities reported that they do not operate at maximum capacity for the following reasons:

- Operating a single shift

- Contamination slows down sorting operations

- Additional feedstock needed

- Lacking modernized equipment

Table 19: In-State MRF Current and Maximum Throughput by Region (2024)[1]

Region	Current Throughput (tons/year)	Current Capacity (tons/year)
Western Maryland	18,400	30,400
Washington Metro[2]	126,800	147,000
Baltimore Metro[2]	288,300	327,500
Southern Maryland	0	0
Upper Eastern Shore	2,550	2,550
Lower Eastern Shore[2]	2,500	2,500
Total	**438,550**	**509,950**

[1] Current throughput and maximum throughput does not include planned facilities.

[2] Does not include all facilities due to survey non-response.

5.1.3 Potential Recycling Capacity

Based on survey data, nearly all in-state single stream and dual stream MRFs require equipment upgrades and modernization. Some are using equipment from vendors that are no longer in business, causing additional downtime due to limited supplies for equipment repairs.

Many of the State's MRFs were built more than 15 years ago, often for a dual-stream feedstock. Those systems have since been retrofitted by adding front-end screens, which allow for a single-stream processing line. Most of the facilities have been modified multiple times over the years by adding modern equipment to upgrade processing capabilities. Each of the MRFs that responded to the survey indicated that they may upgrade and/or replace equipment in the next three (3) years and add an additional processing line. Two (2) facilities are renovating their operations. Upgrades to MRF operations can include screens, optical sorters, robotics and artificial intelligence (AI), magnets, eddy current separators, balers, conveyors, fire protection systems, and other fixed and mobile equipment. These systems allow MRFs to operate more efficiently, process larger quantities of materials, sort materials more effectively, and potentially process new material types.

Based on discussions with MRF operators, MRF improvement recommendations were identified for single stream and dual stream facilities. Costs were estimated for the recommended MRF improvements and aggregated into regional costs, as shown in **Table 20** below. Estimated costs vary by equipment type and may require additional capital to support the reconfiguration of existing equipment and integration with controls.

Table 20: Estimated MRF Expansion Opportunities and Cost Estimate (2024)

Region	Current Material Processed (tons/year)	Projected Total Capacity (tons/year)	Estimated Cost Range
Western Maryland	18,400	30,400	$3.3M - $3.8M
Washington Metro	126,800	206,000	$2.1M - $2.5M
Baltimore Metro	288,300	387,250	$3.8M - $3.9M
Southern Maryland	0	0	N/A
Upper Eastern Shore	2,550	2,500	$0
Lower Eastern Shore	2,500	2,550	$0
Total	**438,550**	**628,700**	**$9.2M - $10.3M**

Note: the estimated cost ranges reflect future investments identified at existing MRFs in the state. Costs do not account for existing approved capital investments, design, construction, or procurement costs. Costs for projects that would expand the footprint or building size of existing MRFs were not considered, as the scope and timeline did not allow for site-visits required to provide independent cost estimates.

Potential upgrades to existing single-stream and dual-stream MRFs are anticipated to add approximately 190,150 TPY of recycling capacity and cost $9.2M to $10.3M. These figures do not include committed dollars to ongoing MRF capital improvements. Further discussion about the impact of ongoing capital improvements on a future EPR for packaging system are provided in Section 11.4.

Push and bale MRFs were not included in the cost estimates above, but these facilities could potentially be upgraded to promote efficiency of material flows across the State. Upgrades such as magnets or eddy current separators can reduce material loss and improve the quality of sorted materials, increasing material recovery rates.

In addition to MRF capital costs to expand capacity, two new MRFs are planned for construction in the state. The total investment costs for those facilities could be between $77-87 million.

5.2 Transfer Stations

Transfer infrastructure is essential to expanding recycling services in Maryland. Transfer stations considered in the Needs Assessment are facilities that accept recyclable materials and/or trash, consolidate the material for shipment, and transfer it for further processing or disposal. Loads can be transferred loose, compacted, or baled. **Processing recyclables at transfer stations in and out of the State presents an opportunity to provide logistical support to efficiently connect recyclables to key end markets.**

Transfer stations are located throughout the state, but are highly concentrated in the Washington Metro, Baltimore Metro, and Southern Maryland regions, as shown in **Figure 20**.

Figure 20: Transfer Stations in Maryland (2024)

Transfer Station Facilities

Materials Accepted
- ● Recyclables & MSW
- ▲ MSW & Other Materials

Map #	Facility Name
1	Mountainview Landfill
2	WM – Western Maryland Waste Systems
3	Penn-Mar Recycling
4	Western Maryland Waste Systems, LLC
5	Site B Solid Waste Processing Facility & Transfer Station
6	Montgomery County Solid Waste Transfer Station
7	Tri-County Recyclable Depot PF&TS
8	Fort Totten Transfer Station
9	Northeast Transfer Station
10	Recycle One Processing Facility & Transfer Station
11	Sheriff Rd Processing & Transfer Station
12	Northern (Carroll County) Landfill Transfer Station
13	Finksburg Transfer Station
14	Central Acceptance Facility
15	Eastern MSW Landfill Facility
16	Auston Processing Facility & Transfer Station
17	Alpha Ridge Processing Facility & Transfer Station
18	Northwest Transfer Station

Map #	Facility Name
19	Baltimore Recycling Center
20	World Recycling Processing Facility & Transfer Station
21	Western Acceptance Facility
22	WM - Curtis Creek Transfer Station
23	Baltimore Processing Center
24	Ameriwaste Processing Facility & Transfer Station
25	WM - Annapolis Junction Recycling & Transfer Station
26	Millersville Municipal Landfill
27	Northern Processing & Transfer Station
28	Charles County Landfill
29	Tri-County Recycling
30	Calvert County Transfer Station (Appeal Landfill)

Map #	Facility Name
31	Saint Andrews Waste Processing and Transfer Station
32	Woodlawn Transfer Station
33	Cecil County Landfill
34	Stemmer's Run Transfer Station
35	Midshore I Regional Solid Waste Facility
36	Foskey Lane Transfer Station
37	Connelly Mill Processing Facility & Transfer Station
38	Bennett Processing Facility
39	Ocean City Transfer Station
40	Worcester County Central Landfill
41	Farmington Transfer Station
42	Milford Transfer Station

There are forty-two (42) transfer stations that accept recyclables generated in the State. Thirty-eight (38) of the transfer stations are located in Maryland, and the other four are located in Washington DC and Delaware. Of those, twenty-two (22) accept recyclables, as shown in **Figure 20**.

Transfer stations can be upgraded to accept increased quantities of recyclable materials by adding equipment (e.g., balers, compactor, etc.), increasing tipping floor space, adding bale storage, and/or increasing the number of bays for recyclables to be loaded into transfer stations. These upgrades could allow existing trash-only transfer stations to upgrade to allow recyclables, or they could allow transfer stations that currently accept recyclables to increase their capacity for recyclables. The cost for equipment upgrades for a single transfer station is included in **Table 21** below. Contingency, permitting, design, and construction administration costs are not included in the cost estimates, but would need to be included in an expansion. Due to space constraints, not all transfer stations in the State would be able to expand to accept larger quantities or additional material types.

Table 21: Transfer Station Capital Upgrade and Equipment Cost Estimate (Per Transfer Station)

Equipment	Estimated Cost
Baler[1]	$1.1M
Forklift	$60,000
Compactor[2]	$2.1M

[1] Represents large baler that could manage one or more types of recyclable materials

[2] Represents compacting loader used to pack recyclables into transfer trailers

5.3 Organics Processing

5.3.1 Organics Facility Overview

There are twenty-five (25) organics recycling facilities in Maryland, including composting and anaerobic digestion (AD) facilities, as shown in **Figure 21**.

Compost facilities are permitted into two tiers:

- Tier I Compost Facility: Facility that accepts Type I feedstock, i.e., yard waste. Yard waste is organic plant waste derived from gardening, landscaping, and tree trimming activities and includes leaves, garden waste, and lawn cuttings.

- Tier II Compost Facility: Facility that accepts Type II feedstock, i.e., a) source-separated organics; b) department-approved animal manure and bedding; c) department-approved industrially produced food processing materials, including industrial poultry and seafood residuals; d) animal mortalities; e) manufactured organic materials such as waxed-corrugated cardboard, non-coated paper, and compostable products; and f) other department-approved materials.

> **Anaerobic Digestion and Composting**
> Anaerobic digestion breaks down food in the absence of oxygen in a sealed container and produces gases that can be captured for energy.
>
> Composting is a process that uses heat and oxygen to break down organic waste into a nutrient-rich product (compost) that can be used as a soil amendment.

Figure 21: Organics Processing Facilities in Maryland (2024)

Map #	Facility Name
1	40 West Landfill
2	Key City
3	Frederick County
4	Montgomery County
5	ACME Biomass
6	Aspen Nursery
7	Compost Crew at Wasche Farm
8	City of College Park
9	Prince George's Facility
10	Harford Waste Disposal Center
11	Veteran Compost - Aberdeen
12	Eastern Sanitary Landfill
13	WeCare Denali

Map #	Facility Name
14	Level Land Lisbon Mulch Yard
15	Alpha Ridge Landfill
16	Charm City
17	Bioenergy Devco
18	Millersville Landfill
19	Tolson & Associates
20	Veteran Compost - Lothian
21	Calvert Wood Recycling
22	West Coast Mushrooms
23	Cecil County Central Landfill
24	Twin Maples
25	Ocean Compost

5.3.2 Existing Organics Processing Capacity

Based on facility capacity data provided by MDE as of June 2024, there are approximately 978,600 tons of processing capacity between Tier I and Tier II organics processing facilities in Maryland. There are nearly 800,000 tons of processing capacity across Tier II and anaerobic digestion facilities. Organics processing capacity by region is shown in **Table 22** below.

Table 22: Organics Processing Capacity by Region

Region	Maximum Capacity	Maximum Tier II Capacity	Number of Facilities that Accept Compostable Packaging
Western Maryland	5,000	N/A	0
Washington Metro	236,850	134,000	1
Baltimore Metro	671,250	605,500	4
Southern Maryland	5,000	N/A	0
Upper Eastern Shore	60,000	60,000	0
Lower Eastern Shore	5,000	500	0

Region	Maximum Capacity	Maximum Tier II Capacity	Number of Facilities that Accept Compostable Packaging
Total	978,600	799,500	5

Tier II compost facilities are most relevant to this Needs Assessment, as they are permitted to accept compostable packaging products. Compostable packaging products can include compostable plastics that are certified by an outside entity, paper yard waste bags, and other packaging types. However, not all facilities that are able to accept compostable packaging based on their Tier II permit status elect to accept these materials. Based on survey responses, at least five (5) organics processing facilities currently accept compostable packaging, and at least two (2) survey respondents stated that they plan to or would be interested in accepting compostable packaging in the future.

5.3.3 Potential Organics Processing Capacity

Based on survey information received from a representative sample of organics facility operators, potential facility upgrades, and associated cost estimates are provided **Table 23** below. The table summarizes the estimated capital costs considered for improving an individual existing Tier II composting facility in Maryland. These estimates are for capital upgrades that are required to safely and efficiently process food waste and compostable packaging. Estimates do not include ongoing operations and maintenance, engineering services, contingency, inflationary costs, or costs for equipment operators, as staffing costs will vary by Region.

As shown in the table below, the total cost to improve equipment and infrastructure for a single organics facility may range from approximately $1.8M to $25.5M depending on facility size.

Table 23: Estimated Compost Facility Improvement Costs per Facility

Equipment / Infrastructure	Estimated Costs by Facility Size		
	Small (up to 2,500 TPY)	Medium (up to 50K TPY)	Large (>50K TPY)
Contamination Screen	$200,000	$750,000	$750,000
Grinder	$500,000	$1,500,000	$1,500,000
Manual Sort Line	N/A	N/A	$4,000,000
Optical sorting[1]	N/A	N/A	$1,000,000
Litter fencing	$25,000	$25,000	$35,000
Lined detention pond	$800,000	$800,000	$2,000,000
Water Truck or Storage Tank[2]	$250,000	$250,000	$250,000
New Building[3]	N/A	N/A	$3,000-$18,000
Total	**$1,775,000**	**$3,325,000**	**$25,535,000**

Cost includes both an optical sorter and its sort line. Likely already on site. Ranging from 10,000 – 60,000 square feet.

5.4 New Facility Development

Development of new recycling processing infrastructure supports the long-term sustainability and efficiency of the State's future recycling system. If potential EPR legislation results in additional recycling tonnages collected, the demand for effective processing solutions is expected to increase across the State. This will likely require expanded capacity to receive, process, and market additional packaging materials.

The following facilities are currently planned in the State:

- New WM Single Stream MRF: A new WM recycling facility is being developed to replace the aging Elkridge MRF. The $50-$60 million project is anticipated to have a planned capacity of 50 tons per hour (TPH) based on discussions with WM representatives. The new facility will feature advanced automation, reducing staffing needs by 40-60% while creating higher-paying roles for maintenance and technical staff. The facility will alleviate space constraints on the tipping floor and storage areas, which were challenges at the Elkridge site. Improved equipment and layout are expected to reduce residue rates, enhance operational efficiency, and minimize disposal costs.

- Montgomery County MRF Planned Upgrades: Montgomery County's dual-stream MRF is being upgraded to address current issues with overcapacity. These capital improvements are expected to total $27.5 million over the next five years. [16] While the overall site footprint cannot be increased, the upgrades will maximize throughput by reconfiguring the space and upgrading equipment. The facility is anticipated to process 25 TPH and will have a commingled container line with optical sorters and robotics.

- Baltimore County MRF Planned Upgrades: The Baltimore County MRF has a design capacity of 35 TPH. However, the facility's processing capacity often exceeds its storage capacity, leading to challenges in managing bale and tip floor storage, especially during disruptions such as port labor strikes or unplanned downtime. Contamination frequently causes mechanical issues, including system stoppages, and the facility has experienced fire hazards due to improperly disposed batteries. Additionally, the software for aging equipment has become increasingly difficult to maintain, compounding downtime and inefficiencies. To address these challenges, a comprehensive study is underway to evaluate options for improving the system,

> **New Facility Development**
> Developing new recycling facilities to support the needs of the State's future recycling program is important, but needs to be considered through an equity lens. Construction activity increased heavy vehicle traffic, and air emissions may disproportionately impact EJ sensitive communities.

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[16] Montgomery County, Maryland. 2024. Full Upgrade of Existing Recycling Center Complex. P802201.pdf

infrastructure, and revenue modeling. The County is considering a full system review to determine the next steps, including potential facility upgrades or redesigns.

As additional facilities are planned, the following should be considered:

- Proximity to freight rail lines is a critical factor for future recycling facility siting. Areas like the City of Baltimore and Washington County (in the Western Maryland Region) demonstrate strong alignment between rail connectivity and redevelopment potential. These Regions are well-positioned for recycling and material recovery facilities, leveraging existing transportation infrastructure to streamline logistics and reduce operational costs.

- Eco parks and business reuse initiatives offer opportunities for economic and environmental improvements. Brownfields along the I-95 corridor present ideal locations for eco parks that support recycling, reuse, and remanufacturing businesses. Replicating models like Baltimore's Camp Small and Second Chance could expand small business opportunities, foster collaboration, and boost recycling capacity while driving innovation and job creation across Maryland.

- PFAs and brownfield redevelopment align with strategic growth planning. City of Baltimore, Montgomery County, and Washington County lead the State in the number of brownfields within PFAs, highlighting strong alignment with state growth priorities. These areas provide significant potential for future recycling infrastructure development, while counties with lower PFA brownfield percentages, like Queen Anne's present fewer opportunities for integrated siting of facilities and may be best suited for hub and spoke collection systems.

5.5 Reuse and Waste Reduction

There are a wide variety of reuse and refill solutions available to businesses and consumers. The Project Team focused on the common reuse and refill categories, descriptions, and definitions identified in the *Global Landscape Analysis of Reuse and Refill Solutions*.[17]

Reuse and refill systems can be categorized into the following models (see Figure 22).[18] These include the following:

- **Refill at home:** users refill their reusable containers at home (e.g. refills delivered through a subscription service)

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[17] Moss E, Gerken K, Youngblood K and Jambeck JR (2022) Global landscape analysis of reuse and refill solutions. *Front. Sustain*.3:1006702 doi: 10.3389/frsus.2022.1006702

[18] Ellen MacArthur Foundation. Reuse Rethinking Packaging: https://www.ellenmacarthurfoundation.org/reuse-rethinking-packaging

- **Refill on the go:** users refill their reusable containers at retail locations (e.g. at an in-store dispensing system)
- **Return from home:** packaging is picked up from home by a pick-up service
- **Return on the go:** users return the packaging at a store or drop off point (e.g. in a deposit return machine)

Figure 22: Overview of Reuse and Refill Models

5.5.1 Overview of Existing Reuse and Refill Infrastructure

Based on a review of the Maryland Recycles Directory, **nearly 300 reuse companies and organizations operate within the state. Approximately 19% of those organizations accept packaging-related materials.**

Table 23 provides a breakdown of the estimated number of reuse programs in Maryland, including an estimated total of package-free shops, reusable cup and container programs, pre-filled refill systems, and any other reuse program types based on a combination of desktop research and survey results.

- Package-Free Shops: These businesses typically sell foods, beverages, household cleaning supplies, and personal care products in bulk, along with other low-waste

goods. Customers use reusable or refillable containers to collect the items. Package-free shops are concentrated in the Washington Metro and Baltimore Metro regions.

- Reusable Cup and Container Programs: These businesses provide customers with specially designed, durable cups and containers that can be used multiple times instead of single-use disposable options. The businesses or organizations often maintain a system to return and clean the reusable cups or containers. These systems are used on university campuses and at indoor/outdoor concert halls.

- Pre-Fill and Refill Systems: In pre-fill systems, products are sold in reusable or returnable packaging that is pre-filled by the manufacturer or distributer. Consumers return the empty containers to designated collection points, where they are cleaned, sanitized, and refilled for future use. Re-fill systems, on the other hand, allow customers to bring their containers to retail locations or refilling stations to purchase products such as household cleaners, personal care items, or bulk foods. In Maryland, businesses with pre-filled and refill systems are primarily concentrated in urban areas, including the City of Baltimore, Montgomery County, and parts of Anne Arundel and Howard counties.

- Other Programs: There are a variety of reuse programs operating in Maryland that do not fall into the categories listed above, such as donation and reuse centers on university campuses, university furniture resale programs, food donation programs, book donation programs, medical equipment and high-tech assistive technology re-use programs, and reuse programs for building and landscaping materials.

Table 24: Maryland Reuse and Refill Solutions by Category

Reuse and Refill Categories	Number Solutions Identified
Package-free shops	49
Reusable cup & container programs	13
Pre-filled refill systems	58
Other Program Types	10

5.5.2 Challenges with Reuse and Refill Programs

Reuse and refill solutions can be challenging to implement and scale up due to the following factors:

- While switching to durable products (e.g., plates) in closed environments (e.g., on-site dining for restaurants) typically requires relatively small capital investment with a payback period of less than a year,[19,20] reuse programs in open systems (e.g., to-go

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[19] Upstream. "Reuse wins: top findings show reuse beats single-use every time." Accessed November 13, 2024. https://upstreamsolutions.org/reuse-wins-report.

[20] Clean Water Action. Rethink Disposable Case Studies." Accessed November 13, 2024. https://cleanwater.org/author/rethink-disposable-case-studies.

containers, refillable beer bottles) have a hard time achieving cost-parity with single-use until they achieve full-scale operations.

- Investors may hesitate to invest in reuse and refill programs. The market is often still considered unproven in the United States, as there are limited large-scale demonstrations of return on investment and proof of consumer demand.

- Shifting to reuse and refill will in most cases require new infrastructure for collection (e.g., new bins or reverse-vending machines) and reconditioning (e.g., industrial-scale washing equipment).

- Bringing reusable or refillable containers back to a retail location from home is an inconvenience that can stifle adoption of reuse.

- Geographic challenges to reuse include factors such as sparse populations in some parts of the State, lack of infrastructure for collection and processing reusable materials, long distances to potential reuse facilities, varied local regulations based on a diverse geography throughout the State, environmental conditions impacting material durability, and limited access to markets for reused goods in certain regions.

- Policy challenges related to reuse include lack of supportive regulations and incentives, inadequate infrastructure for collection and cleaning of reusable items, concerns about hygiene and safety, and difficulties in establishing standards for reused products.

5.5.3 Opportunities for Reuse and Refill

While there are challenges associated with expanding reuse and refill infrastructure statewide, there are opportunities to increase access to these programs, including the following:

- **Maryland has a diverse range of reuse programs at its colleges, universities, and state agencies, which present opportunities for expanding sustainable practices across the State.**

- Statewide initiatives offer significant opportunities for environmental and community impact.

- Several reusable cup and container services are expanding to multiple cities and states, such as r.World, Bold Reuse, Deliver Zero, Re:Dish, and others.

- Large corporations, such as Walmart and Starbucks, have piloted reusable cup programs. If pilot projects are successful, these corporations may expand reuse infrastructure across the U.S. and potentially into the State.

- Federal and state policies, such as EPR, can support reuse and refill infrastructure.

- Local policies can support reuse and refill infrastructure. For example, in California, there are multiple municipalities with ordinances that require reusables for on-site dining. Public agencies can also use grants to promote reusable systems.
- Non-profit organizations have organized and fostered grassroots support for reuse in cities across the country.

6 Worker Conditions, Wages, and Benefits

6.1 Worker Conditions

The solid waste and recycling industry can have dangerous and demanding jobs, creating difficult workers conditions. These critical workers are necessary to collect material, operate equipment, complete physically challenging tasks, manually extract and move material, and risk exposure to potentially hazardous materials. The solid waste industry has historically been a dangerous industry and continues to be identified as such nationally. Recent Bureau of Labor Statistics (BLS) data indicates that waste and recycling collection was the fourth deadliest occupation in 2023, with 41.4 fatalities per 100,000 employees.[21] Workforce development and retention in this industry are impacted by safety concerns, worker conditions, wages, and benefits. Within the solid waste industry, competing roles in public and private sector jobs create competition for key workers.

Heat Related Illness
A City of Baltimore employee died from heat stress on the job in August 2024, with temperatures over 100 degrees and no water available. As a result of this incident, the community and workers demanded better working conditions. The results included improved procedures related to heat illness, training, and creating an environment that supports safety. Baltimore City's Administrator has created a statewide Heat Illness Protection Plan intended to be implemented by the summer of 2025.

Current events specific to the State have highlighted the severity of safety concerns, including facility fires, labor strikes, extreme weather, and overall unsafe working conditions. While there are concerns, both recently and historically within the State, there are opportunities to improve worker conditions and make improvements to benefit current workers and incentivize safe working practices with new workers within the industry.

6.1.1 Curbside Collection Conditions

Curbside collection workers' conditions can vary greatly depending on the type of vehicle used and the customers serviced, including difficult alley collection and diverse weather and road conditions. In 2023, the solid waste collection injury rate among workers was 4.3 cases per 100 Full Time Equivalent (FTE) employees, and 24 of the 35 fatalities in 2023 were attributed to transportation incidents.[22]

Manual collection vehicles typically require two staff, with one driving the vehicle and the other manually moving collection containers to the truck for emptying. Manual collection

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[21] U.S. Bureau of Labor Statistics. Graphics for Economic News Release. Civilian occupations with high fatal work injury rates

[22] Waste Dive. 2023. Injury rates for waste industry workers fell in 2023, but illnesses rose. Injury rates for waste industry workers fell in 2023

is physically straining and potentially dangerous, with workers operating outside of the collection vehicle and with a higher risk of pinching or crushing injuries to workers.

Automated collection utilizes technology by way of an arm to grab and empty collection containers, eliminating the need for workers to be outside the vehicles and exposed to potential dangers. Most new collection programs utilize automated collection due to the increased efficiencies, improved safety, and reduced labor costs.

Other technologies can improve curbside collection safety such as cameras inside and outside of trucks to identify safety concerns or problem materials, and other technology to track collection and improve efficiencies.

6.1.2 Facility Conditions

Worker Strikes

Recent strikes have occurred for curbside collection workers in Maryland, most recently in Anne Arundel County. Workers reported low wages, safety concerns, and lack of PPE as reasons for the strike. Meeting the needs of the labor force that allow recycling programs to thrive is critical to improving future program performance, particularly in EJ sensitive communities.

Solid waste facilities include drop-off stations, recycling processing MRFs, organics processing, transfer stations, and landfills. **These facilities require workers to deal with potentially hazardous or dangerous materials, move or manage waste materials, and operate machinery to process materials. Facilities conditions can be dangers and require physically strenuous tasks for workers.**

Older facilities, particularly MRFs, can lack automated processes that require additional labor to perform dangerous or difficult tasks such as moving materials or hand-picking materials. The ergonomics of sort lines are not favorable and can be physically demanding on workers. With the addition of robotics and artificial intelligence, there is an opportunity to improve worker conditions and advance workers from more manual jobs to those requiring more skills. High contamination rates in recycling across the State also result in less favorable working conditions as staff are required to hand sort materials, unclog machinery due to recycling contamination, or remove tanglers that clog or damage machinery.

Specific materials at facilities also result in additional worker concerns, particularly with the rise of batteries in the waste stream and resulting facility fires.

Contamination, at MRFs and organics processing facilities particularly, can cause hazardous working conditions particularly if workers are required to manually remove contaminants. In such scenarios, they may be exposed to abrasive materials, puncture hazards, and heat hazards (at organics facilities).

Prolonged operation of equipment such as compactors and front-end loaders at facilities can cause lumbar injuries and overuse injuries over time. Vehicle operators at landfills manage materials on uneven working surfaces, which cause movement in the cab of front-end loaders and compactors. Repetitive motions can lead to long-term injuries at other facilities such as transfer stations or MRFs.

6.2 Labor Considerations

The solid waste industry relies on labor to manage operations and complete strenuous tasks as previously detailed. **Table 25** compares the average wage of trash and recycling workers in the State and nationally.

6.2.1 Salary, Wages, and Benefits

Table 25: Average Wages for Waste Workers (National and Maryland Specific)

Occupation	Maryland Annual Average Wage	National Annual Average Wage	Percentage Differences
Vehicle Operators	$54,688	$56,348	-3.0%
Sorters	$30,847	$30,776	0.2%
Mechanics, Technicians, and Machinery Maintenance Workers	$52,404	$52,283	0.2%
Facility Managers	$82,149	$84,642	-3.0%
Route Managers	$57,505	$69,265	-20.5%
Sales Representatives	$76,024	$75,848	0.2%

Annual average salary information was retrieved from Maryland-specific and national annual averages on Ziprecruiter.com

The national average for annual wages exceeds the same position in the State for vehicle operators, facility managers, and route managers as shown in **Table 25**. The average annual salary in the Washington metro and Baltimore metro regions is significantly higher (e.g., more than double in some cases) than salaries in the Western Maryland, Upper Eastern Shore, and Lower Maryland regions. This may be due to the higher population density and higher cost of living in the Washington and Baltimore Metro areas, requiring that solid waste and recycling managers and coordinators have more people and equipment to manage.

Table 26: Average Annual Salary by Region

Region	Solid Waste and Recycling Manager	Recycling Coordinator
Western Maryland	$75,585	$47,415
Washington Metro	$173.325	$114,180
Baltimore Metro	$146,455	$101,920
Southern Maryland	$88,212	$80,740
Upper Eastern Shore	$91,350	Not Available
Lower Eastern Shore	$69,800	$53,600

This data focuses on manager roles only, as they are more typically salaried positions compared to other positions such as drivers or equipment operators.

Benefits for recycling employees include employer sponsored non-cash compensation such as healthcare, retirement savings plans, and other insurance policies. **While many**

public entities and private waste management companies offer similar benefits for their employees, the value and types of these benefits can range widely.

Public sector employees often enjoy pension plans that historically provided a key incentive for retention, as they are fully funded by employers. Recently, there has been a trend where employers are turning to 401K style plans, which shifts the burden of funding retirement accounts to the employee with a potential match by the employer.

6.2.2 Unions

Unions are common in the solid waste industry and represent workers' collective interest, allowing groups of workers to negotiate wages, benefits, and working conditions.

While specific data comparing union and non-union wages for solid waste and recycling workers in the State is not publicly available, unionized positions generally offer higher wages and more competitive benefits due to Collective Bargaining Agreements (CBAs). These unions have established CBAs with both public and private employers in Maryland's solid waste and recycling industries, ensuring that workers receive fair compensation and benefits. **Table 27** summarizes the unions representing solid waste and recycling workers in the State.

There are strong potential opportunities for expanding family-supporting, union careers in EPR for packaging within the hauling, processing, and manufacturing sectors. More investigation and collaboration with unions and adjacent workforce development partners in the sector are needed to maximize long-term benefits. Union stakeholders' voices will be crucial in the development of regulations as well as the EPR plan submitted to the state by the Producer Responsibility Organization.

Table 27: Summary of Unions Representing Solid Waste and Recycling Workers in the State

Union	Local Chapter	Location	Number of Members
International Brotherhood of Teamsters	No 992	10312 Remington Drive, Hagerstown, MD 21740	1,267
	No 570	6910 Eastern Ave, Baltimore, MD 21224	3,203
	No 355	1030 S Dukeland St, Baltimore, MD 21223	6,572
American Federation of State, County and Municipal Employees (AFSCME)	Maryland Council #3	1410 Bush Street, Suite A Baltimore, MD 21230	Unknown, it represents nearly 45,000 members.
	Local #44		Not Publicly Disclosed, Part of the broader council #3

Laborers International Union of North America (LIUNA)	Local # 572	Camp Springs, MD	2,814
	Local # 616	Cresaptown, MD	294
	Local # 710	3200 Wilkens Avenue Baltimore, MD 21229	663

This list provides a snapshot of information on unions in the State based on data summarized from Unionfacts.com

6.2.3 Incarcerated and Formerly Incarcerated Labor

Incarcerated individuals (laborers that are currently in jail or prison) and formerly incarcerated individuals (laborers that have previously been in jail or prison) are key elements of the solid waste and recycling labor pool and these individuals support many aspects of the industry. The State's efforts aim to build valuable skillsets in individuals and support workforce development, while also reducing recidivism. The Maryland Department of Public Safety (DPS) and Correctional Services has a Rehabilitation Work Release program that enables inmates to work for a private employer in the community. **Table 28** shows the participating institutions in the DPS work release program.

Table 28: Participating Institutions in DPS Work Release

Institution	Providing Employment Opportunities In:
Baltimore Pre-Release Unit 926 Greenmount Avenue Baltimore, Maryland 21202 410-234-1878	Baltimore City, Baltimore, Harford, Lower part of Carroll and Upper part of Anne Arundel Counties Public transportation within 2 hours transporting time.
Baltimore Pre-Release Unit for Women 301 N. Calverton Road Baltimore, Maryland 21223 410-223-2260	Baltimore City, Anne Arundel, Baltimore, Frederick, Carroll, Howard, and parts of Prince George's Counties Public transportation within 60 miles of facility.
Eastern Pre-Release Unit 700 Flat Iron Square Road Church Hill, Maryland 21623 410-810-5400	Caroline, Kent, Queen Anne's and Talbot Counties Operations - Corrections Transportation.
Jessup Pre-Release Unit 2000 Toulson Road Jessup, Maryland 20794 410-540-2700	Anne Arundel, Howard and Prince George's Counties Operations - Corrections Transportation
Maryland Correctional Training Center Harold E. Donnell Building 18800 Roxbury Road Hagerstown, Maryland 21746 240-420-1601	Washington County Operations - Corrections Transportation
Poplar Hill Pre-Release Unit 24090 Nanticoke Road Quantico, Maryland 21856 410-845-4580	Wicomico, Worcester, Somerset and lower part of Dorchester Counties Operations - Corrections Transportation
Southern Maryland Pre-Release Unit 14320 Oakes Road Charlotte Hall, Maryland 20622 301-274-4701	Prince George's, Calvert, Charles and St. Mary's Counties Operations - Corrections Transportation

In 2014 the State utilized prison labor to dismantle and recycle the vacant Maryland Correction Housing in Jessup, Maryland. This process was described as a cost-effective strategy, a process that provided job and skills training for incarcerated individuals, and allowed for increased ability to recycle materials, making the project more environmentally friendly.[23]

There are numerous State, regional, union, and national programs related to helping inmates and returning citizens secure jobs that include positions in the solid waste and recycling industry. More details can be found in **Appendix D: Workers Conditions, Wages, and Benefits Technical Memorandum**.

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[23] Becky Lewis. April 2018. Inmates Dismantle a Prison – With Administrative Approval. Inmates Dismantle a Prison - With Administration Approval | Office of Justice Programs

6.2.4 Recruitment & Retention

Nationally, there is a desire to increase recruitment and retention in the solid waste and recycling industry. **Despite higher demand for solid waste and recycling jobs, the industry has ongoing challenges with recruitment and retention due to an aging workforce and competitors in other industries for the same labor pool (e.g., delivery drivers such as Amazon and FedEx).** In 2020, the COVID pandemic exacerbated the issue, and as a result, national solid waste management companies such as WM, Republic Services, Waste Connections, GFL Environmental, and Casella Waste Systems have made recruitment and retention a key priority, especially for younger potential employees entering the workforce. Providing potential employees with fair wages, benefits, safety protocols, and retention benefits can help attract workers. Other strategies to increase retention includes signing bonuses, seniority bonuses, and tenure for employees.

Economic Development Opportunities
There are opportunities to establish workforce development programs and re-entry programs to increase the labor pool for recycling systems for untrained, underemployed, or formerly incarcerated individuals. Consider how EPR program planning can provide opportunities the re-entry workforce to support the increased labor needs of the future recycling collection, processing, marketing, and end use operations. Workforce development programs present an opportunity to supplement existing labor pools in the State.

7 Opportunities for MWBE

The solid waste and recycling industry represents a sizeable portion of the economic activity in the State. **EPR has the potential to create business opportunities in the state and generate additional jobs and may incentivize and expand opportunities for the participation of Minority or Women-owned Business Enterprise (MWBE) organizations in the State.**

The State currently offers opportunities for MWBE organizations, through regulations to support MWBE in procurement. Potential EPR legislation could address systemic inequalities that have created barriers to entry and growth for MWBEs in the recycling industry and address this equity concern in the State. These inequities include historical discrimination (gender and racial), lack of generational wealth, and more. These are all societal conditions that make it difficult for women and minorities to start businesses and secure opportunities.

Minority, Women Owned, and Small Business Enterprises
MWBE is a term that may refer to businesses with controlling ownership by a minority or women. Sometimes this term includes small business, with annual revenue under a specified threshold. For the purposes of the Needs Assessment, MWBE is used to refer to one, some, or potentially all of these business types. Typically, businesses are categorized by individual classifications (e.g., cannot claim credit as more than one for any given project).

Historically, the solid waste industry has lacked diversity, particularly in high-level positions within an organization. **In recent years, major companies in the waste industry have reported increased efforts to make their operations more diverse and inclusive. The purpose of these changes is to benefit corporate culture and enhance recruitment and retention.** The Equal Employment Opportunity Commission (EEOC) estimated in 2018 that over half of the employees in the waste management remediation services category were White and over 80% were male.[24] Incorporating MWBEs within the State's solid waste system can provide additional diversity and workforce options within the industry, as well as the State.

The implementation of EPR has the potential to create additional opportunities for businesses to expand their offered services, including MWBEs already operating in the State. Existing programs and support aim to build up MWBEs within the State, but opportunities for improvement exist that could be addressed to better support MWBEs in the future.

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[24] Cole Rosengren. November 20 2024. Diversity efforts taking shape at waste industry's big companies, but serious work remains, Diversity efforts taking shape at waste industry's big companies, but serious work remains | Waste Dive

7.1 MWBE Certification

The State's policies and programs make it a beneficial environment for MWBEs and the State is often considered favorable for such businesses. **Minority-owned businesses make up 25.4% of companies in the state and over half (56.6%) of those businesses have been in business for six years or more, slightly higher than the national average**.[25] Anne Arundel County has a directory that identifies registered small businesses and minority-owned businesses. The directory includes 281 registered minority businesses in the State. Approximately 33 of these businesses are related to recycling and approximately nine (9) are related to solid waste.[26] The State's rankings for MWBEs can be found in **Figure 23**.

Figure 23: State of Maryland Rankings of MWBEs
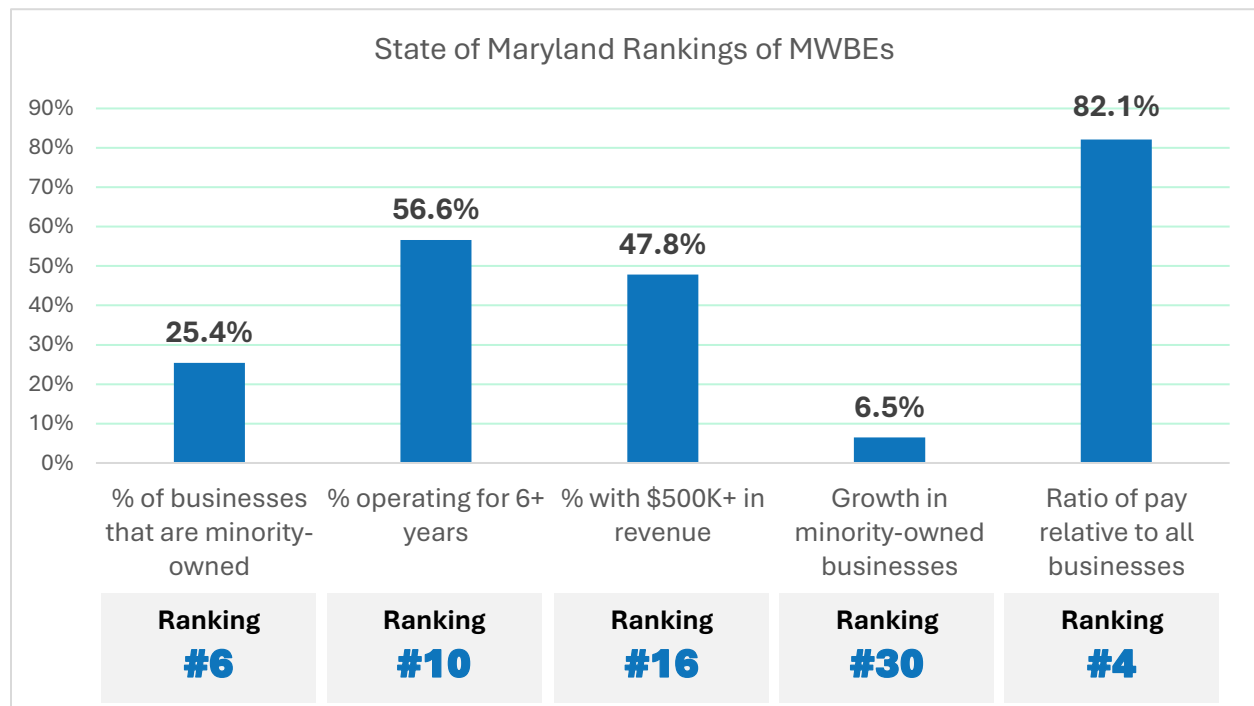
In 1978, Maryland's general assembly established the State Minority Business Enterprise (MBE) program, an MWBE Program created so that minority, women, and socially and economically disadvantaged small business owners are included in the State's procurement and contracting opportunities. It is intended to help professionals with the skills to deliver specific services to the State and participate in procurement for work in their areas of expertise. When a business seeks a MWBE certification, the owner is expected to use NAICS codes to categorize the type of work their business completes. The

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[25] Tierra Williams. October 29th, 2024. Maryland is ranked No.1 in the nation where minority-owned businesses are thriving, Maryland is ranked No.1 in the nation where minority-owned businesses are thriving - 47abc

[26] Anne Arundel County Maryland-2024- Directory of Certified Business Enterprises (CBE), Directory of Certified Business Enterprises (CBE) | Anne Arundel County Government

program can help MWBE businesses build capabilities to self-perform work with the State over time.

Businesses that wish to receive MWBE certification are required to apply via the Maryland Department of Transportation's (MDOT) website. The application includes the submittal of financial information to confirm that applicants are eligible for certification by having revenue and a personal net worth less than the maximum allowable under the program. The application also includes questions to verify that the applicant has the required training and education. This verification step is intended to prevent the business from being a "pass-through" from another business seeking to use the MWBE certification to secure work intended for a certified firm or by a non-intended party. Once an application is submitted, an officer is assigned to the case and serves as a resource for the owner through the process. A site visit is scheduled once the information is verified. Finally, the officer completes a final recommendation and submits the application for approval. This process can be seen in **Figure 24** and is further detailed in **Appendix E: Opportunities for MWBE Technical Memorandum**.

Figure 24: Steps for MWBE Certification[27]

Application
Submit an application to the Office of Minority Business Enterprise (OMBE).

Investigation
An investigator reviews documentation, conducts an on-site/jobsite visit and prepares an investigative report.

Evaluation
The Certification Review Committee evaluates whether the applicant firm meets Federal Certification program requirements.

Determination
A written determination is issued from the OMBE.

Certification
Completed all steps successfully. Now a WMBE Certified Business

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[27] Maryland Department of Transportation. 2024. DBE/ACDBE/SBE Certification Overview, *MBE_DBE_ACDBE_Certification_Overview_Updated_2.7.2024 (2).pdf*

7.2 NAICS Codes

NAICS codes provide a clear framework for MWBEs to classify their work capabilities and align their services with procurement opportunities. Once a business is certified, companies that wish to hire a certified MWBE may search for the appropriate business by NAICS code. The Project Team used the NAICS codes to identify specific businesses within the solid waste industry that are MWBE businesses. NAICS codes are used by federal statistical agencies to classify business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy. Each NAICS code also includes subcode categories that represent the types of work that businesses, including MWBEs, offer and are eligible to receive. Subcodes can be less obvious and more specific to each business entity. MWBEs can select relevant subcodes during the certification process that can lead to additional opportunities based on specific procurement needs. The five (5) primary NAICS Codes identified by the Maryland Department of Transportation as relevant businesses within the recycling and solid waste industry are shown in **Table 29**. These specific NAICS codes were determined based on their relevance to activities within the recycling and solid waste industries, such as collection, processing, and environmental consulting services, and are strategic candidates for opportunities that are generated from potential EPR programs.

Table 29: Recycling and Solid Waste Industry Primary NAICS Codes

NAICS Code	Definition
562111 Solid Waste Collection	Collection and hauling of non-hazardous solid waste. Activities include residential and commercial garbage and recycling collection, recyclable material management, and operation of non-hazardous solid waste transfer stations. This classification excludes businesses focused on hazardous waste collection.[28]
562920 Materials Recovery Facilities	Materials Recovery Facilities (MRF) operation and management. These facilities focus on separating and sorting recyclable materials—such as paper, plastics, metals, and glass—from the waste stream and marketing materials. Activities include separating commingled recyclables processing and preparing materials for recycling markets.[29]
541620 Environmental Consulting Services	Advice and assistance on environmental issues. Businesses that fall under this code typically employ a multidisciplinary staff of scientists, engineers, and other technicians. Services include conducting environmental assessments, air and water quality analysis, ecological restoration, sustainability consulting, and addressing issues like contamination, remediation, and compliance with environmental regulations.[30]
561410 Document Preparation Services	Document-related services, such as typing, word processing, proofreading, editing, transcription, resume writing, and desktop publishing. These services often support administrative, legal, and technical document needs, excluding court reporting.[31]
541910 Market Research & Public Opinion Polling	Collecting, analyzing, and presenting data on market trends and public opinion. Services include conducting surveys, analyzing consumer behavior, polling for public or political opinions, and providing insights that guide businesses, media, or policy decisions.[32]

Translation Services (NAICS codes 541930, 561410) may support education, outreach, and compliance related to recycling, but are not listed as they are not directly involved in the management of recycling and solid waste.

The State offers many resources to support MWBE businesses and encourage their participation in procurement and contracts. These initiatives are designed to enhance business's ability to access funding, navigate state procurement processes, and participate in key industries, such as recycling. These resources will continue to be key as EPR is considered and MWBEs consider new or enhanced involvement in the waste and recycling industry.

7.3 Procurement Policies

In addition to the resources provided, the State also provides procurement policies that promote equitable opportunities for small businesses, including MWBEs. While

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[28] NAICS Association-2024-562111 Solid Waste Collection NAICS Code Description

[29] NAICS Association-2024-562920 Materials Recovery Facilities NAICS Code Description

[30] NAICS Association-2024-541620 Environmental Consulting Services NAICS Code Description

[31] NAICS Association-2024-561410 Document Preparation Services NAICS Code Description

[32] NAICS Association-2024-541910 Marketing Research and Public Opinion Polling NAICS Code Description

not exclusively designed for solid waste and recycling, these policies can also apply to contracts in those sectors.

Table 30 outlines key initiatives within the State's procurement policies that set aspirational goals, reserve procurement spending, and promote the inclusion of certified small businesses. These policies demonstrate the State's commitment to fostering inclusive procurement practices across state agencies and working to incorporate equity into procurement practices.

Procurement Policies and Goals

The State has a commitment to include goals in the purchasing and procurement of goods and services to increase opportunities for MWBE businesses. As part of potential EPR for packaging legislation and program planning, the law may provide the PRO levers to support the State's commitment to providing MWBE opportunities as part of the future recycling system.

Table 30: Procurement Policies in the State of Maryland

Organization	Description
Minority Business Enterprise Program (Maryland Department of General Services) [33]	Maryland has set a 29% statewide aspirational goal for MBE participation in state procurement contracts. Each procurement agency is required to structure its procedures to award a minimum of 29% of the agency's total dollar value of all procurement contracts to certified MBEs.
Small Business Reserve (SBR) Program (Maryland office of state Procurement) [34]	The SBR Program mandates that participating agencies reserve at least 15% of their total procurement spending for small businesses, which can include MBEs and WBEs.
Procurement Review Group (PRG) (Maryland Department of General Services) [35]	The PRG evaluates each contract to determine appropriate MBE participation goals based on factors such as the type of work and the availability of certified MBEs capable of performing the work.

7.4 Commercial Driver's License

The State has several programs designed to reduce financial barriers and expand access to Commercial Driver's License (CDL) training for individuals entering the State's recycling and waste industry. These programs provide affordable, accessible, and targeted training opportunities, addressing the growing demand for qualified drivers within the industry. The State is home to community colleges and private organizations that prioritize workforce development specific to CLS. The programs emphasize inclusivity by supporting

[33] Maryland Department of General Services-2024-Business Opportunities, Business Opportunities

[34] Office of Small Minority and Business Affairs. 2024. Minority Business Enterprise (MBE) Program Minority Business Enterprise Program

[35] Maryland Office of State Procurement. 2024. Home » Maryland Procurement Manual – 9. Policies, Procedures, and Best Practices procurement.maryland.gov/maryland-procurement-manual-9-policies-procedures-and-best-practices/

underserved communities, veterans, and refugees while promoting sustainable employment pathways in the State's recycling and waste sectors. CDL-certified drivers and MWBEs intersect in industries like transportation, logistics, and waste management, where MWBEs often own businesses requiring CDL drivers for services such as freight hauling or recycling.

7.5 Challenges and Opportunities

The State's existing programs, resources, and policies aim to support and advance MWBEs across the State. Yet these organizations still face challenges in the certification process due to various requirements and other barriers. Potential EPR programs present opportunities to further support MWBEs, incentivize them to work in solid waste, and expand their impact on the State. **Table 31** provides a comparison matrix related to expanding MWBE opportunities in the recycling sector.

Table 31: MWBE Challenges and Opportunities Comparison Matrix

Criteria	Challenges and Opportunities
Access to Projects, Capital, and Funding	MWBE companies may **struggle with accessing capital** needed for growing their companies. While there are **grants available** to support sustainability-focused projects, they are **often highly competitive** and may **favor larger entities** with more resources that can prepare grant submissions. EPR for packaging has the **opportunity to support existing recognition and certification programs** aimed at increasing access to projects, capital, and funding for MWBEs and SBEs.
Partnership Opportunities	MWBEs can **struggle accessing industry networks and partnerships** that can provide opportunities and insights for business expansion. EPR for packaging could **facilitate and incentivize** opportunities with other MWBE or SBE firms, larger companies in the recycling industry, responsible end markets, or brands leading to **larger projects and more collaborative partnerships**.
Competition	MWBEs can **struggle to compete with larger firms** to win projects or **attract and retain skilled workers** to join their company that can provide more competitive compensation packages. MWBE participation requirements can create project opportunities, but can also foster an overly-competitive, rather than collaborative, business landscape. A potential EPR for packaging program could prioritize **fostering collaboration rather than competition** among the MWBE community to achieve key programmatic targets.
Certification Process	While the State has a **forward-thinking, supportive MWBE** program, there are **logistical challenges participating in multiple MWBE programs** at the State, regional, and local levels. Providing resources and information about the **importance of selecting key NAICS codes** for MWBEs that are currently operating in, or may expand into, the recycling industry can help them qualify for additional future opportunities. EPR for packaging has the opportunity to **increase initial and sustained technical support** for MWBE businesses to navigate the process among numerous NAICS codes to support the needs of the future recycling industry.
Business Growth and Expansion	MWBE businesses face **challenges justifying time and expense of exploring new business offerings** or subject matter expertise. Most MWBEs have employees with skills that can transfer into several industries but **without guidance of skills required in the recycling industry**, **MWBEs may not be aware of new opportunities.** Potential EPR for packaging legislation could establish industry- led forums that provide an opportunity for a collaborative space to share the skillsets and specific work needed by MWBEs to **meet key programmatic targets**. This type of forum could provide MWBEs the opportunity to **find partnerships, workers, and create awareness** of how they can **build capacity in the recycling industry.**

Although the certification process can take time to complete and differs by community, there is an opportunity to create centralized resources and collaboration to make the process more streamlined. Potential EPR legislation could support the process of establishing a streamlined approach to alleviate barriers for MWBEs and reduce the amount of time needed to gain certification. Centralized resources to assist applicants could increase opportunities and create efficiencies. Applicants may benefit from a training program specific to the solid waste and recycling industry to benefit business owners and encourage them to enter the field, as they may also lack relevant training or experience. Other opportunities include stronger public-private partnerships to help foster MWBE growth which is currently underutilized. The opportunities for improvement in this leading and forward-thinking existing program can help benefit MWBEs in the State.

MWBE Programs
There are existing MWBE programs that aim to include women-owned and disadvantaged small businesses. Streamlining the certification process would allow MWBE businesses to be brought on more quickly, minimize barriers to entry, and build in flexibility to adjust categories of certification as business grow and build capabilities over time.

8 Economic Opportunities and End Markets

Recyclable materials represent economic and environmental value that are partially lost because of the portion of these materials that are disposed of in landfills. The materials represent an economic opportunity to generate revenue through recycling markets, support recycling systems, and provide resources to create additional materials. Recycling materials can create jobs, and support local end markets. Recycling markets divert waste from landfills and lower demand for virgin materials, which benefits the environment both locally and regionally. The availability of responsible end markets drives demand for the use of recycled materials and supports investment in recycling programs, facilities, and infrastructure. Strong end markets benefit local economies, support local jobs, and reduce negative environmental impacts.

Increasing the capture of recyclables in the State depends heavily on the local and regional end markets, which drive demand for packaging materials covered by potential EPR legislation. There are ongoing efforts to support end markets and minimizing barriers to recycling can support the State's ability to realize the economic value of these materials.

8.1 Recycling Market Development

The State's existing Recycling Market Development law requires the Office of Recycling within the Maryland Department of the Environment (MDE) to promote development of markets for recycled materials and products in the State, which was passed in 2021.[36]

8.2 Lost Revenue and Value of Recyclables

Significant value is lost through the disposal of recyclable materials in landfills, representing both economic and environmental opportunities for improvement with an EPR for packaging program. **Table 32** shows the estimated tons of recyclable materials disposed in landfills in the State in 2022 from both the residential and commercial sector.

Table 32: Estimated Annual Tons of Recyclables Disposed in the State in 2022

Material Type	Residential	Commercial
Glass	67,000	35,000
Metal	50,000	34,000
Rigid Plastic	122,000	113,000
Flexible Plastic	147,000	269,000
Paper	238,000	246,000
Cardboard	155,000	331,000
Total	**779,000**	**1,028,000**

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[36] Maryland Department of Environment. 2021. Recycling Market Development Law. Laws - Statute Text

The Project Team estimated the value of recycling disposed of through surveys to MRFs regarding material specific revenues sourced from in-state MRFs and additional data figures from recyclingmarkets.net. In addition to the averages provided, the Project Team used high and low values from the same data sources to develop a sensitivity of the total value for material disposed in the State. **Table 33** shows the estimated value of recyclables disposed in the State.

Table 33: Annual Value of Total Recyclable Materials Disposed (2022) in $ Million

Material Type	Low	Average	High
Glass	$0.0	$1.4	$2.8
Metal Packaging	$56.8	$59.8	64.2
Rigid Plastic	$50.2	$53.8	$59.6
Flexible Plastic	$0.0	$0.0	$0.0
Paper	$33.7	$38.5	$46.3
Cardboard	$48.5	$57.1	$75.1
Total	**$189.1**	**$210.5**	**$248.1**

Overall, the total value of recyclables disposed annually ranges from $189.1 to $248.1 million. Metal packaging and cardboard are the materials with the most value disposed in landfills. More details, including the annual value of residential and commercial materials disposed can be found in **Appendix G: Recycling Economic Opportunities Technical Memorandum.** In both sectors, metal packaging, rigid plastic, paper, and cardboard are the most valuable materials. Paper and cardboard represent the greatest opportunities to recover volumes of recycling material currently disposed from both the residential and commercial sectors. While flexible packaging is a large volume (417,000 tons), there is limited value for flexible packaging material so the costs for separately collecting and processing the material would not be balanced by revenue generated from the sale of the materials. Limited available end markets further make this material challenging to recycle. Subsidizing the cost of collection and PCR goals would make selling this recycled material more competitive in the marketplace and create demand for that material.

8.3 Employment Opportunities

The recycling industry in the State employs approximately 5,000 people, generating $3.4 million in wages and $1.6 billion in total economic output related to primary collection and processing of recycling (e.g., not including end markets).[37] To recover the lost value of the commodities currently disposed in the State, EPR legislation would need to expand the capacity of the State's recycling system which would provide further primary, secondary, and tertiary economic benefits through additional jobs, wages, and increased revenue for existing companies.

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[37] Institute of Scrap Recycling. 2021. *U.S. Based Recycling Industry Economic Impact Study*.

Opportunities for additional or expanded employment as the result of increased recycling could include education, outreach, compliance, collections including skilled drivers and equipment operators, facility workers including pickers, mechanics, managers, and equipment operators, and end market industries such as paper mills, scrap yards, bottling plants, and more.

8.4 Barriers to Increasing Recycling

Recycling faces significant barriers linked to the location of end markets, transportation challenges, expanding access, and minimizing contamination. These factors play a key role in determining the economic feasibility of recycling programs.

8.4.1 Recycled Content Market Demand and End Markets

End markets can be both a barrier and a driver of sustainable recycling programs. The impact of end markets depends on the availability of enough quality feedstock for remanufacturing to meet recycled content standards and demand. **The demand for recycled content plays a critical role in driving the remanufacturing process and reducing barriers to recycling, by creating robust end markets for materials.** When manufacturers demand recycled materials for production, it stabilizes markets and provides a clear path for recycled materials to be used as feedstocks and creates demand. However, the volatility of recycling commodity pricing can pose challenges for end markets to consistently source recycled content, highlighting the need for stronger and more predictable market demand. EPR legislation that includes recycled content requirements for manufacturers can incentivize the use of recycled materials and create stable end markets.

When primary and secondary processors are tightly integrated, it has the potential to minimize material losses and increase compatibility with industrial specifications for recycled products. For example, close collaboration between MRFs and remanufacturers can help optimize the composition of recycled resins or fibers, reducing the need for virgin materials and decreasing economic losses of disposed recyclables.

By increasing efficiencies in recycling end markets, potential EPR legislation can stabilize pricing and drive demand for post-consumer feedstocks to manufacture packaging materials. **Appendix G: Recycling Economic Opportunities Technical Memorandum** presents high-level considerations related to end markets in the State and surrounding areas for specific material types including glass, paper, plastic, and metal.

EPR that integrates recycled content can support market demand for such materials. Many brands already incorporate recycled content in their products. Leveraging existing use of recycled content can further enhance the growth of recycling programs by ensuring that collected materials are effectively utilized and end markets are available. As manufacturers incorporate hard to recycle materials like flexible plastics into their products, they help to close gaps in the recycling supply chain.

Developing and supporting demand for recycled content of materials that currently lack established end markets would be very beneficial to reducing the volume of recyclable

packaging disposed. With strong recycled content market demand, current economic barriers for specific materials can be reduced through the demand for such items in manufacturing.

8.4.2 Location

In regions where end markets are significant distances from MRFs, the costs of transportation can outweigh the value of materials, leading to financial challenges for recycling operations. Significant distances can discourage investments in local recycling infrastructure due to these added costs. Furthermore, global market fluctuations, such as import restrictions by countries like China, can complicate the availability and stability of end markets, making it difficult to sustain recycling systems in more distant locations.

Transportation challenges also hinder recycling efforts, particularly for challenging geographies in the State where there are significant costs to ship or transport materials. In some areas, like the Baltimore Metro and Washington Metro Regions, heavy trucking corridors and rail transportation provide access to end markets. Within the State, challenges exist with roadway infrastructure, long transit distances and tolling costs, limited barging options or port infrastructure, and rising fuel costs. These challenges present an opportunity for improvements to create a more well-coordinated logistics network for the collection, sorting, and transporting of materials for processing and end markets.

8.4.3 Economies of Scale

Economies of scale are critical in recycling collection and processing because they directly influence the cost-effectiveness and sustainability of new and enhanced recycling programs. **By increasing the volume of recyclable materials processed, fixed costs such as equipment and facilities are spread over a larger quantity of output. This may also lead to investment in facilities such as automation to improve efficiencies and recovery rates.** Larger volumes of material may also benefit end market negotiations by providing large, consistent, and high-quality materials. Economies of scale are particularly challenging for more rural areas of the State, where lack of scale may undermine recycling program economic sustainability, discourage participation or new program implementation, and reduce recycling rates. Inefficient or financially unstable recycling programs risk eroding public trust in recycling, leading to decreased participation and higher contamination of materials. To result in long-term success, recycling initiatives must be carefully planned to aggregate sufficient material volumes, often through regional collaborations or partnerships. This strategic approach not only produces economic sustainability but also maximizes environmental benefits by increasing material recovery.

8.4.4 Contamination

Contaminated material, both at MRFs and composting facilities presents challenges for marketing materials for end markets and producing clean material to drive demand.

Similar to MRFs, contamination results in downtime, contaminated commodities, increased processing costs, and increased residue disposal costs, and increased workplace injuries. Materials like plastic bags and tanglers get caught in equipment screens and rotors, glass is abrasive and reduces the useful life of the equipment, batteries cause fires during handling and processing, and contamination can be unsafe for employees to handle causing puncture wounds or other injury. When commodities are contaminated, the facility ultimately pays for the cost of managing and disposing those materials.

Surveys at both facilities provide insight into current contamination levels. Varying recycling contamination levels across the State are likely due to numerous factors, including the type of collection (e.g., dual stream in Montgomery County compared to single stream in other areas) and the level of education, outreach, and compliance efforts. **Table 34** details recycling contamination by region.

Table 34: Single-Family Contamination Rates by Region

Region	County	Single-Family Contamination Rate
Western Maryland	Allegany	5%-10%
	Garrett	Less than 5%
	Washington	30%+
Washington Metro	Prince George's	21%-25%
	Frederick	5%-10%
	Montgomery	5%-10%
Baltimore Metro	Anne Arundel	5%-10%
	Baltimore	Greater than 30%
	Carroll	11%-15%
	City of Baltimore	16%-20%
	Harford	N/A
	Howard	5%-10%
Southern Maryland	Calvert	N/A
	Charles	N/A
	St. Mary's	N/A
Upper Eastern Shore	Cecil	16%-20%
	Caroline	N/A
	Kent	N/A
	Queen Anne's	N/A
	Talbot	N/A
Lower Eastern Shore	Dorchester	N/A
	Somerset	N/A
	Wicomico	N/A
	Worcester	Greater than 30%

Specific materials of concern related to recycling contamination in single-family recycling stream include: film plastic (e.g. grocery bags and garbage bags), tanglers, food waste, batteries, sharps, non-recyclable plastics (e.g., Styrofoam, thermoforms, etc.), and explosives (e.g. gas canisters) based on County surveys. This is not a comprehensive list of contaminants at MRFs in the State but is consistent with material types indicated through surveys and interviews with MRF operators.

Based on the MRF survey and interviews, costs to manage contamination can range from $1,000 to $50,000 per month depending on the type of program, facility configuration, and available disposal sites. Smaller or dual stream facilities indicated they were on the lower end of this range, in the $1,000 to $5,000 per month range compared to larger and/or single stream facilities in the $10,000 to $50,000 range per year.

The survey of composting facilities found that food and yard waste have lower contamination rates of five to 10% as compared to MRFs. Compostable packaging presents a challenge to process at facilities. Residue rates at composting facilities can range from as little as five (5) tons per year to as much as 5,000 tons per year depending on the size and feedstock, and residue materials include dirty or wet paper towels, non-compostable plastics, compostable plastics, metal, and glass.

Similar to MRFs, contamination results in downtime, contaminated commodities, increased processing costs, and increased residue disposal costs. Increasing the volume of compostable packaging delivered to composting facilities in the State may introduce contaminants and/or degrade the quality of marketable product if facilities are not equipped with the processing technology or staff to manage compostable packaging as part of the existing operations.

9 Environmental Justice

As the State plans for EPR, it must also understand how new programs may relate to EJ concerns or considerations. The State's existing EJ Policies support the use of EJ screening tools and consulting with the Commission on Environmental Justice and Sustainable Communities (CEJSC) to identify communities disproportionally affected by climate impacts and GHG emissions.

The Needs Assessment considers two EJ screening tools: the State's MDE EJ Screen Tool and the EPA's EJScreen tool. MDE's EJ Screening Tool allows users to identify potentially overburdened or underserved communities at the census tract level. There are many layers available for users to turn on or off, allowing users to see multiple data visualization.

MDE calculates an EJ Score using four EJ indicators based on census and health data, including:

- Pollution burden exposure
- Pollution burden environmental effects
- Sensitive populations
- Socioeconomic factors

The EJ score is a composite scoring that can guide users with data that could be used to inform decisions on siting, permitting, enforcement, and infrastructure improvements.

Figure 25 displays the MDE EJ Score layer at the census tract level in the MDE EJ Screening Tool.

CEJSC Group

The twenty-member CEJSC group was established in January 2001 and consists of representatives from multiple state agencies and local government organizations who are responsible for providing recommendations on EJ and analyzing the effectiveness of laws and policies to address EJ issues for the State government.

MDE EJ Screening Tool

Darker colors indicate scores that are in a higher percentile, or areas that are more overburdened and/or underserved, and lighter colors indicate scores that are in a lower percentile, or areas that are less overburdened and/or underserved. Areas in yellow have an EJ score in the 0-24th percentile, green shows areas in the 25-49.9th percentile, blue-green areas are in the 50-74th percentile, and areas shown in dark blue are in the 75-100th percentile. There are multiple resources on EJ that provide users with access to various GIS databases, tools, inventories, and registries consisting of educational material to help make informed decisions on programming and infrastructure, including an EJ screening tool available from the EPA. These resources are further discussed in **Appendix H: Equity Within Recycling System Technical Memorandum.**

Figure 25: MDE EJ Score Layer on the MDE EJ Screening Tool
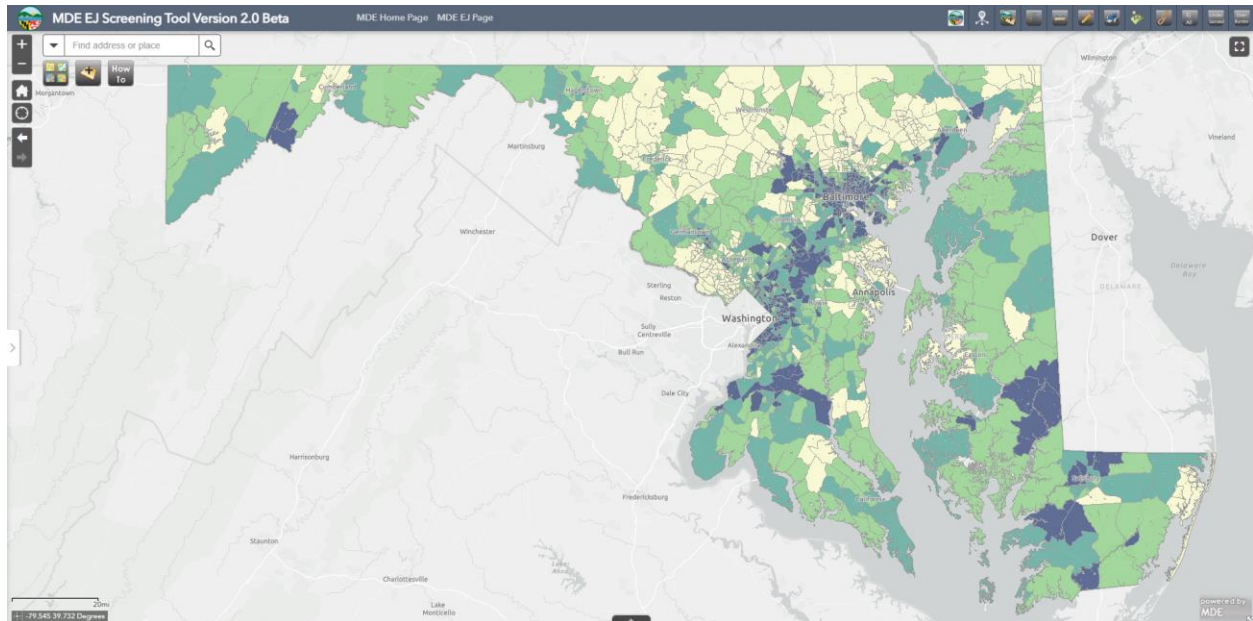
Higher EJ scores in urban versus rural areas have different meanings and needs. Higher scores in urban areas tend to be indicative of higher diversity and larger nonwhite populations that are affected by urban pollution. Higher scores in rural areas tend to signify low-income and unemployed populations affected by challenging geography and less access to infrastructure. Thus, there are different ways to increase equitable outcomes for recycling in urban versus rural areas.

In the Washington Metro Region, the urban census tracts surrounding Washington D.C. and a rural area in southern Prince George's County have the highest EJ scores in the region. The urban areas around Washington D.C. have higher underserved scores, relating to the region having the highest percentages of non-white and limited English-speaking populations in the State. These urban areas also have higher pollution burden exposure and pollution burden environmental effects indicator scores, making them overburdened. The rural areas on the western and southern borders of the region have higher overburdened pollution burden environmental effects indicator scores due to a higher risk of exposure to pollution from farming practices and mining.

In the Baltimore Metro Region, urban areas in and around the City of Baltimore and the I-95 corridor have EJ scores in the highest percentiles. The City of Baltimore has the highest percentile score in the State, reflecting areas with higher density of underserved populations and urban pollution risks. The Lower Eastern Shore Region has some of the highest EJ scores in the State, with most of the counties in the region in the mid to upper percentiles of the underserved indicator. This region has the highest low-income population, the highest unemployment rate, and the lowest income per capita in the State. From an overburdened perspective, much of the region is in the mid to higher percentiles of the pollution burden environmental effects and sensitive populations indicators due to industry.

Generally, the Upper Eastern Shore Region has EJ scores in the middle percentiles. The lower EJ scores in Cecil County are due to less sensitive populations close to the infrastructure surrounding the I-95 corridor and the higher EJ scores in Caroline County are related to industry.

Statewide, the areas with the highest EJ scores are the urban parts of the Washington Metro and Baltimore Metro Regions and rural areas in the Lower Eastern Shore Region. Underserved and overburdened urban areas in and around Baltimore City, Washington D.C, and along the I-95 corridor consist of minority nonwhite populations that may be disproportionally impacted by urban pollution. This analysis of the EJ score highlights the importance of balancing the need for additional recycling infrastructure and programming in some Regions (e.g., Lower Eastern Shore) and support to optimize existing recycling operations on other Regions (e.g., Baltimore Metro).

Expanding Infrastructure Equitably

Recycling programs in rural areas needs to consider the challenges of rural environments, mountainous areas, or water geography. To minimize environmental and cost impacts, infrastructure and service must capture economies of scale to minimize unintended consequences of disproportionally impact low-income areas with limited financial resources. Conversely, improving recycling performance in the more densely populated Regions requires that ongoing and future operations are enhanced to minimize tailpipe emissions, traffic congestion, and roadway degradation so as not to further burden historically underserved communities.

10 Current Recycling Performance and Cost

This section analyzes the need and potential economic impact of EPR for packaging and paper products (PPP) in Maryland. To that end, this section estimates the performance and cost of the state recycling system for PPP at a baseline state (2022). The following subsections provide an overview of the baseline generation, recycling, and cost of managing covered packaging and paper products in Maryland.

Appendix B: Residential Recycling Stream Analysis discusses MDE's reporting structure for statewide waste generation and diversion.

This Needs Assessment seeks to evaluate the baseline performance and cost of a recycling system for PPP generated by both the residential and commercial sectors as this is what can be potentially covered by an EPR program for packaging. Recycling rates provided in the state's Annual Maryland Solid Waste Management and Diversion Report may include a wider scope of materials than PPP, which is the primary focus of this Needs Assessment. For this reason, the results in this baseline assessment are not directly comparable to the state's recycling rates and only evaluate PPP materials.

10.1 Methodology

The Project Team calculated three (3) main outputs to assess the current cost and performance of the baseline PPP recycling system in Maryland.

1. Active Service for Residential Customers: Active service refers to a household which either has service automatically provided or has the ability to subscribe to the service.

2. Current waste flow for PPP for residential and commercial sectors.

3. System costs to manage PPP materials for residential and commercial sectors.

10.1.1 Covered Materials and Entities

The first step in this analysis was to establish what materials and entities would be covered by a potential EPR system. The Project Team based this scope on a workshop with MDE and the EPR Advisory Committee in which covered materials and entities were determined. The covered materials and entities evaluated are throughout this Needs Assessment are intended to guide discussions on what covered materials and entities could be considered in potential EPR for packaging legislation.

Covered Materials – This includes primary, secondary, and tertiary PPP of all material types including metals, glass, plastic, and fiber. A covered material means that this packaging would have a fee placed on it as part of the EPR system and would be included as part of total generation figures. The sum of all these covered materials would be the denominator in any recycling rate mentioned in this Needs Assessment.

Covered Entities – This includes all single-family, multi-family, and commercial entities in the state.

All PPP are considered covered materials generated from covered entities within this Technical Memorandum.

10.1.2 Material Flow

To calculate the generation of PPP in Maryland, the Project Team used a "bottom-up" approach of combining diversion data with disposal data to estimate overall generation.

Material flow refers to the movement, generation, collection, treatment, and disposal of waste materials in a given area and is important for understanding, managing and improving waste management systems.

The Project Team used the following sources to calculate the material flow:

1. MDE provided annual county-level MRA reports

2. A MRF survey issued to the MRFs within Maryland as discussed in the **Appendix B: Residential Recycling Stream Analysis** and **Appendix C: Infrastructure and Capacity Technical Memorandums**, which provided tonnage and composition data on materials flows for nine (9) recycling facilities in Maryland.

The Project Team characterized MSW disposed through field sorting and local waste characterizations conducted from November 4 - 15, 2024, which provided material disposal tons and material flow compositions at local and county level in Maryland

Figure 26 below shows the process of taking the statewide waste characterization and the state's MRA data to produce overall PPP generated into the state.

Figure 26: Method for Calculating Generation of PPP Covered Materials
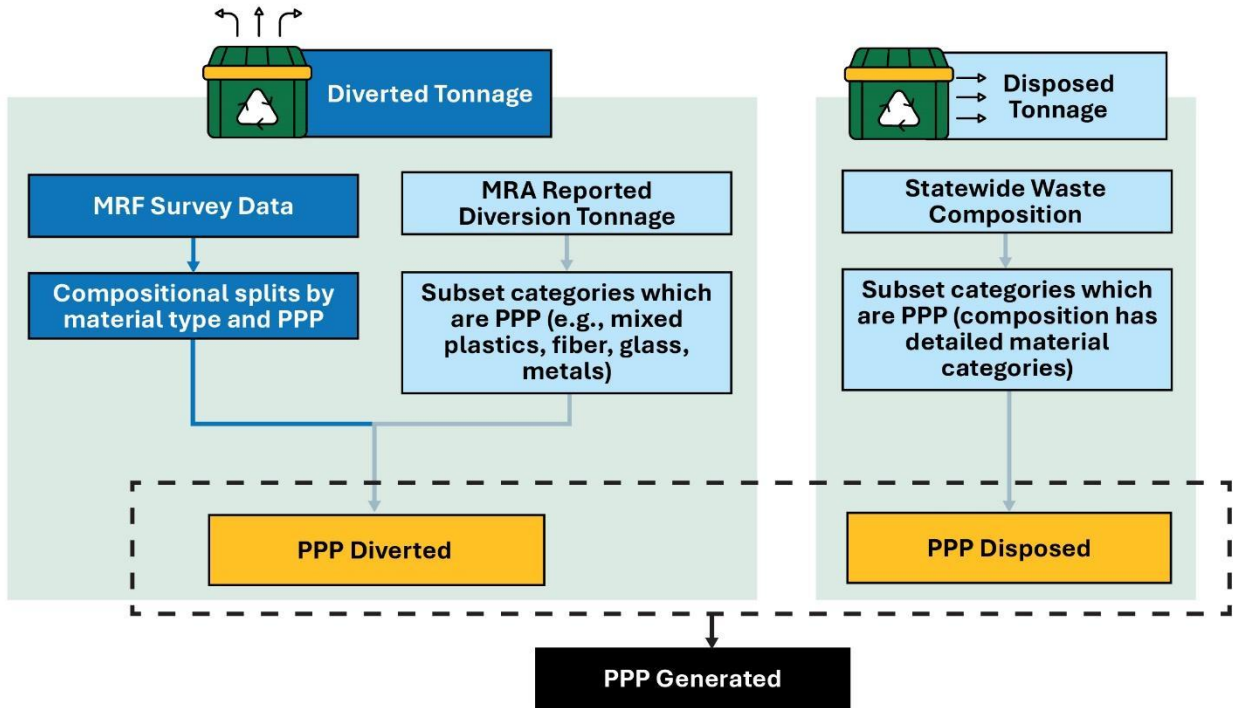
The Project Team calculated total tons of PPP disposed and recycled from MRA tons separately using the sources mentioned above. PPP is a subset of MRA tons. The diagram below shows the composition of material reported to MDE as recycled by counties, and the subset that accounts for PPP material:

Figure 27: PPP Share of All Tons Reported as Recycled to MDE
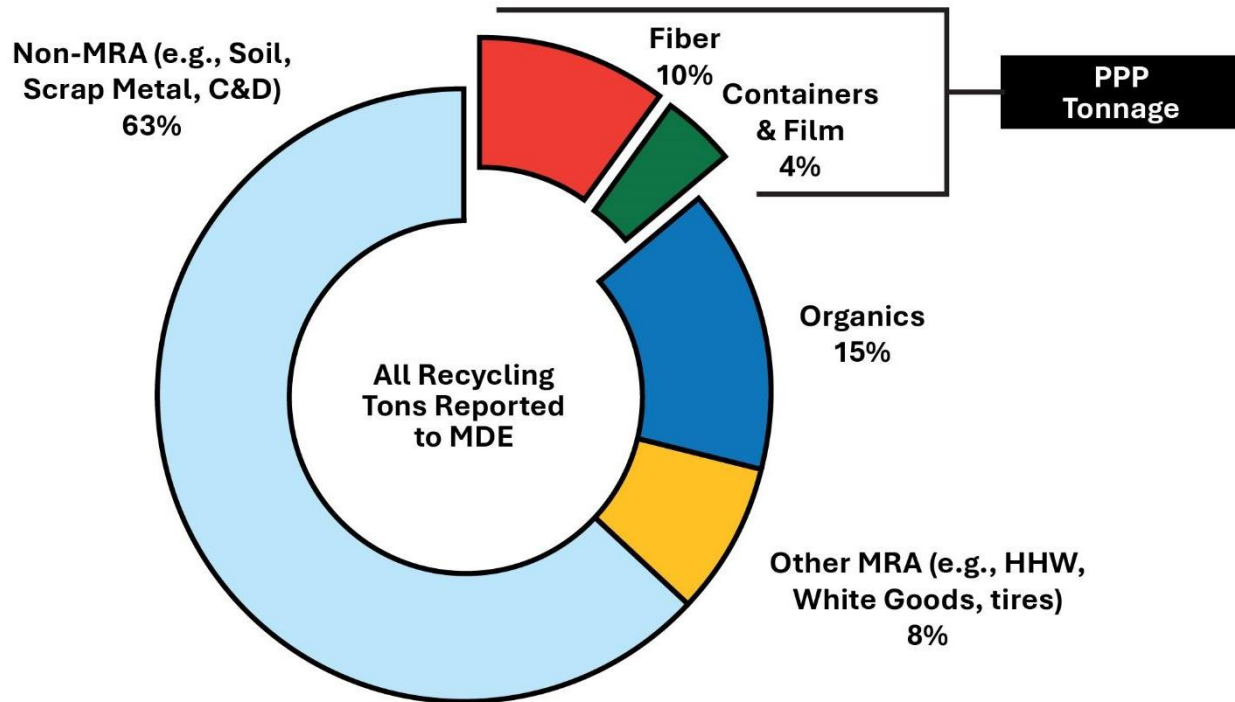
Overall generation was then calculated by adding together the recycling and disposed tons. Finally, recycling rates were calculated by dividing the tons recycled by the overall tons generated.

Single-family households with curbside recycling service in a county are considered to have a capture rate of 50%, it was assumed that a multi-family household with service in the same county has a capture rate of 37.5%.

Due to Maryland-specific data limitations, the Project Team leveraged nationwide capture rates to complete this analysis. For example, in Seattle, multi-family households have a capture rate that is about 50% of single-family households.[38] Furthermore, municipalities in Ontario which have a higher percentage of served multi-family households as a percent of all households tend to have lower diversion rates. [39] The Project Team chose 75% for this Needs Assessment as a conservative estimate.

10.1.2.1 Multi-Family and Commercial Adjustment for Recycling

Annual county-provided tonnage data is separated by commercial and residential sectors and aggregated by MDE. Counties are instructed to categorize multi-family recycling as residential; however, MDE informed the Project Team that multi-family recycling data may

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[38] Seattle Public Utilities. 2023. Waste Prevention and Recycling Report
https://www.seattle.gov/documents/Departments/SPU/Documents/Reports/SolidWaste/2023/2023-WastePreventionRecyclingReport.pdf

[39] Eunomia analysis of 2021 Ontario Datacall Report: https://rpra.ca/programs/about-the-datacall/

still be included as commercial recycling data due to the nature of multi-family households' collection routes being combined with commercial recycling routes. In order to isolate the commercial data, the Project Team estimated a proportion of the tons reported as commercial that could be from multi-family properties, by using the survey response data provided by counties, as shown in **Table 35**. This effort allowed the Project Team to report on multi-family and commercial recycling data separately in the Needs Assessment.

Table 35: Multi-Family Share of Commercial Recycling Collected from County Survey

	Percent of Reported Commercial Recycling Tons which are Muti-Family (range in parenthesis)	**Multi Family Dwelling Units per Capita (range in parenthesis)**
Average of survey responses	24% (15%-40%)	0.14 (0.04 - 0.5)
Statewide	Not available	0.11 (0.02-0.45)

Table 35 shows the share of commercial recycling data from the county survey that is considered to be multi-family. The proportion ranges from 15% to 40% and appears to depend on how common multi-family housing is in a county. Based on available survey data, an average of 24% of commercial collected material is multi-family. The Project Team then adjusted the percentage of commercial tonnage that is multi-family for each county depending on the overall prevalence of multi-family housing in the county. The Project Team indexed the multi-family households per capita for each county to the average in the survey data, and then used this index to scale the proportion of commercial recycling that is multi-family.

10.1.2.2 MRF Residue and Collection

Counties do not report residue (caused by both contaminated inbound material and process residue) in their annual reporting to MDE (remaining material after material recovery process occurs); therefore, the project team calculated the MRF residue in the state by using data provided in the MRF survey responses which included the MRFs' average percent and tonnage of residue sent for disposal each year. Survey responses included estimates of reside composition and the Project Team reviewed additional supporting sources to estimate the single-stream MRF residue composition, including:

1. Titus MRF Services Northeast Secondary Sorting Study[40]

2. MSW Consultants 2023 Vermont Waste Characterization Study[41]

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[40] American Chemistry Council. 2022. Northeast Secondary Sorting Study https://www.americanchemistry.com/better-policy-regulation/plastics/resources/northeast-secondary-sorting-study https://www.americanchemistry.com/better-policy-regulation/plastics/resources/northeast-secondary-sorting-study

[41] Vermont DEC. 2024. 2023 Vermont Waste Composition Study https://dec.vermont.gov/sites/dec/files/wmp/SolidWaste/Documents/2023-VT-Waste-Composition-Study.pdf

3. King County's 2022 MRF Material Assessment Study[42]

The Titus and Vermont assessments provide comparable, statewide material category estimates for the MRF residue stream. The Vermont and the King County studies provide detailed breakdowns into material categories. The Project Team recognizes that the Vermont and Titus studies may have fewer beverage containers in their MRF stream due to active bottle bills (also known as deposit return systems) in those states; therefore, King County's material composition was used to generate assumptions more comparable to Maryland for materials which would fall under deposit in a DRS (e.g., PET Bottles, aluminum cans, and glass bottles). All other materials used a combination of the sources.

Based on compiled data from the sources described above, the MRF residue stream calculations for recyclable material for single and dual-stream MRFs were added to the total recycled tonnage. Residue was calculated for each region depending on the MRF shed within each region. Adding the residue to the outbound recycling tonnage produced a comprehensive total tonnage of recyclable material collected in the State.

10.1.3 Curbside Recycling Access

Curbside recycling access was evaluated based on survey responses from Counties and haulers and detailed evaluation of households by Region as described in **Appendix B: Residential Recycling Stream Analysis.**

Subscriber percentages were provided in survey responses for both the single-family and multi-family households within each county for which responses were received. **Table 36** shows the subscription rates compiled at the Regional level. This table shows the estimated percent of households who have open market service as their only option for subscribing to curbside recycling service.

Table 36: Estimated Open Market Subscription Rates

Region	Single Family Households with Open Market Contracting	Single Family Open Market Subscription Percentage	Multi Family Households with Open Market Contracting	Multi Family Open Market Subscription Percentage
Western Maryland	66,800	37%	16,000	22%
Washington Metro	8,400	37%	276,400	64%
Baltimore Metro	137,600	72%	216,300	15%
Southern Maryland	68,000	27%	14,000	58%
Upper Eastern Shore	83,300	88%	13,800	75%
Lower Eastern Shore	68,000	12%	37,500	23%
Statewide	**432,100**	**52%**	**573,900**	**42%**

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[42] Cascadia. 2022. 2022 King County Material Recovery Facility Assessment
https://your.kingcounty.gov/dnrp/library/solid-waste/Solid-waste-planning-monitoring/Solid-waste-monitoring/MRF-assessment-2022.pdf

These estimated open market subscription numbers were combined with the county and municipally-managed curbside recycling household figures by Region to generate a total access number for residential recycling of PPP, which is provided in **Section 10.3**.

10.1.4 Recycling Rate

The project team used recycling and generation tonnage data to calculate the recycling rate. Generation tons include tons sent for recycling, tons in MRF residue, and tons disposed. Tons of recycling are considered material which are sent to secondary processors (either baled or loose) based on the appropriate end markets by material type. This means that recycling tons are considered post MRF, and after source-separated material has been collected. **Figure 28** below illustrates the points within the recycling value chain used to calculate the recycling rates for this Needs Assessment.

Figure 28: Illustrative Flow of Material and Calculation Point of Recycling
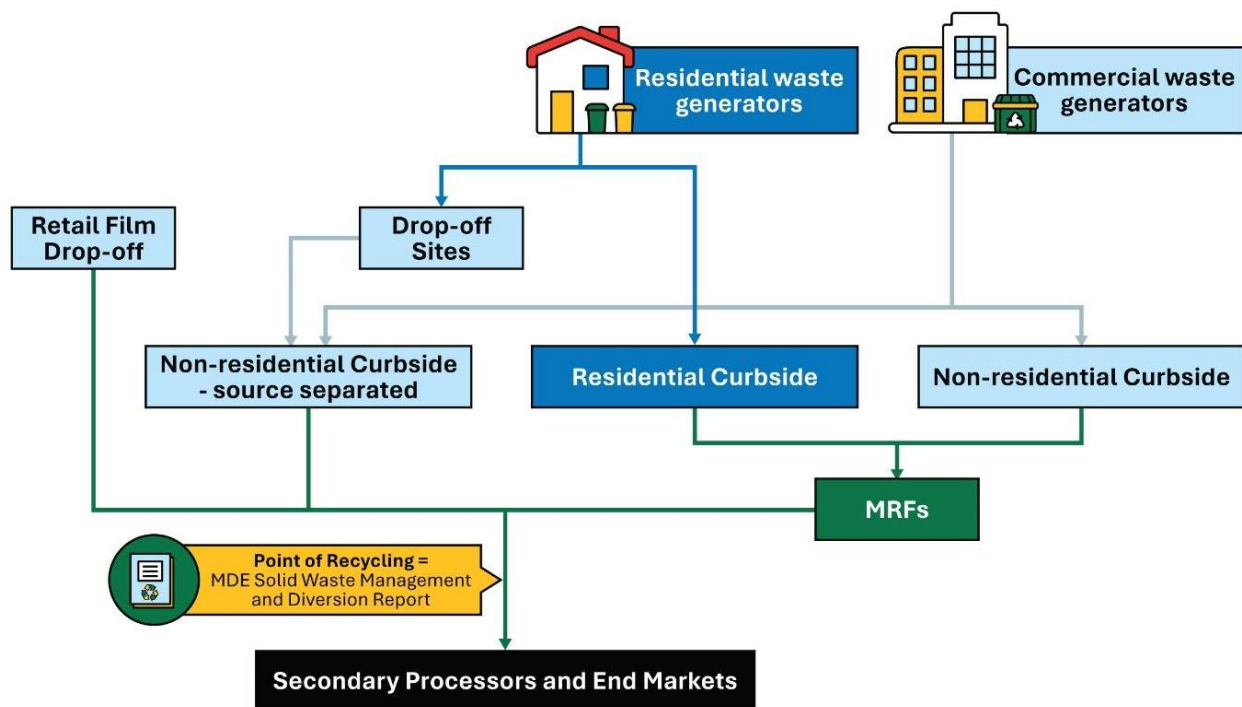
The figure shows each of the individual collection streams eventually converging to the re-processing stage after the material has been sorted. This is where the point of recycling is measured for this study, residues at the MRF are not included as recycling.

The recycling rate is then calculated as the tonnage at the point of recycling divided by the overall tonnage generated.

10.1.5 Costs

Costs for PPP curbside collection and recycling are calculated using the level of active recycling results and recycling material flow to determine the cost to collect the curbside tonnage. The process includes first calculating the number of routes needed to service the number of households and tonnage of material collected. Using this analysis, the project team could then use a cost per route number from the hauler survey to estimate the cost of material.

10.1.5.1 Route Calculation

The project team calculated the baseline number of recycling routes by using the following sources and assumptions:

1. Households served per recycling route from the hauler survey (Method A)

2. A truck capacity of 25 cubic yards, a bulk density of 150 pounds per cubic yard for single-stream recycling, and a compaction ratio of 3:1 in a truck. [43]

3. A maximum of two (2) tips per route, including an assessment of how many routes are needed so that trucks aren't filled more than twice per collection route (Method B)

The number of routes is the *maximum* routes needed between methods A and method B above, as in the max of:

1. Number of Routes A = # of households / # of households service per route, and

2. Number of Routes B = Volume of material collected per day / 2 tips.

This is shown in **Figure 29** below.

Figure 29: Calculation of Required Collection Routes

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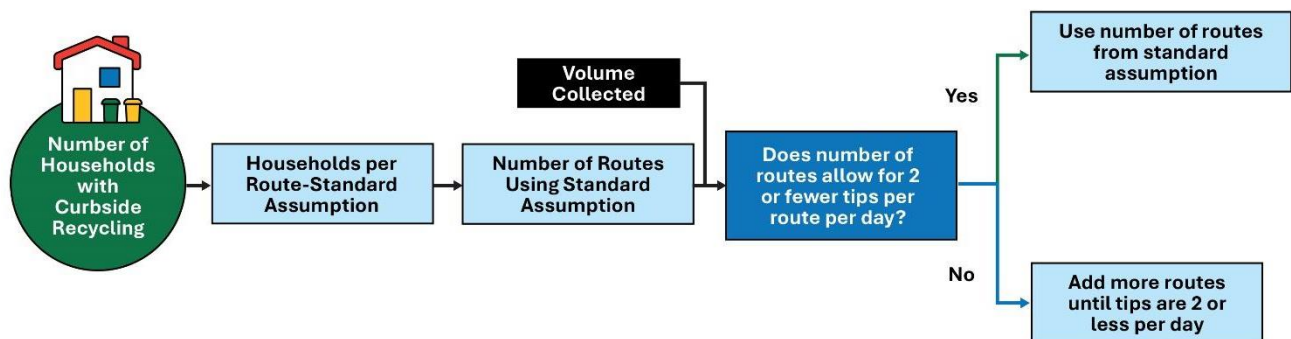
[43] Cascadia (2015) Waste Audit and Inventory. (Waste Management density factor on page 10)
https://www.csueastbay.edu/sustainability/files/docs/operations/cascadia-waste-audit-report.pdf

The standard assumption of 1,000 – 1,500 households per route is based on survey results with the number of routes needed based on household numbers. The tip-based number can add more routes to a county based on tonnage generated in that Region. The Project Team used the number of current active recycling households, which includes all households who are provided service by the county, municipality, or elect to subscribe to open-market service.

To account for multi-family, the Project Team then assumed that an average of eight (8) multi-family units were equal to one single-family household in terms of time constraints on a route. For volume constraints the Project Team still estimated that a truck could fill up twice on a route. The multi-family unit assumption was determined by finding that the average multi-family unit in Maryland is in a building with 8-14 units as detailed in **Appendix F: Multi-Family and Commercial Recycling Services Technical Memorandum.**

Applying the above average customers per route for different property densities provides the following estimated number of routes by county in the state, provided in **Table 37**.

Table 37: Estimated Number of Recycling Routes in Maryland – By Region (2022)

Region	Number of Routes	Dwelling Units Percent Single Family	Dwelling Units Percent Multi Family	Dwelling Units Served per Route (SF and MF)
Western Maryland	21	87%	13%	2,646
Baltimore Metro	397	88%	12%	2,377
Southern Maryland	45	90%	10%	1,900
Upper Eastern Shore	47	89%	11%	1,916
Lower Eastern Shore	11	73%	27%	2,931
Washington Metro	315	77%	23%	2,411
Statewide	**836**	**83%**	**17%**	**2,352**

Based on these calculations, a recycling truck may carry approximately 5.6 tons per load, which is consistent with industry standard payloads for compacting single-stream collection vehicles but may be lower for multi-stream collection vehicles with limited compaction.

After calculating the number of routes needed, the Project Team uses an estimated cost per recycling route to calculate the total cost of recycling.

10.1.5.2 Cost per Route Calculation

Based on survey responses from haulers, the range of cost per route varies from $175,000 for bi-weekly service, and $400,000 for weekly service.

Note, not all haulers responded to the Needs Assessment survey; therefore, this data may not be representative of all haulers in Maryland. For that reason, the project team also estimated the cost of a recycling route for each region by using activity-based costing (e.g., calculating the cost of trucks, containers, fuel, labor, maintenance, and insurance on each route) to create a further precise estimate. The result of the activity-based costing yielded

a result of between $250,000 and $300,000 per route. To be conservative, the project team used a higher cost per route than this activity-based method; however, slightly lower than the results from the survey. The Project Team assumed costs per route shown in **Table 38** for cost modeling residential services. These costs were used for the purpose of this evaluation and may vary by hauler and other factors such as inflation and procurement lead time.

Table 38: Cost per Recycling Route used in Modelling

Service Level	Cost per Route used in Modelling	Route Cost from Survey
Weekly Service	$350,000	$400,000
Bi-Weekly Service	$250,000	$175,000

These cost per routes were then applied to the total number of routes provided in Section 10.1.5.1 to get an estimated total cost of recycling collection.

To estimate commercial costs, the Project Team used a similar approach; however, hauler survey responses provided a broad range for commercial recycling routes between $100,000 and $400,000 per route. Survey responses from municipalities provided an average cost of $35 per cubic yard, which the project team ultimately used to estimate the total cost of curbside recycling for commercial material collected through single stream collection. The operational costs of collecting high quality cardboard and clean office paper on a source separated basis is assumed to have a net cost of $0, as revenues from this commodity stream can be sufficient to offset operations costs.

10.1.6 Drop-Off Costs

Based on survey responses, every county in Maryland has at least one drop-off site. The project team estimated the cost of drop-off service by using average costs to operate an unstaffed drop-off provided by Maryland Environmental Services (MES), at $260 per ton. The Project Team then applied this to the tonnage of material collected through drop-offs in each county.

Costs for staffed drop-off locations were developed for counties who responded to the county survey that their site is staffed. Counties provided information on whether their drop-offs were unstaffed, part time staffed or fully staffed. The project team assumed that a fully-staffed drop-off employs 1 FTE, while a part time staffed drop-off employs 0.5 FTEs. These FTEs were then multiplied by an annual salary and benefits using an average salary of $42,000.[44]

10.2 Recycling Composition and Generation

The Project Team estimated the generation and composition of PPP by generator and by material type. As EPR legislation has yet to pass in Maryland, this report analyzes primary,

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[44] Maryland Bureau of Labor Statistics Data for average salary for a refuse and recyclable material collector. This salary used is based on national data, which may vary from the wage and salary data presented in **Appendix D: Worker Conditions, Wages, and Benefits Technical Memorandum.**

secondary, and tertiary packaging and paper of all material types including metal, glass, plastic, and fiber as the basis for covered packaging materials in the state. Within this Needs Assessment, these materials are referred to as covered materials or covered PPP.

Figure 30 shows the generation of packaging materials by material and generator type. OCC/Cardboard, paper, and flexible plastic are the three largest categories of the material stream, and these materials are predominantly generated by the commercial sector. For example, 75% of OCC/Cardboard packaging in Maryland is generated by the commercial sector. The generation of metal, rigid plastic, and glass packaging are all more evenly split between the residential and commercial sectors.

Figure 30: Generation of Covered PPP at Baseline
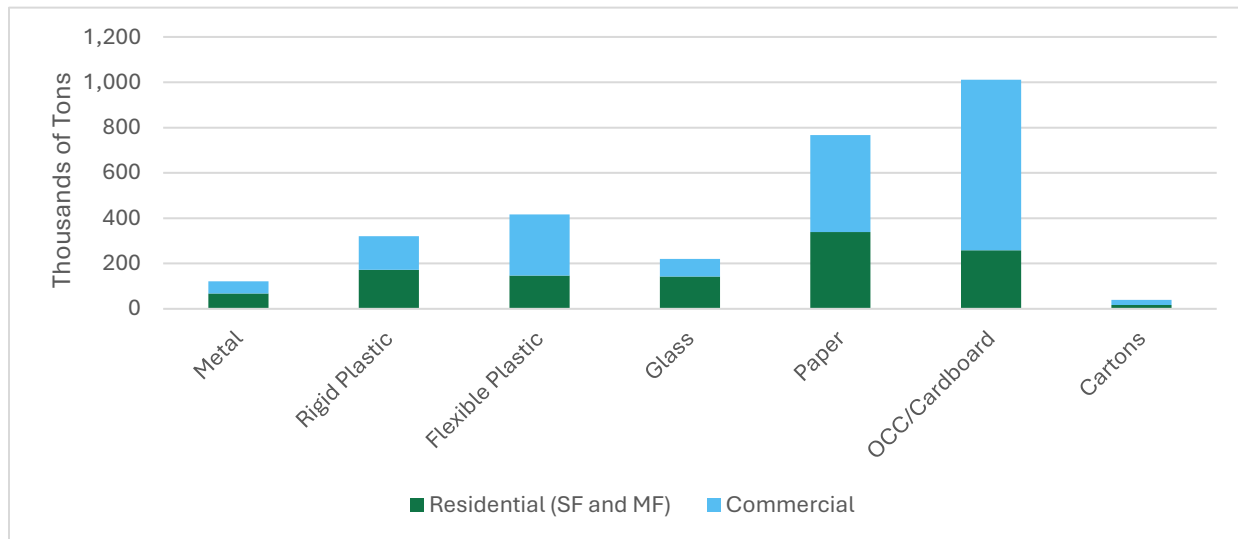
Figure **31**, Figure **32**, and Figure **33** show the estimated residential, commercial, and total waste compositions in Maryland. For residential entities (single and multi-family households) paper makes up the largest share of waste generated at approximately 30% of the sector's total waste composition. For commercial entities OCC/Cardboard makes up the largest share of waste generated at approximately 45% of the sector's total waste composition. Overall, OCC/Cardboard is the covered material that generates the greatest tons in Maryland, making up approximately 35% of the total generated covered materials in Maryland. Cartons generate the least number of tons in both the residential and commercial sectors, making up approximately 1% of total covered materials generated in Maryland. More glass is generated in the residential sector than in the commercial sector with glass making up approximately 12% of total covered materials generated in the residential sector and approximately 4% of total covered materials generated in the commercial sector.

Figure 31: Residential Covered PPP Waste Composition
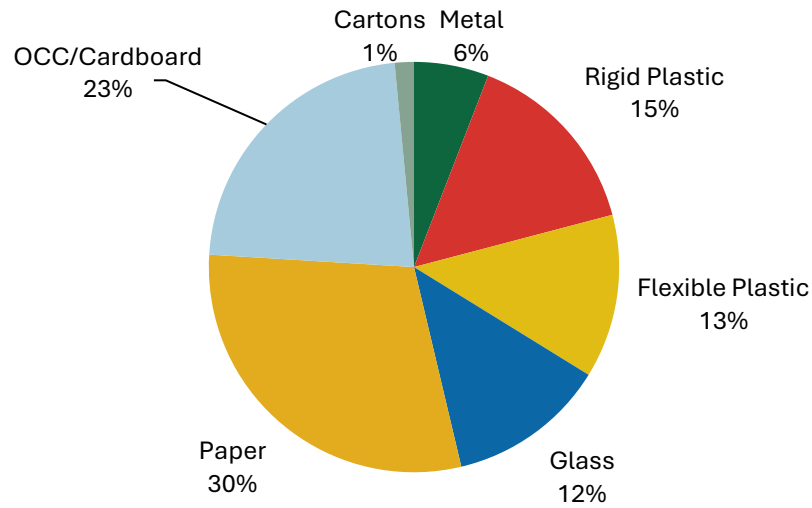
Figure 32: Commercial Covered PPP Waste Composition
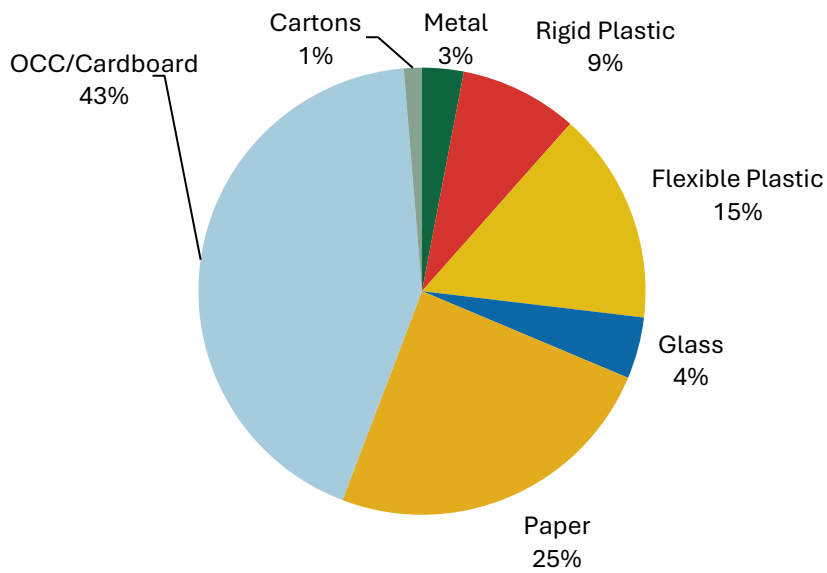
Figure 33: Total Residential and Commercial Covered PPP Waste Composition
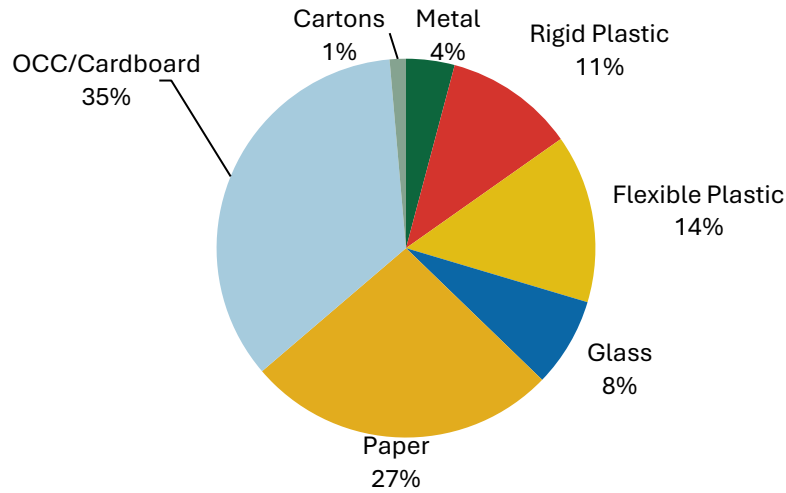
In 2022, almost three (3) million tons of covered PPP were generated statewide.

Table 39 shows the total generation of covered PPP by generator and Region. Statewide, approximately 60% of generated covered materials come from the commercial sector, with the remaining 40% coming from single-family and multi-family residences. The Washington Metro and Baltimore Metro Regions generate the highest tons in both the residential and commercial sectors, together making up ~80% of the total generated covered materials in Maryland.

Table 39: Estimated Total Generation of Covered PPP by Generator and Region (tons)

Region	Single-family	Multi-family	Commercial	Total
Western Maryland	46,000	8,000	94,000	**148,000**
Washington Metro	295,000	102,000	616,000	**1,013,000**
Baltimore Metro	418,000	111,000	756,000	**1,285,000**
Southern Maryland	59,000	5,000	89,000	**153,000**
Upper Eastern Shore	44,000	4,800	124,000	**172,800**
Lower Eastern Shore	36,000	13,000	76,000	**125,000**
Statewide	898,000	243,800	1,755,000	**2,896,800**

Table 40 shows the total generation of covered PPP by material and Region. OCC/Cardboard makes up the highest amount of covered PPP generation, which is over one (1) million tons statewide or approximately 35% of the total covered PPP generated. Flexible plastic generates nearly 100,000 more tons than rigid plastic statewide, and cartons generate the lowest amount of covered material tons, making up approximately 1% of the total generated covered materials statewide.

Table 40: Estimated Total Generation of Covered PPP by Material and Region (tons)

Region	Metal	Rigid Plastic	Flexible Plastic	Glass	Paper	OCC/ Cardboard	Cartons	Total
Western Maryland	8,000	14,000	20,000	8,000	37,000	59,000	2,000	148,000
Washington Metro	39,000	107,000	126,000	108,000	279,000	343,000	11,000	1,013,000
Baltimore Metro	54,000	144,000	207,000	72,000	343,000	445,000	20,000	1,285,000
Southern Maryland	10,000	16,000	20,000	15,000	40,000	50,000	2,000	153,000
Upper Eastern Shore	5,000	24,800	18,700	8,600	37,400	76,200	2,100	172,800
Lower Eastern Shore	6,000	15,000	24,000	9,000	31,000	38,000	2,000	125,000
Statewide	**122,000**	**320,800**	**415,700**	**220,600**	**767,400**	**1,011,200**	**39,100**	**2,896,800**

Table 41 shows the total per capita generation of covered PPP by Region. The Upper Eastern Shore Region has the highest per capita generation at 1,400 pounds per capita, followed by the Western Maryland and Lower Eastern Shore Regions who both have a total per capita generation of 1,200 pounds. The reason for such high generation in the Upper Eastern Shore is a higher rate of commercial cardboard generation per capita compared to the other Regions.

Table 41: Total Per Capita Generation of Covered PPP by Region

Region	Pounds per Capita Residential	Pounds per Capita Commercial	Total Pounds per Capita
Western Maryland	429	747	1,200
Washington Metro	347	538	890
Baltimore Metro	379	542	920
Southern Maryland	342	473	820
Upper Eastern Shore	399	1,009	1,400
Lower Eastern Shore	458	714	1,200
Statewide	**371**	**569**	**940**

10.3 Recycling Access and Recycling Rates

The following section provides more details on who has access to recycling services and the estimated recycling rates in Maryland. **Appendix B: Residential Recycling Stream Analysis** contains detailed information on access to recycling service, also summarized in **Table 42** below.

Across the state, approximately 78% of households have active curbside recycling service available. Active service refers to a household which either has service automatically

provided or has the ability to subscribe to the service and chooses to do so. Service levels are highest in the Washington Metro, Baltimore Metro, and Upper Eastern Shore Regions of the state. Service levels are lowest in the Lower Eastern Shore Region which only has 27% of households with active curbside recycling service. The Lower Eastern Shore is a predominantly rural area of the state. Statewide, single-family homes have higher rates of active service (89%) compared to multi-family households (49%).

Table 42: Number and Percent of Single-family (SF) and Multi-family (MF) Households with Active Curbside Recycling Service

Region	# of SF HH With Active Service	% of SF HH With Active Service	# of MF HH With Active Service	% of MF HH With Active Service	Total # of HH With Active Service	Total % of HH With Active Service
Western Maryland	48,300	53%	7,300	37%	55,600	50%
Washington Metro	583,100	99%	176,200	64%	759,300	88%
Baltimore Metro	828,400	96%	115,300	39%	943,700	81%
Southern Maryland	77,400	61%	8,100	58%	85,500	61%
Upper Eastern Shore	79,700	88%	10,300	75%	90,000	87%
Lower Eastern Shore	23,500	28%	8,800	23%	32,300	27%
Statewide	**1,640,300**	**89%**	**326,000**	**49%**	**1,966,300**	**78%**

The following tables show the volume recycled and recycling rate of covered PPP across the different Regions in Maryland. The recycling rate is calculated after the material is sorted at a MRF.

Table 43 shows the volume of material recycled by different generator types. Commercial entities recycle more than half of the covered PPP in the state. Single-family homes recycle more material as compared to multi-family homes. Furthermore, as Washington and Baltimore metros are the largest regions, they recycle more than three quarters of all material recycled in the state.

Table 43: Estimated Volume of Covered PPP Recycled in Maryland at Baseline by Generator (tons)

Region	Single Family	Multi Family	Commercial	Total
Western Maryland	5,800	600	45,100	51,500
Washington Metro	115,100	22,100	273,600	410,800
Baltimore Metro	126,500	14,100	227,900	368,400
Southern Maryland	10,600	500	40,900	52,100
Upper Eastern Shore	8,400	700	76,800	85,900
Lower Eastern Shore	2,900	600	12,200	15,700
Statewide	269,300	38,600	676,500	984,400

Table 44 shows the percent of material generated in each Region that is recycled. Overall, approximately 34% of covered PPP is recycled in the state. The Upper Eastern Shore Region has the highest recycling rate (approximately 50%) as a result of high commercial cardboard recycling, while the Lower Eastern Shore Region has the lowest recycling rate (approximately 13%). Commercial entities have higher recycling rates (approximately 39%) compared to single family (approximately 30%) and multi-family homes (approximately 16%). The difference in recycling rates between-single family and multi-family homes is not surprising as single-family homes have much higher levels of access.

Table 44: Estimated Recycling Rate of Covered PPP in Maryland at Baseline by Generator Type (percent)

Region	Single Family	Multi Family	Commercial	Total
Western Maryland	13%	8%	48%	35%
Washington Metro	39%	22%	44%	41%
Baltimore Metro	30%	13%	30%	29%
Southern Maryland	18%	10%	46%	34%
Upper Eastern Shore	19%	14%	62%	50%
Lower Eastern Shore	8%	5%	16%	13%
Statewide	30%	16%	39%	34%

ADC for glass is not considered recycling within the above table; however, in Maryland ADC is currently considered recycling.

On average about 247 pounds of covered materials are recycled annually by each residential household which has active recycling service as shown in **Table 45**. This is an average between single family and multi-family households. The table also shows the capture rate by households with curbside recycling. This includes material lost to MRF residue, while recycling rates do not. This shows that even amongst households who can recycle, many still do not recycle at high rates as only 40% of material is captured from these households.

Table 45: Estimated Household Capture Rate of Residential Covered PPP

Region	Total Pounds per Households	Collected Material Capture Rate as a % of Material Generated by Households with Curbside Recycling Service
Western Maryland	85	19%
Washington Metro	307	46%
Baltimore Metro	223	37%
Southern Maryland	116	35%
Upper Eastern Shore	158	30%
Lower Eastern Shore	26	18%
Statewide	**228**	**40%**

The following tables show similar information from above but rather than presenting the recycling data by the generator type, these tables provide information on the types of materials recycled. **Table 46** shows the volume of materials recycled. More than half of the material recycled in Maryland is OCC/Cardboard. Much of this comes from the commercial sector as the commercial sector has a higher share of OCC/Cardboard than compared to residential entities. Note in this table alternative daily cover (ADC) is not considered recycling.

Table 46: Estimated Volume of Covered PPP Recycled in Maryland at Baseline by Material Type (tons)

Region	Metal	Rigid Plastic	Flexible Plastic	Glass	Paper	OCC/ Cardboard	Cartons	Total
Western Maryland	2,300	2,100	0	1,400	12,100	33,600	100	51,500
Washington Metro	15,300	31,100	0	31,900	131,900	199,000	1,500	410,800
Baltimore Metro	11,700	31,600	0	19,600	102,600	201,700	1,200	368,400
Southern Maryland	5,100	3,900	0	0	16,600	26,300	200	52,100
Upper Eastern Shore	1,000	14,800	0	0	15,900	54,100	200	85,900
Lower Eastern Shore	1,000	2,200	0	0	3,400	9,000	0	15,700
Statewide	**36,400**	**85,700**	**0**	**52,900**	**282,500**	**523,700**	**3,200**	**984,400**

ADC for glass is not considered recycling within the above table; however, in Maryland ADC is currently considered recycling.

Table 47 shows the recycling of different material types. Not only does OCC/Cardboard have the highest amount of material recycled it also has the highest recycling rate at 52%. Metal, rigid plastics, and paper have recycling rates between 27% - 37%. Glass has a recycling rate of 24% and cartons have the second lowest recycling rate of 8%. Within this table ADC is not considered recycling. Flexible plastic has the lowest recycling rate of all materials which is effectively 0%. As described above, Upper Eastern Shore has the highest recycling rate of any Region and this recycling rate is driven by the higher than average recycling rate of OCC/Cardboard from much of the commercial entities there.

Table 47: Estimated Recycling Rate of Covered PPP in Maryland at Baseline by Material Type (percent rounded)

Region	Metal	Rigid Plastic	Flexible Plastic	Glass	Paper	OCC/ Cardboard	Cartons	Total
Western Maryland	29%	15%	0%	18%	33%	57%	5%	35%
Washington Metro	39%	29%	0%	30%	47%	58%	14%	41%
Baltimore Metro	22%	22%	0%	27%	30%	45%	6%	29%
Southern Maryland	51%	24%	0%	0%	42%	53%	10%	34%
Upper Eastern Shore	20%	60%	0%	0%	43%	71%	10%	50%
Lower Eastern Shore	17%	15%	0%	0%	11%	24%	0%	13%
Statewide	**30%**	**27%**	**0%**	**24%**	**37%**	**52%**	**8%**	**34%**

ADC for glass is not considered recycling within the above table; however, in Maryland ADC is currently considered recycling.

Table 48 summarizes the tons recycled and recycling rate for different materials by different generator types. Overall multi-family households have a lower recycling rate for different materials compared to single-family households. One of the main reasons for this is their lower levels of access to curbside recycling services for multi-family households across the state. Commercial entities have a higher overall recycling rate compared to single family households (39% vs 30%) but there are some materials single-family households recycle at a higher rate compared to commercial entities. For example, single-family households recycle 31% of glass compared to only 19% for commercial entities.

Table 48: Estimated Volume and Recycling Rate of Covered PPP at Baseline by Material Type and Generator

Material	Single Family (tons)	Single Family (percent)	Multi Family (tons)	Multi Family (percent)	Commercial (tons)	Commercial (percent)	Total (tons)	Total (percent)
Metal	15,800	30%	2,200	16%	18,400	35%	36,400	35%
Rigid Plastic	42,400	32%	6,300	17%	37,000	25%	85,700	25%
Flexible Plastic	0	0%	0	0%	0	0%	0	0%
Glass	34,800	31%	2,900	10%	15,200	19%	52,900	19%
Paper	85,400	32%	14,000	19%	183,100	43%	282,500	43%
OCC/ Cardboard	89,600	44%	13,000	24%	421,100	56%	523,700	56%
Cartons	1,300	9%	200	6%	1,700	8%	3,200	8%
Total	**269,300**	**30%**	**38,600**	**16%**	**676,500**	**39%**	**984,400**	**34%**

ADC for glass is not considered recycling within the above table; however, in Maryland ADC is currently considered recycling.

The **Table 48** results show the recycling rates that did not consider ADC for landfills as recycling. A future EPR program will likely need to decide on a definition of recycling, but many programs do not consider ADC to meet a definition of recycling. Currently, the MRA recycling rate does consider ADC to be of beneficial use; therefore, additional results are included which show the glass (**Table 49**) and statewide (**Table 50**) recycling rates with ADC counted towards the recycling rate. If ADC counted towards recycling, then the glass recycling rate would increase from approximately 24% to 53% and the statewide covered PPP recycling rate would increase from approximately 34% to 36%.

Table 49: Estimated Glass Recycling Rate by Region

Region	Single Family	Multi Family	Commercial	Total
Western Maryland	40%	24%	12%	31%
Washington Metro	72%	44%	74%	69%
Baltimore Metro	45%	19%	22%	35%
Southern Maryland	54%	32%	77%	60%
Upper Eastern Shore	46%	31%	44%	42%
Lower Eastern Shore	40%	17%	48%	40%
Statewide	58%	34%	55%	53%

ADC for glass is not considered recycling within the above table; however, in Maryland ADC is currently considered recycling. Glass recycling here differs from the totals reported in MRA data as this is only glass packaging and does not include any ADC.

Table 50: Estimated Statewide Recycling Rate by Region

Region	Single Family	Multi Family	Commercial	Total
Western Maryland	14%	9%	48%	35%
Washington Metro	45%	27%	48%	45%
Baltimore Metro	31%	14%	30%	29%
Southern Maryland	25%	15%	52%	40%
Upper Eastern Shore	24%	17%	63%	52%
Lower Eastern Shore	13%	6%	19%	15%
Statewide	33%	19%	40%	36%

ADC for glass is considered recycling within the above table; however, in Maryland ADC is currently considered recycling.

10.4 Recycling Costs

This report estimates the net cost of the recycling system which manages covered PPP in 2022. The recycling system includes both curbside and drop-off recycling for the residential and commercial sector. The results include the costs of collecting and sorting these materials. These are net costs as these results consider the material value of the recycled material. **Table 51** includes the total net cost of this recycling system in addition

to the cost per ton and cost per household. In 2022 actors across the recycling system paid approximately $406 million to collect and sort covered PPP. This is approximately $412 per ton recycled, and if the cost was apportioned across households in the state, then it would cost on average $8 to $10 per household per month.

Table 51: Estimated Cost of Recycling Covered PPP at Baseline ($)

Region	Total Annualized Costs	Cost Per Ton Collected	Costs Per Ton Recycled	Costs Per Household Per Month
Western Maryland	$15,599,000	$290	$303	$6.39
Washington Metro	$152,204,000	$438	$369	$9.89
Baltimore Metro	$180,766,000	$432	$492	$10.28
Southern Maryland	$21,207,000	$106	$406	$8.20
Upper Eastern Shore	$29,746,000	$266	$346	$13.11
Lower Eastern Shore	$6,911,000	$312	$443	$3.58
Statewide	**$406,433,000**	**$352**	**$412**	**$9.68**

Table 52 shows how the costs break down across different generator types. Residential curbside collection (single family and multi-family) makes up nearly two-thirds of the total cost. Although commercial entities recycle more material than residential entities, the cost of their service is lower as many commercial facilities have agreements to send their materials directly to processors especially for cardboard which is done at a very low or no cost.

Table 52: Estimated Total Cost of Recycling Covered PPP by Generator Type at Baseline ($)

Region	Residential Curbside	Commercial Curbside	Drop-off Costs	Statewide
Western Maryland	$6,794,000	$7,687,000	$1,118,000	$15,599,000
Washington Metro	$100,738,000	$49,720,000	$1,746,000	$152,204,000
Baltimore Metro	$138,100,000	$38,685,000	$3,981,000	$180,766,000
Southern Maryland	$12,037,000	$7,745,000	$1,425,000	$21,207,000
Upper Eastern Shore	$15,427,000	$13,211,000	$1,107,000	$29,746,000
Lower Eastern Shore	$3,188,000	$2,397,000	$1,326,000	$6,911,000
Statewide	**$276,284,000**	**$119,445,000**	**$10,703,000**	**$406,432,000**

10.5 Key Findings

This Needs Assessment estimated the baseline performance and cost of recycling covered PPP in Maryland in 2022. This analysis found the following key results.

- Maryland generated approximately 2.9 million tons of covered PPP in 2022. Approximately 60% were generated in the commercial sector, 30% by single-family households, and 10% by multi-family households.

- The materials that make up the largest share of the composition of covered PPP include OCC/cardboard (35%), paper (27%), and flexible plastic (14%). The materials which make up smaller shares are rigid plastic (11%), glass (8%), metal (4%), and cartons (1%).

- Approximately 34% of covered PPP is recycled in Maryland equivalent to 984,400 tons.

- The commercial sector has the highest recycling rate (39%) followed by single-family households (30%), and multi-family households (16%).

- The covered PPP materials with the highest recycling rates include OCC/Cardboard (52%) and paper (37%). Materials with lower recycling rates include metal (30%), rigid plastics (27%), and glass (24%). The materials with the lowest recycling rates include cartons (8%) and flexible plastics which is essentially 0%.

- The collection and sorting of covered PPP in Maryland in 2022 is estimated to cost approximately $406 million. Approximately 65% of the cost is from residential curbside collection, 32% is from commercial curbside collection, and 3% is from drop-off collection.

11 Future Recycling Performance and Cost

This Needs Assessment analyzes a potential Extended Producer Responsibility (EPR) for PPP in Maryland. To that end, this Needs Assessment estimates the performance and cost of a potential future state recycling system with an EPR program for PPP. The following sections provide a summary of the operational characteristics within a potential EPR system and estimates the recycling performance and cost of managing covered PPP in Maryland under that system.

11.1 Scenario Development Methodology

There are many ways to design and implement an EPR program. The objective of this analysis was to estimate the performance and cost of an EPR system that is realistic, and which considers best practice from other jurisdictions. The EPR system analyzed for this Needs Assessment is based on a future system that could be implemented within five (5) years of the start of the program. Five (5) years is an achievable and demanding timescale for investing in and rolling out service and access improvements.

This system is just one potential scenario to help understand the potential performance and cost of EPR. If EPR legislation is passed in the State, adjustments to these operational design characteristics could be made. As these results are based on a system five (5) years after the program starts, they represent a first step in improvements and EPR could achieve greater performance 10 or 15 years beyond the program start state.

To identify system operational characteristics to analyze as part of a future EPR system, the project team first created a list of operational characteristics that are generally most impactful to a recycling system. These operational characteristics were agreed on with MDE and are based on the Project Team's decades of experience working with and modelling recycling programs. The seven (7) operational characteristics reviewed as part of this analysis are summarized in **Table 53**.

Table 53: Operational Characteristics Reviewed

Operational Characteristic	Description	Expected Impact
Residential Curbside Recycling Collection Frequency	How often material is collected from residential households.	The frequency of collection impacts the quantities of covered PPP collected and the cost of collection. When households have more frequent collection more material overall is collected from these households, but this increases frequency requires additional trucks and staff increasing cost.
Residential Curbside Recycling Access	Which residential properties have access to curbside recycling.	When more households have access to recycling, the overall number of households participating is likely to increase, which impacts the total volume of material collected and the cost of collection.
Commercial Access	Which commercial properties have access to curbside recycling.	Some commercial entities work directly with recyclers to send their materials to end market, while other rely on collection of mixed materials. Expanding access to more commercial entities is expected to increase participation leading to additional material capture and costs.
Curbside Collection Method	How is curbside material collected (single-stream, dual-stream etc.)	The collection method of materials (single-stream or dual-stream) impacts the level of contamination of the collected materials and the cost of collection.
Education and Recycling Compliance	What is the level of education and awareness initiatives across the State including compliance in proper sorting between recycling and non-recycling.	Education in recycling can help support increased participation from households with active service in addition to lowering contamination has households are more likely to properly sort materials.
Technology Investment	What is the level of investment in MRF/Composting technology and infrastructure.	Technology can also properly sort material to increase yields of collected material. This technology requires investment which increases cost.
Accepted Materials	What covered materials are accepted in curbside programs statewide.	When more materials are accepted as part of curbside programs, the overall capture of covered PPP increases.

To define the future system to be modeled, the Project Team facilitated a two (2) hour workshop with MDE and the EPR Advisory Council on December 17, 2024. Members of the Council were provided with an advanced version of workshop materials that included the list of operational characteristics for discussion, which could be modeled in the future state EPR system design. For example, as part of the discussion on frequency of curbside collection, the Project Team and the Council discussed the following frequency options:

1. Current service frequency for recycling remains the same. Jurisdictions with new service under EPR get every other week recycling collection.

2. All households receive recycling collection every other week.

3. All households receive recycling collection weekly.

4. The frequency for recycling collection for all households is at the same frequency as garbage collection.

For each characteristic, the Project Team explained how the changes may impact the system and identified which characteristics were most impactful for performance and cost.

Table 54 includes a description of each operational characteristic, both at baseline and in the future state, included as part of this analysis based on feedback from the Advisory Council and Maryland Department of Environment (MDE). More information on these characteristics is provided within this Needs Assessment.

Table 54: Operational Changes Modeled as Part of EPR in Maryland

Operational Characteristic	Characteristic at Baseline	Future State to Be Modeled
Residential Curbside Recycling Access	Approximately 78% of households have active service. This includes 89% of single-family households and 49 % of multi-family households.	Access to curbside recycling is expanded to all households with curbside garbage collection (equivalency).
Residential Curbside Recycling Collection Frequency	The most common collection frequency is weekly with some jurisdictions collecting every other week.	Current service frequency remains the same. Jurisdictions with new service under EPR get every other week collection.
Commercial Access	The hauler survey confirmed jurisdictions with commercial garbage are also provided commercial recycling. Six (6) counties surveyed mentioned that they have limited commercial curbside collection. Large offices must recycle.	Recycling services are offered to all commercial entities with increased participation compared to baseline. There are an estimated additional 10,000 commercial businesses with service, a 15-20% increase. There is also an assumed increase in source separated paper and cardboard collection to bring commercial recycling rates of these material to national averages.[45]
Curbside Collection Method	The most common collection method is single stream, with three counties reporting dual stream.	Collection method for current service remains the same. New service is provided in a similar proportion to current service (84% of new service is single stream and 16% of new service is dual stream)
Education and Recycling Compliance	Many jurisdictions currently run education and outreach programs. One-third of jurisdictions surveyed reported annual household spending on education/outreach ranging from $0.50 to $2 per household.	Investment in education set at best practice level (~$10/household).[46]
Technology Investment	Of the MRFs that responded to surveys, some MRFs have access to ballistic separators, optical sorters, and air classifiers but no technology is universal across all MRFs. Recycling processing infrastructure includes state of the art single-stream facilities, dual-stream facilities, mini-MRFs, and push & bale facilities. Composting infrastructure to manage packaging varies depending on Tier I and Tier II classifications.	Targeted investment at MRFs to manage key materials where there is capacity for adding/expanding equipment. Support existing Tier II composting facilities to accept compostable plastics/packaging. More details are provided in **Appendix C: Infrastructure and Capacity.**
Accepted Materials	Most MRFs accept the following materials: OCC, other paper, metals, plastic containers, glass, and some other materials depending on the facility equipment, capacity, and contracts with jurisdictions.	Materials based on statewide waste characterization to develop a uniform materials list. Mono material flexibles (e.g., plastic film, etc.) would be recovered via drop-off. More detail is provided in the following **Section 11.2.**

Section 11.2 includes more details on how each operational characteristic's impacts on performance and cost was determined. In summary, the future EPR system in Maryland modeled, includes the following:

- Curbside recycling collection is provided to all households which have curbside garbage collection, for both single and multi-family households. Drop-off recycling is provided to other households. See **Section 11.2.2** for details.

- For households who currently have curbside recycling, collection frequency remains the same and new households would have collection every other week. This is the same for single and multi-family households. See **Section 11.2.1** for details.

- Across the State, the PPP would be collected through single-stream and dual-stream methods. An estimated 84% would have single-stream and 16% dual-stream. See **Section 11.2.4** for details.

- Additional materials would be accepted in curbside recycling compared versus present day and mono-material plastic film would be accepted at drop-off programs. See **Section 11.2.6** for details.

- There would be increased annual investment in education and compliance which may improve participation in recycling and proper separation of materials. Per the county survey this is about five (5) times the current average in the State. See **Section 11.2.5** for details.

- Capital investments would be made in MRFs and compost facilities to improve technology for better recovery of collected materials. See **Section 11.2.7** for details.

11.2 Analysis Methodology

The following sections provide more information on the steps taken to evaluate the changes in performance and cost from the 2022 baseline of each of the system operational characteristics.

11.2.1 Frequency

Based on the discussion with the Advisory Council and MDE, the Project Team modeled a system where the frequency of collection remains the same in the future as in 2024 for households currently with service. Households that do not have a curbside recycling service but do have curbside garbage service would be provided with every other week curbside recycling collection.

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[45] American Forestry and Paper Association. 2024. Paper Industry Announces 2023 U.S. Paper Recycling Rates Using Updated Methodology. Paper Industry Announces 2023 Recycling Rates | AF&PA

[46] The Recycling Partnership. 2021. Paying it Forward: How Investment in Recycling Will Pay Dividends https://recyclingpartnership.org/wp-content/uploads/dlm_uploads/2021/05/Paying-It-Forward-5.18.21-final.pdf

11.2.2 Residential Curbside Recycling Access

For future system performance enhancement modeling, the Project Team expanded residential curbside access to households within the state that have access to curbside garbage. There is no existing data on how many households have curbside garbage; therefore, based on stakeholder surveys the Project Team assumed that all households except for a select few counties have curbside garbage and recycling. The counties listed below were identified as not receiving curbside garbage based on responses to the county survey and follow up interviews and discussions. Those counties include:

- Allegany County

- Dorchester County

- Garrett County

- Somerset County

- St. Mary's County

- Washington County

While these counties may not have universal curbside garbage, there is likely a proportion of households which do have the service, either through their county or municipality, or through the open market. To estimate what proportion of households that have curbside garbage, the Project Team conducted a comparison utilizing the following two (2) metrics:

1. Households within each county that fall outside of Census Designated Places (CDPs) and municipalities. These households are likely to be more remote than others in the county.

2. Comparing the number of households outside of CDPs and municipalities with the number of estimated households to *not have curbside recycling services*.

The Project Team then took the lower of these two (2) values as the number of households that do not have curbside garbage collection – as it was assumed that if households elect to have recycling services, they will have garbage services. The results of the comparison for the identified counties are shown below:

Table 55: Methodology to Estimate Number of Households without Curbside Garbage

County	Estimated Single-Family Households Without Recycling Service	Estimated Households Outside of CDPs	Estimated Number of Households without Garbage Curbside (lower value of two populations)
Allegany County	11,000	7,500	7,500
Dorchester County	13,000	7,300	7,300
Garrett County	10,000	14,500	10,000
Somerset County	7,600	5,400	5,400
St. Mary's County	24,300	25,200	24,300
Washington County	21,000	17,300	17,300

Total	87,100	77,153	71,900

In total, 71,900 single-family households are estimated to not have curbside garbage service in Maryland. This represents 3% of all households in the state, and 4% of all single-family households. The remaining households within the State except for these 71,900 were modeled as having curbside recycling services in the future under EPR.

To understand the impact of expanding the service, the Project Team used the same baseline capture rates for households that currently have service and applied that rate to households with new service.

The cost of expanding curbside access was modeled in the same way as baseline, as discussed in **Section 10.1.5**.

11.2.3 Commercial Recycling Access

The Project Team determined which sectors of commercial entities would receive curbside recycling services under EPR. This was determined by identifying businesses with waste streams that are likely to contain PPP. The project team used NAICS codes and Census County Business Pattern data to find the total number of businesses in Maryland by business type. The Project Team then determined which of these businesses would be targets for collection under an EPR scenario (i.e. those that generate high proportions of PPP). Those businesses are shown below:

Table 56: Number of Businesses in Scope in Maryland

NAICS Code	NAICS Description	# of Businesses in Maryland (Census County Business Pattern Data)
44-45	Retail Trade	16,667
52	Finance and Insurance	7,126
53	Real Estate and Rental and Leasing	7,453
54	Professional, Scientific and Technical Services	21,212
56	Administrative and Support and Waste Management and Remediation Services	8,478
61	Educational Services	2,245
71	Arts, Entertainment and recreation	2,253
72	Accommodation and Food Services	12,529
Total		77,963

Note: the number of businesses and NAICS codes were selected for modeling purposes, and do not reflect the same NAICS codes or number of businesses as presented in **Appendix F: Multi-Family and Commercial Recycling Service**.

A total of 77,963 commercial entities statewide are estimated to be provided collection service under a potential EPR for packaging program. The Project Team modeled a single-stream recycling service for these properties using an average yield per business of recycling of 2.2 tons per year based on responses received as part of the hauler survey. There is limited data on the tonnage of recycling collected from businesses; therefore, this is a sensitive assumption.

In addition to a greater number of businesses receiving single-stream recycling, the project team also modeled an increase in source-separated tonnage of paper and cardboard from the commercial sector. The Project Team used average commercial capture rates from the America Forestry and Paper Association (AF&PA) of 65% for paper, and 71% for OCC/Cardboard.[47] These rates were applied to cardboard and paper not collected via single-stream.

11.2.4 Curbside Collection Method

The curbside collection system improvement assumed under EPR for packaging was split between single-stream and dual-stream recycling. Single-stream recycling was provided to 84% of the new households, while dual stream recycling was provided to 16% of new households. This split mirrors the current percentage split of single versus dual-stream collection in the State. The Project Team did not model a different collection yield for single-stream versus dual-stream for targeted PPP as there was no data to suggest different quantities of target material collected per household within the source data. This means households recycle the same volume of material whether they have single-stream or dual-stream collection. The Project Team did model a difference in the level of contamination collected for each stream using data from the MRF survey.

Households with dual-stream recycling had a contamination rate that was more than 50% less than those of single-stream recycling (see **Table 57**). This primarily impacts the cost of collecting and sorting the recyclables, rather than impacting collection and recycling rates.

Table 57: Average Contamination Percentage by Collection Type

MRF Type	Average Contamination Percent from MRF Survey
Single-Stream	22%
Dual-Stream	10%

11.2.5 Education and Recycling Compliance

Under EPR, counties were assumed to spend additional funds for education and compliance in line with best practice of around $10/household. While the impact of

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[47] The American Forest & Paper Association (AF&PA). 2023. Paper Industry Announces 2023 U.S. Paper Recycling Rates Using Updated Methodology https://www.afandpa.org/news/2024/paper-industry-announces-2023-us-paper-recycling-rates-using-updated-methodology

education and compliance are difficult to isolate, The Recycling Partnership estimated that education could amount to a 20-point increase in recycling rate for the residential sector.[48]

The Project Team did not assume a 20-point increase to recycling as a result of education and compliance. The Project Team modeled a system where material-specific capture rates at curbside increase to those seen in another established curbside EPR program, Ontario. Ontario has an established program with quality available data. A comparison between the single-family capture rate and the Ontario capture rate figures are shown in **Table 58** below.

Table 58: Capture Rate for Single-Family Households with Curbside Services

Material Category	Average Single Family Capture Rate for Households – Maryland Baseline	Capture Rate from Ontario Program[49]
Metal Packaging	30%	61%
Rigid Plastic	32%	44%
Flexible Plastic	0%	7%
Glass	31%	77%
Paper	32%	65%
OCC/Cardboard	44%	71%
Cartons	10%	40%
Total	**30%**	**60%**

ADC for glass is not considered recycling within the above table; however, in Maryland ADC is currently considered recycling.

The Project Team assumed that the Regions which were performing highest in 2022, the baseline year, could achieve the Ontario recycling rates for single-family households. Regions with lower recycling rates than the statewide averages at the 2022 baseline were then modeled with a discounted collection rate that took their ratio of performance versus the statewide average baseline capture rate of 40%. The ratio was calculated by:

- Taking Region X's baseline capture rate of 30%

- Dividing by statewide average baseline capture rate of 40%

- This then would yield a ratio of 0.75 for Region X

This ratio was then multiplied by the Ontario figures to achieve a more realistic, Region-specific capture rate for all Regions.

This was done for all single-family households in a Region. Multi-family households were assumed to have a capture rate that is 75% of the capture rate of single-family households (see **Section 10.1.2** for further explanation).

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[48] The Recycling Partnership. 2021. Paying it Forward: How Investment in Recycling Will Pay Dividends https://recyclingpartnership.org/wp-content/uploads/dlm_uploads/2021/05/Paying-It-Forward-5.18.21-final.pdf

[49] 2021-SO-Four-Step-Fee-Model-ABC.xlsx, referred to as "recovery" in source data

11.2.6 Accepted Materials

The Project Team established a common list of accepted materials based on an assessment of recyclability conducted for the Colorado Department of Public Health's (CDPHE) Needs Assessment. It should be noted that this list is used for modeling purposes only. The actual materials accepted under EPR in the state of Maryland may differ due to Maryland's definitions in statute and the plan submitted to MDE aligning with that statute. This assessment analyzed the collection, sortability, and end markets for various packaging and paper products. Additionally, the project team modelled "drop-off only" materials which are currently difficult to collect and recycle through curbside streams. A summarized list is shown below:

Table 59: Material Acceptance under EPR

Material	Accepted in Curbside	Accepted in Drop-Off Only	Not Accepted
Aluminum Cans	X		
Other Aluminum (e.g., trays)	X		
Tin/Steel Cans	X		
PET #1 Bottles	X		
PET #1 Other (e.g., trays)	X		
HDPE #2 Natural Bottles	X		
HDPE #2 Colored Bottles	X		
HDPE #2 Non-Bottle	X		
PP #5	X		
Plastic #3-7	X		
Expanded Polystyrene (EPS)		X	
Mono-Material Film		X	
Multi-Material Film			X
Glass Bottles & Jars	X		
Mixed Paper Products	X		
Other Paper Packaging	X		
Old Corrugated Cardboard (OCC)/Cardboard	X		
Cartons/Polycoats	X		

11.2.7 Technology Investment

The Project Team modeled MRF improvements as discussed in the **Appendix C: Infrastructure and Capacity** Technical Memorandum. The impact of the MRF improvements were assumed to bring the residue rates (excluding contamination) to the best in class in the State currently. This meant that the average single-stream loss rate for target materials is 9% in the EPR scenario. Additionally, the Project Team modeled a glass cleanup system for each single stream MRF in the state. It is assumed that this investment

would allow glass which is collected curbside to be sent to recycling applications, rather than beneficial reuse (e.g. alternative daily cover).

11.2.8 Curbside Costs

See **Section 10.1.5** methodology for details on cost calculations.

11.2.9 Drop-Off Costs

The Project Team estimated the cost of drop-off service for the future EPR for packaging by using average costs to operate unstaffed drop-off provided by Maryland Environmental Service (MES), of $260 per ton, plus salary information from the Maryland Bureau of Labor Statistics Data (average salary of $42,000 for a Refuse and Recyclable Material Collector). Drop-off costs for a future EPR scenario assume that all drop-off centers in Maryland would have one (1) FTE with an average salary of $42,000. Employee benefits of approximately 45% of an employee's salary were also included based off employee benefit costs taken from the US Department of Labors Bureau of Labor Statistics. The Project Team then applied this to the tonnage of material estimated to be collected through drop-offs in each Region in the future EPR scenario.

The future EPR scenario also included a new dumpster in each drop-off center for plastic film. The cost of a new dumpster, assuming a useful life of 15 years, was multiplied by the number of drop-off centers within each region.

The employee salary, employee benefits, and new dumpsters costs were added to the cost of operating unstaffed drop-off centers to get the total cost for drop-off centers in the future EPR scenario.

11.2.10 Out of Scope Costs

This analysis includes the cost to collect and recycle covered PPP under the system described in **Table 54**. There are additional costs the producer responsibility organization (PRO) may incur when setting up a system that were not included as part of this analysis. This might include startup costs such as hiring and setting up a local Maryland team to implement a program plan, reimbursement costs to the State for program development, or building up fund reserves so there is enough funding to consistently implement a program.

11.3 Recycling Access and Recycling Rates

The following section provides an overview of the performance of the potential EPR system for PPP recycling in Maryland.

During the 2022 baseline year, approximately 78% of households had active service for curbside recycling. This includes 89% of single-family households and 49% of multifamily households. Active service refers to a household which either has service automatically provided or has the ability to subscribe to the service and chooses to do so.

Table 60 summarizes the households with active service to curbside recycling under EPR. Under an EPR program active service would increase to 97% in total. This 21-point increase

is a result of the Project Team assuming that all households with curbside garbage would receive curbside recycling under EPR. Active service for single family households would increase to 96% and multi-family households would increase to 100%. Multi-family households are more common in urban areas where curbside garbage is standard while there are some single-family homes in rural areas that have drop off garbage collection. The Lower Eastern Shore Region would see the greatest increase in active service from an estimated 27% in 2022 to 97% under EPR.

Table 60: Projected Households with Active Curbside Recycling Service Under EPR (percent)
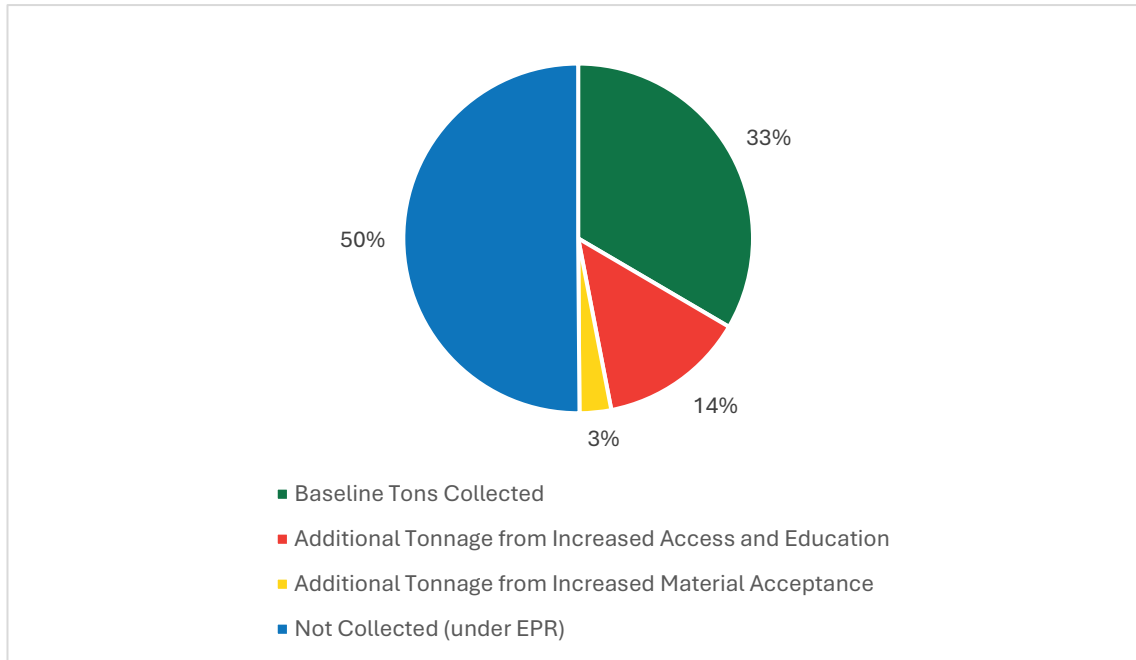
Region	Single Family	Multi-Family	Total
Western Maryland	61%	100%	68%
Washington Metro	100%	100%	100%
Baltimore Metro	100%	100%	100%
Southern Maryland	81%	100%	83%
Upper Eastern Shore	100%	100%	100%
Lower Eastern Shore	85%	100%	90%
Statewide	**96%**	**100%**	**97%**

EPR for PPP has the potential to create a statewide accepted materials list which harmonizes recycling programs, so all households are able to recycle the same PPPs either through curbside or drop-off facilities. A summary of the acceptance for different material types under EPR is included in **Table 59**.

Under the EPR system modeled, 50% of residential materials are collected in either curbside (96%) or drop off programs (4%). This is an improvement from baseline as currently only 33% of covered PPP is collected statewide, as shown in **Figure 34**. At baseline, 91% of this material is collected in curbside programs and 9% is collected as part of drop-off programs.

Figure 34: Capture of Covered PPP at Baseline and Under EPR (All Residential)

In 2022 it is estimated that 984,400 tons of covered PPP was recycled in Maryland. This includes 676,500 tons in the commercial sector, 269,300 tons from single-family homes, and 38,600 tons from multi-family homes. **Table 61** shows the estimated recycling performance of different generators when EPR is fully in place assumed to be approximately five (5) years after initial implementation. The total volume of material recycled would increase to 1,445,000 tons. The area with the greatest increase of materials is the Baltimore Metro Region with tons increasing from 367,400 tons at baseline to 612,000 under EPR. The high increase in the Baltimore Metro Region is due to multi-family recycling access increasing from 39% to 100% under EPR. Residential properties could recycle an additional 200,000 tons of material under EPR.

Table 61: Estimated Volume of Covered PPP Recycled in Maryland Under EPR by Generator (tons)

Region	Single Family	Multi Family	Commercial	Total
Western Maryland	10,200	1,400	51,700	63,300
Washington Metro	175,800	45,200	333,800	554,800
Baltimore Metro	199,100	31,900	381,200	612,200
Southern Maryland	23,800	1,500	48,700	74,000
Upper Eastern Shore	16,600	1,400	75,900	93,900
Lower Eastern Shore	8,800	1,700	36,300	46,800
Statewide	**434,300**	**83,100**	**927,600**	**1,445,000**

In the 2022 baseline it was calculated that the commercial sector had the highest recycling rate at 39%, followed by single family households (30%) and multi-family households

(16%). **Table 62** shows the recycling performance of different sectors in the future. Overall, the recycling rates improves from 34% at baseline to 50% under EPR. The recycling rate performance improves the most for multi-family households as more households have access. The recycling rate for multi-family households is estimated, based on the assumptions provided above, to increase from 16% in 2022 to 34%. Overall residential properties have higher increases in recycling rates compared to commercial properties. Many commercial properties are already sending materials that they generate high volumes of such as OCC/cardboard directly to recyclers limiting opportunities to increase recycling rates for those materials. Residential properties have greater increases in access under EPR which supper higher recycling rates. The area with the greatest recycling rate increase is the Lower Eastern Shore Region, where the recycling rate increases from 13% at baseline to 38% under EPR.

Table 62: Estimated Recycling Rate of Covered PPP in Maryland Under EPR by Generator Type (percent)

Region	Single Family	Multi Family	Commercial	Total
Western Maryland	22%	18%	55%	43%
Washington Metro	59%	44%	54%	55%
Baltimore Metro	48%	29%	50%	48%
Southern Maryland	40%	32%	55%	49%
Upper Eastern Shore	38%	28%	62%	55%
Lower Eastern Shore	25%	14%	48%	38%
Statewide	**48%**	**34%**	**53%**	**50%**

To achieve the recycling rates of covered PPP shown above, the capture rate of material would need to improve accordingly. At baseline approximately 40% of material generated is captured from households with active curbside recycling collection. **Table 63** shows how these capture rates improve under a system with EPR. In some cases, the pounds per household decrease as most of the households who gain service under EPR have lower capture rates, particularly multi-family units.

Table 63: Estimated EPR System Household Capture Rate of Residential Covered PPP

Region	Total Pounds per Household (Baseline)	Total Pounds per Household (EPR)
Western Maryland	429	245
Washington Metro	347	587
Baltimore Metro	379	444
Southern Maryland	342	441
Upper Eastern Shore	399	382
Lower Eastern Shore	458	192
Statewide	**371**	**475**

Table 64 and **Table 65** show similar information presented in **Table 61** and **Table 62** but rather than presenting the recycling data by the generator type, these tables provide the

information by material for each County. Overall, the total volume of material recycled improves from 984,400 tons to 1,445,000 tons. The material type with the greatest increase in recycled tons is OCC/Cardboard, with tons increasing from 523,700 tons at baseline to 697,000 under EPR.

Table 64: Estimated Volume of Covered PPP Recycled in Maryland Under EPR by Material Type (tons)

Region	Metal	Rigid Plastic	Flexible Plastic	Glass	Paper	OCC/ Cardboard	Cartons	Total
Western Maryland	3,000	2,800	2,200	2,600	16,000	36,300	200	63,100
Washington Metro	20,500	37,100	8,800	55,300	183,100	247,400	2,700	554,900
Baltimore Metro	19,100	40,200	20,300	26,900	195,600	306,800	3,300	612,200
Southern Maryland	6,200	5,300	2,200	4,500	23,500	31,900	400	74,000
Upper Eastern Shore	1,500	15,300	1,900	2,500	20,400	51,900	300	93,800
Lower Eastern Shore	2,000	4,400	2,400	2,200	13,000	22,900	100	47,000
Statewide	52,300	105,100	37,800	94,000	451,600	697,200	7,000	1,445,000

ADC for glass is not considered recycling as part of the future state assessment. However, in Maryland ADC is currently considered recycling.

PPP material recycling rate increases under the designed EPR system are estimated as follows and detailed in **Table 65**:

- Metal increases from 30% to 44%
- Rigid plastic increases from 27% to 33%
- Flexible plastic increases from 0% to 9%
- Glass increases from 24% to 43%
- Paper increases from 37% to 59%
- OCC/Cardboard increases from 52% to 69%
- Cartons increases from 8% to 17%

Table 65: Estimated Recycling Rate of Covered PPP in Maryland Under EPR by Material Type (percent rounded)

Region	Metal	Rigid Plastic	Flexible Plastic	Glass	Paper	OCC/ Cardboard	Cartons	Total
Western Maryland	46%	20%	11%	34%	43%	62%	10%	43%
Washington Metro	53%	35%	7%	51%	66%	72%	23%	55%
Baltimore Metro	35%	28%	10%	37%	57%	69%	16%	48%
Southern Maryland	64%	35%	11%	32%	58%	64%	18%	49%
Upper Eastern Shore	31%	61%	11%	31%	55%	68%	16%	55%
Lower Eastern Shore	34%	29%	10%	24%	42%	61%	5%	38%
Statewide	**44%**	**33%**	**9%**	**43%**	**59%**	**69%**	**17%**	**50%**

ADC for glass is not considered recycling within the above table; however, in Maryland ADC is currently considered recycling.

Table 66 summarizes the volume recycled and recycling rate for different materials by different generator types. All materials and generator types see an increase in recycling rate performance under EPR. Cartons see some of the highest increases in recycling rates for residential households as they would now be collected as part of curbside collection under the modeled EPR system. Metal, glass, and OCC/cardboard also see large jumps in recycling rates and overall higher recycling.

Table 66: Estimated Volume and Recycling Rate of Covered PPP Under EPR by Material Type and Generator

Material	Single Family (tons)	Single Family (percent)	Multi Family (tons)	Multi Family (percent)	Commercial (tons)	Commercial (percent)	Total (tons)	Total (percent)
Metal	26,100	49%	4,800	35%	21,600	41%	52,500	44%
Rigid Plastic	52,900	39%	9,900	27%	42,400	28%	105,200	33%
Flexible Plastic	12,700	11%	1,500	5%	23,600	9%	37,800	9%
Glass	61,800	55%	12,400	40%	19,900	26%	94,100	43%
Paper	142,500	54%	29,100	40%	279,900	65%	451,500	59%
OCC/Cardboard	134,600	66%	24,800	46%	537,600	71%	697,100	69%
Cartons	3,700	27%	700	20%	2,500	11%	6,900	17%
Total	434,300	48%	83,100	34%	927,600	53%	1,445,100	50%

ADC for glass is not considered recycling within the above table; however, in Maryland ADC is currently considered recycling.

11.4 Recycling Costs

This section of the Needs Assessment provides an estimated net cost of the recycling system which manages covered PPP under EPR. The recycling system includes both curbside and drop-off recycling for the residential and identified business within the commercial sector. The results include the costs of collecting and sorting these materials and the costs associated with improving drop-off facilities and equipment at MRFs and composting systems as detailed above. Collection costs under EPR for the residential and commercial sector were calculated in the same method as described in **Section 10.1.5.** These costs are net of material revenue. **Table 67** includes the total net cost of this recycling system under EPR in addition to the net cost per ton and net cost per household. Under EPR, stakeholders across the recycling system pay approximately $550 million to collect and sort covered PPP, an increase of about $150 million from the 2022 baseline. This is approximately $378 per ton recycled and if the cost was apportioned across households in the state, the average cost per household increase by 20% over the baseline to $12.4 from $9.7 per household per month. Overall, the cost per ton recycled decreases as the volume collected increases.

Table 67: Estimated Cost of Recycling Covered PPP Under EPR ($)[1]

Region	Total Annualized Costs	Cost Per Ton Collected	Costs Per Ton Recycled	Costs per Household per Month (All Households)
Western Maryland	$17,256,000	$242	$263	$7.50
Washington Metro	$223,737,000	$354	$403	$14.80
Baltimore Metro	$217,726,000	$313	$356	$11.30
Southern Maryland	$34,995,000	$416	$473	$13.70
Upper Eastern Shore	$37,619,000	$353	$401	$15.00
Lower Eastern Shore	$16,998,000	$320	$362	$6.50
Statewide	$548,330,000	$333	$378	$12.40

1 Costs are shown per ton as collected (pre-sorting), and per ton recycled (input into a processor)

Table 68 shows how the costs break down across different generator types. Residential curbside collection (single-family and multi-family) makes up nearly two-thirds of the total cost. Although commercial entities recycle more material than residential entities, the cost of their service is lower as many commercial facilities have agreements to send their materials directly to processors especially for cardboard which is done at a low or no cost. The Project Team assumed a useful lifetime of 10 years and an interest rate of 7%, when calculating MRF upgrades annualized capital costs. A majority of the increased cost from baseline comes from the residential curbside collection as this increases from $276,452,000 at baseline to $358,863,000 under EPR.

Table 68: Estimated Total Annual Costs of Recycling Covered PPP by Generator Type Under EPR ($)

Region	Residential Curbside	Commercial Curbside	Drop-off Costs	MRF Upgrades (Annualized Capital Costs)	Compost Facility Upgrades Annualized Capital Costs)	Total
Western Maryland	$7,234,000	$7,374,000	$2,072,000	$576,000	$0	$17,256,000
Washington Metro	$151,530,000	$69,967,000	$1,862,000	$378,000	$811,000	$224,548,000
Baltimore Metro	$154,266,000	$60,108,000	$2,719,000	$633,000	$0	$217,726,000
Southern Maryland	$20,407,000	$11,850,000	$2,738,000	$0	$0	$34,995,000
Upper Eastern Shore	$17,419,000	$18,923,000	$1,277,000	$0	$557,000	$38,176,000
Lower Eastern Shore	$8,007,000	$7,636,000	$1,355,000	$0	$272,000	$17,270,000
Statewide	**$358,863,000**	**$175,858,000**	**$12,023,000**	**$1,587,000**	**$1,640,000**	**$549,971,000**

Table 68 shows the annual costs of the system including the operating and annualized capital costs. Total capital costs for MRF capacity upgrades were calculated in the **Appendix C: Infrastructure and Capacity Technical Memorandum**. These costs were then annualized by assuming a 7% interest rate, and a conservative useful lifetime of 10 years.

In addition to the annualized MRF upgrades in **Table 68,** two new MRF expansion projects are currently planned and could be operational by the start of an EPR program. The combined total MRF capital costs are estimated at between $75-$85 million.[50] In a scenario where these costs are reimbursed on an annual basis by the EPR program, The Table below shows these costs annualized in the same way as capital costs in **Table 69**. The table assumes a total expenditure cost of $80 million and varies based on the useful life of the MRF.

Table 69: Annualized Cost of New MRF Expansions

	Annualized Cost (15-year useful life)	Annualized Cost (10-year useful life)
Annualized Cost of New MRF Expansion ($)	$6,298,000	$8,844,000

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[50] These estimated costs are based on publicly available information gathered from facilities that have allocated funds and are currently undergoing facility upgrades as described in Section 5.4.

Depending on the useful life of the new MRFs, the annualized cost of the investments could be between $6.3 million and $8.8 million per year. This could be added on to the $550 million total cost of the operations of the program in **Table 69**, resulting in a total annual cost between $556 and $558 million.

Table 70 shows the gross capital costs required to support the EPR system. This $20 million includes capacity upgrades for MRFs and compost facility upgrades to managed covered PPP.

Table 70: Gross Capital Upgrade Costs for Facilities

Capital Description	Statewide Capital Cost
MRF Capacity Upgrades (including glass clean-up)	$9,650,000
Composting Upgrades	$8,425,000
Total	**$19,575,000**

If factoring in the new MRF expansion costs of $80 million, the total MRF investment cost could be approximately $100 million.

An EPR system in Maryland will move the financial cost of recycling covered PPP at its end of life from local government to producers. The investment in the system and expansion of services to nearly all residential households would be paid by the PRO rather than the counties or households that are currently paying for this service today. The future system analyzed results in more material being recycled at a lower cost of recycling per ton recycled. The total cost of recycling increases as there are more households are being serviced and more material overall is collected.

As the costs would be covered by the PRO, governments and households could use the savings to support expanding waste management services to other non-PPP categories such as rolling out programs to collect organic waste.

11.5 Impact and Policy Design

Beyond increasing the recycling rate, EPR has the potential to create wider benefits for the Maryland environment and the economy. **Table 71** summarizes the greenhouse gas (GHG) reduction, increased jobs, and the value of material captured. Utilizing the Environmental Protection Agency's (EPA) WARM tool, an EPR system could reduce GHG by an additional 1,000,000 metric tons which is equivalent to taking 233,255 gasoline powered passenger vehicles off the road. Furthermore, this system could generate an additional 2,075 jobs. These are the total jobs generated and could be created in regions outside of Maryland as some collected material is sent outside of the state for processing. The value of the material recycled in the system will also increase from $149 million to $202 million.

Table 71: Estimated Benefits of Recycling System at Baseline and Under EPR

	GHG Reduced (thousand MTCO2E)	Jobs	Material Value Recycled ($M)
Baseline System	-3,080	6,770	$149
EPR System	-4,099	8,845	$202
Difference	**-1,019**	**2,075**	**$53**

These results provide insight into the benefits an EPR program designed based on the above system characteristics could deliver in Maryland. The estimated recycling rate of 50% could be a realistic target for a program five (5) years after the program starts, noting that it may take two (2) to three (3) years to go through the regulatory process, set up the PRO systems, develop the PRO plan prior to the program beginning after a bill is passed.

The specific operational characteristics used to model the future state show where the system could improve but legislation does not need to be this prescriptive if both a target for access as well as recycling rate is provided. Curbside access requirements that, for example, state that recycling has to be provided to all households that have curbside garbage collection has been written into legislation in other states (Colorado). If the government is given oversight responsibilities, they could work with the PRO during program plan development to identify how to design and implement a program that meets overarching goals without the need for overly prescriptive requirements set out with the legislation.

This Needs Assessment focused on the collection and recycling of covered PPP in Maryland. PPP EPR programs are increasingly including goals that go beyond recycling including setting targets for source reduction and reuse of materials. Although not reviewed as part of this study, these types of requirements could further support a circular economy in Maryland. Overall, source reduction and reuse targets are only just recently emerging in legislation globally, setting realistic targets or allowing the PRO to define these targets and being clear on the methodology for measuring compliance is more challenging and there is little best practice to call on which should be noted when considering integrating these targets into EPR legislation.

12 Conclusion

The following present key themes and conclusions from the Needs Assessment that are intended to inform the EPR for packaging legislation in the State and future program planning:

- **EPR for packaging can play a pivotal role in advancing long-term climate action planning and zero waste initiatives in the State.** Creating a sustainable funding mechanism and policy framework, EPR for packaging can support local zero waste plans by providing support at the State level to drive implementation that may not be possible solely at the local level. Supporting interstate collaboration and leveraging collective purchasing power can enable cost-effective solutions for Maryland and neighboring states, but jurisdictional challenges may complicate unified approaches across state lines.

- **Aligning future EPR program targets with existing operations, harmonizing education and outreach, and justifying investments in infrastructure on a regional basis has potential to increase the State's recycling rate of PPP from 34% to 50% or greater.** Benefits under the modelled EPR system include $202 million of material value recycled (an increase of $53 million from the baseline), a reduction of more than 1 million metric tons of CO_2E, and the creation of 2,075 additional jobs. Additionally, the increased investment in infrastructure and local jobs would occur, without significant impacts to state capital or operations budgets. The PRO should coordinate with County and/or municipal stakeholders to determine how to balance current operations with further expansions to achieve an increase in the State's recycling rate.

- **As the State coordinates with the PRO to plan for implementation of EPR, it is critical to support communities to increase participation and increase quality and volume of recycling while minimizing negative environmental impacts.** Balancing these priorities to align with the State's commitment to environmental justice and net-zero commitments would support sustained, long-term improvements in the statewide recycling rate. Increasing capture rate is important for improving recycling program performance, but deploying equipment and developing infrastructure may increase health and human impacts on overburdened communities. Increased collection vehicle or facility emissions, roadway damage, and property damage may be disproportionately impacted on areas need to be offset by financial support, technology upgrades, education/outreach support, contracting support, fueling infrastructure, hiring local MWBE businesses.

- **Clearly defined expectations during EPR for packaging program design and implementation for the PRO are essential to expand recycling access, investment in recycling infrastructure, and detailing the responsibility of multiple parties (e.g., MDE's role in the program).** There are recycling facility investments currently being made in the State, which will be relevant to the PRO as

reimbursement, performance, etc. are discussed in future program planning efforts. Stakeholders also seek further understanding of MDE's role in compliance, reporting, and rulemaking.

- **Lessons from other EPR programs, such as those for tires and batteries, highlight the importance of balancing policy mechanisms with administrative feasibility**. Establishing forward-thinking and transparent internal controls and reporting requirements for a potential EPR for packaging program positions the State and PRO for long-term success. For example, while point-of-sale reimbursements offer potential and may work for other EPR program types (e.g., tires, batteries, etc.), the accounting and administrative demands require careful consideration and may not be fit for EPR for packaging.

- **Program implementation should balance the quality of dual-stream or multi-stream collection and processing systems with the convenience and increased volume generated by single-stream collection.** Single-stream systems offer improved convenience for residents, as they allow recyclables to be placed in one bin without the need for self-sorting. This convenience often leads to higher participation rates and volumes of materials collected, but the ease also results in more contamination which must be removed at MRFs with higher levels of automation. Other areas of the State are best fit for a cost-effective hub-and-spoke systems on a regional basis to collect and transport dual-stream, multi-stream, or drop-off station material to end markets.

- **EPR for packaging will improve recycling rates across the state, while also increasing recycling access in currently underserved communities.** The varied types of recycling programs in the State contribute to inconsistencies in education, outreach, and compliance efforts across the State. EPR for packaging can establish a list of materials that must be recycled and support the diverse needs throughout the State to upgrade contracts, programs, education, and facilities required to build consistency across different jurisdictions and where generators live, work, and recreate.