Maryland
Department of
the Environment

APPENDIX C

| INFRASTRUCTURE AND CAPACITY

FINAL NEEDS ASSESSMENT | MARYLAND STATEWIDE RECYCLING NEEDS ASSESSMENT

HDR

VPC VISION PLANNING AND CONSULTING

Contents

Tables

Figures

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1 Introduction

The capacity of recycling infrastructure helps to determine the ability of Maryland (State) to expand and/or optimize recycling systems. This technical memorandum summarizes existing facilities and/or operations in the recycling value chain and evaluates the current operational requirements, expansion costs, and opportunities for facility development. Additionally, this technical memorandum evaluates reuse and waste reduction infrastructure. The information presented is intended to identify opportunities to fill service and infrastructure gaps and improve consistent, accessible recyclable service to residents and businesses through an Extended Producer Responsibility (EPR) for packaging program in the State.

1.1 Background

1.1.1 Facility Permitting and Reporting

Maryland Department of Environment (MDE) regulates Solid Waste Acceptance (SWA) facilities, which require a Refuse Disposal (RD) Permit for the installation, alteration, or extension of the facility under the authority of the Environment Article, §9-204 of the Annotated Code of Maryland, and regulations at COMAR 26.04.07. As part of the RD permit, SWA Facilities are required to submit annual tonnage reports to MDE; however, recycling facilities are not required to be permitted as an SWA by MDE. Therefore, all facilities that process recycled material may not have been captured in the subsequent analysis (e.g., scrap metal recycling yards, tire recycling facilities, etc.). A list of recycling facilities, transfer stations, and composting facilities that manage and process recyclable materials is provided in **Appendix B: Residential Recycling Stream Analysis.**

Recycling tonnage data is provided to MDE through the Maryland Recycling Act (MRA) Tonnage Reporting Surveys, submitted annually by counties and the City of Baltimore. Tonnage submitted is summarized in MDE's Annual Report.[1]

1.1.2 Maryland Source Reduction Credit Program

The Source Reduction Credit Program (SRCP) is a part of Maryland waste reduction and diversion efforts, which incentivizes counties and municipalities to develop public education programs, and other practices that encourage waste reduction.

Introduced in 2000, the SRCP was created to help Maryland meet its annual waste diversion goal of 40%.[2] By offering credits for source reduction activities, the State aims to incentivize counties to reduce waste generation at its source rather than

[1] Maryland Department of Environment. 2023. "Maryland Solid Waste Management and Diversion Report." Maryland Solid Waste Management and Diversion Report.pdf

[2] Maryland Department of the Environment. "Source Reduction." https://mde.maryland.gov/programs/land/recyclingandoperationsprogram/pages/source_reduction.aspx.

focusing solely on recycling efforts. It helps the State's 23 counties and the City of Baltimore to increase their waste diversion rate by adding up to 5% to their recycling rate based on MDE's assessment of the source reduction activities.

This helps the counties contribute to the State's 40% waste diversion goal, decrease total waste generation to lower overall disposal costs, reduce energy use and pollution, extend landfill space, and conserve natural resources.

Counties and the City of Baltimore receive the source reduction credit by completing a Source Reduction Credit Checklist, including supporting documentation of ongoing or completed eligible activities. The checklist documents the various source reduction activities implemented by the county.

The checklist includes the following activities:

- Part 1 - Yard Trimmings and Food Scrap Source Reduction Credit[3]
    - Ongoing, multi-faceted public education program promoting grasscycling[4], home composting of yard trimmings, food donation, and/or home food composting. Education efforts must reach at least 30% of single-family households.
- Part 2 - General Source Reduction Reporting
    - Promotion/General Education (e.g., distribution of regular newsletter, hosting workshops, etc.)
    - Technical Assistance (e.g., on-site waste audits, personalized support on waste reductio programs, etc.)
    - Reuse and repair events (e.g., take-back program, reusable takeout container initiatives, etc.)

Unlike a points-based system, there's no fixed award assigned to individual activities. Instead, MDE reviews the checklist, considering the amount of reported activities, quality, and impact. MDE awards a credit between 0% and 5% based on this comprehensive review. This percentage is added to the county's recycling rate to determine the total waste diversion rate. The final credit awarded is based on MDE's assessment of the overall impact and comprehensiveness of the county's source reduction program. This encourages counties to focus on meaningful, effective strategies. Counties are encouraged to continuously improve their efforts each year. They can propose new activities to MDE for consideration within the checklist for future years, promoting innovation and adaptation in waste reduction strategies.

1.2 Methodology

Detailed description of the Project Team's approach to conducting surveys, desktop research, and stakeholder interviews are presented in **Appendix B: Residential**

[3] One percent of the credit awarded for each activity.

[4] Grasscycling is a method of handling grass clippings by leaving them to decompose on the lawn when mowing.

Recycling Stream Analysis along with the results of the recycling stream analysis including baseline system programs, infrastructure, and costs. The following describes the methodology by which the Project Team further assessed the information presented in the recycling stream analysis to evaluate the operational requirements, costs, and opportunities for expanding and/or optimizing the recycling infrastructure and capacity within the system.

1.2.1 Survey and Interview

As stated in **Appendix B: Residential Recycling Stream Analysis**, the Project Team surveyed known MRFs and composting facilities that process Maryland materials. Additionally, MRFs were also interviewed to gather additional information to assess recycling capacity, end markets, challenges, and opportunities for system optimization within an Extended Producer Responsibility (EPR) program for paper and packaging materials in Maryland. Transfer stations were also assessed to determine facility locations and materials accepted across the State. Specifically, the Project Team utilized survey, interview, and desktop research to gather the following information per facility type:

- **MRFs:** Location, equipment, personnel, capacity, tonnage, materials accepted, contamination rate, residue composition, capital and operating costs, infrastructure, and end markets.
- **Composting facilities:** Location, equipment, personnel, capacity, tonnage, materials accepted (particularly compostable packaging), contamination rate, residue composition, capital and operating costs, infrastructure, and end markets.
- **Transfer stations:** Location and materials accepted.

1.2.2 Facility Capacity Analysis

The Project Team evaluated the information gathered in surveys and interviews to develop a capacity analysis for MRFs in Maryland, including estimated costs for increasing capacity through capital improvements. Estimated capital costs for improvements to push and bale facilities, transfer stations, and composting facilities were also assessed based on feedback from surveys and interviews in addition to Project Team industry knowledge.

The current capacity of MRFs in Maryland is organized by current throughput and maximum throughput based on survey responses, as facilities are commonly not operated at their maximum throughput due to feedstock quantities, equipment age, contamination levels, staffing levels, etc. Through discussions with MRF operators in interviews and the Project Team's experience with MRF operations nationwide, potential facility improvements were suggested (e.g., equipment, additional shifts) that can be implemented within each unique Maryland MRF to effectively process increased volumes of packaging materials. Based on the recommended facility improvements, the Project Team estimated a potential expanded recycling capacity and associated capital costs for existing MRFs in Maryland. Note, the estimated

potential expanded recycling capacity also includes reported new capacity coming online based on new planned facilities (see **Section 4.1**).System upgrade capital costs are separated by potential costs recommended by the Project Team and planned (already in motion by the facility owner/operator) costs.

1.2.3 Categorizing Reuse and Refill Solutions

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*.[5]

Typically, reuse and refill systems can be categorized into four (4) main models developed by the Ellen MacArthur Foundation (see **Figure 1**).[6] These include the following:

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

[5] 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

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

Figure 1: Overview of Reuse and Refill Models

The Project Team assembled a database of reuse and refill programs in Maryland, including the major types of packaging and paper formats reduced by these models and the types of residential and non-residential entities to whom they are available. The Project Team also interviewed internal and external reuse and refill experts, key Maryland stakeholders, and reuse service providers to identify programs and discuss trends, challenges, and improvement opportunities for reuse and refill systems in place in Maryland and those that are not yet active in Maryland.

2 Recycling Processing Capacity

The following sections describe the current state of recycling infrastructure and capacity in terms of equipment and levels of automation, feedstocks, current and potential capacity, and costs for improvements in Maryland. Three types of facilities are considered: single stream, dual stream, and push and bale facilities/multi-stream[7].

2.1 Recycling Processing Overview

As shown in **Table 1**, there are five (5) in-state single stream MRFs, one (1) dual stream MRF, and seven (7) push and bale facilities that process Maryland recyclables.

[7] Push and bale and multi-stream facilities are combined in this Technical Memorandum due to the similarities of their operations. The **Appendix B: Recycling Stream Analysis** Technical Memorandum provides more detail on the breakdown between the two facility types.

Table 1: Material Recovery Facilities (MRFs) by Region

Region	Single-stream Facilities	Dual-stream Facilities	Push and Bale / Multi-stream Facilities	Total
Western Maryland	1	0	1	2
Washington Metro[1]	2	1	1	4
Baltimore Metro[2]	2	0	2	4
Southern Maryland	0	0	0	0
Upper Eastern Shore	0	0	1	1
Lower Eastern Shore[3]	0	0	2	2
Out-of-State	3	0	0	3
Total In-State	5	1	7	13
Total	8	1	7	16

1. Includes one (1) paper only push and bale facilities
2. Includes one (1) paper only push and bale facility
3. One (1) facility has limited single stream sorting capabilities and the other is strictly a multi-stream facility accepting source-separated materials.

This does not include industrial recycling facilities such as construction and demolition recycling operations. The majority of the facilities are located in the Regions with the largest populations, Washington Metro and Baltimore Metro Regions. Three (3) out-of-state single stream facilities also receive material from Maryland.

2.1.1 Existing Infrastructure Capacity

Based on survey data reported by nine (9) out of 13 in-state recycling facilities, the current infrastructure could manage approximately 71,400 additional tons per year compared to what is currently processed. The maximum facility throughput was derived from facility design data provided by the MRFs. As shown in **Table 2**, existing MRFs can potentially increase capacity in the Western Maryland, Washington Metro, and Baltimore Metro Regions. These are Regions where MRFs have higher levels of automation and processing capacity, whereas the facilities in the Upper and Lower Eastern Shore Regions are more manual operations that cannot accept additional tonnage.

Table 2: In-State MRF Maximum Capacity by Region (2024)[1]

Region	Current Throughput (tons/year)	Current Maximum Throughput (tons/year)
Western Maryland	18,400	30,400
Washington Metro[2]	126,800	147,000

Region	Current Throughput (tons/year)	Current Maximum Throughput (tons/year)
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 as described in Section 4.1.
2. Does not include all facilities due to survey non-response.

Facilities reported that they are not operating at maximum capacity for the following reasons:

- Operating a single shift
- Contamination slows down sorting operations
- Additional feedstock needed
- Lacking modernized equipment

Recommendations for how these facilities can improve their existing operations and increase capacity beyond facility design are provided in **Section 2.3**.

2.1.2 Contamination

MRFs indicated that the key impacts of contamination include facility downtime, lower value commodities, increased residue costs, and increased workplace injuries. The average contamination was reported to vary from 10% to 30% for single stream facilities and five (5) to 10% for dual stream. This information was self-reported, and records were not shared with the project team.

Common contaminants include plastic bags, tanglers (rope, electrical cords, string lights, etc.), batteries, propane cylinders, clothing, and bulky items. Materials like plastic bags and tanglers get caught in equipment screens and rotors, and batteries and propane cylinders can cause fires during handling and processing. Contamination can be unsafe for employees to manage causing puncture wounds or other injury.

When a MRF rejects material, it is held apart from other recyclables and the MRF pays for the cost of managing and disposing of those materials. Depending on the customer and specific contractual provisions, MRFs may charge a fee for

contaminated loads. In some cases, MRFs track rejected loads that arrive frequently from specific routes or municipalities.

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 single-stream 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.

Further information about the impact of contamination on end markets and economic opportunities can be found in **Appendix G: Recycling Economic Opportunities Technical Memorandum.**

2.2 MRF Processing Equipment

Based on survey data, nearly all in-state single stream and dual stream MRFs require equipment upgrades and modernization. Some are using equipment that is outdated and from vendors that are no longer in business, causing additional downtime due to limited supply chains for equipment repairs. The push and bale facilities use processing equipment that is designed to separate select commodities, such as large cardboard or metals from single-stream feedstock, leaving a residual blend that is shipped to another facility to complete processing of the comingled material. Many of the smaller facilities accept source-separated feedstock and bale it directly for end markets, bypassing the primary sorting system.

Many of the State's MRFs were built more than 15 years ago, often for a dual-stream feedstock and those systems have since been retrofitted by adding front-end screens, which allow the processing line to sort single-stream commingled materials. 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 completely renovating their operations, which is discussed in **Section 2.3**.

Typically, MRF equipment at larger MRFs begins to age after about 10 years. Technology has advanced rapidly with new and improved equipment developed for the current feedstock. In addition, controls, electrical components, and other replacement parts for older equipment may be difficult to secure. The smaller MRFs tend to use older systems with fewer upgrades which may be due to the system being designed for greater capacity than they are currently operating at, resulting in reduced wear and tear on equipment. Equipment that is routinely operated at or near its design capacity may be likely to need repairs more often than equipment operating below its design capacity. Larger systems that have been retrofitted more frequently tend to have equipment and process lines with components from various manufacturers. In those cases, the design capacity and bottlenecks for the overall processing system are harder to identify.

2.2.1 Screens

The surveyed single stream and dual stream MRFs reported having some version of a screen. Star screens are the most common type of screen and used to separate paper (fiber) materials from containers. The single stream facilities have a cardboard or OCC screen designed to separate large cardboard from the smaller fiber and containers. These screens often have two (2) or three (3) screen decks to get a cleaner OCC product. The smaller non-OCC material falls through the screen, often onto a glass-breaking screen designed to crush glass and separate the materials less than two (2) inches. The remaining material often passes over a series of fiber screens where the remaining paper is separated from the containers that fall through the screen.

Some systems may use vibrating screens for some applications. Ballistic screens may be used to separate glass fines and containers from fiber in one step. Another newer concept is to use an auger screen at the beginning of the sorting process to separate oversized material from smaller material as a means of reducing the number of sorters for cost savings and safety reasons; however, these are not currently used in Maryland MRFs. Screens are replaced as they wear out, or better arrangements are installed. For facilities that are looking to upgrade outdated screens, the Project Team discussed the benefits of screens with larger shafts so plastic film is less likely to get tangled in the screens, as the facility staff spends significant time cutting plastic film out of them.

2.2.2 Optical Sorters

Optical sorters have been introduced to MRF processing systems as a labor-saving device. The optical sorters can make hundreds of picks per minute and are much more efficient than manual sorters. The technology was first used in container sorting and, more recently, for fiber sorting. Most of the single stream MRFs surveyed had at least one (1) optical sorter, with one (1) facility that does not have optical sorters. The dual stream facility does not have optical sorters as containers are already separated from the fiber in the collection. The larger MRFs use several optical sorters for containers and at least one (1) utilizes them for fiber sortation as well.

2.2.3 Robotics and AI

Robotics and Artificial Intelligence (AI) are newer technologies at MRF facilities. The current Maryland facilities do not utilize these technologies for sortation; however, new facilities (as discussed in **Section 4)** will likely include robotics and artificial intelligence. Robotic technology and AI continue to advance but some issues persist with the grabbing function as well as the speed of the robots. Modern robots can pick faster than a human, but not every pick results in a successful grab of a target. They are helpful in quality control applications and residual cleaning of process residue lines. AI is helpful in monitoring the processing line to identify missed commodities, which can provide an early alert to operators to adjust a screen or optical sorter. They can also be used to balance processing speed for maximum processing rates.

As processing systems are pushed to maximize throughput and efficiency, advanced control systems, potentially with AI features, will be helpful. Robotics and AI will continue to improve and are used in more MRF processes nationally.

2.2.4 Magnets

Magnets are used to capture tin cans and other ferrous (magnetic) materials. They are highly reliable and often have a long-life span. Additional magnets could be used in some MRFs to help clean up the glass stream or otherwise capture additional ferrous materials that are missed. Magnets can also be considered at push and bale facilities to capture metals at a more valuable state and bale that material rather than sending them with other containers for comingled processing.

2.2.5 Eddy Current Separators

Eddy current separators (ECS) are used to capture aluminum and certain other nonferrous metals. Some of the ECS units noted during site visits have been in the facilities for many years; however, ECS units can be damaged by stray ferrous metals, have torn belts, or lose efficiency in other ways. The units should be assessed to determine their collection efficiency. ECS units can miss material in two (2) ways: 1) flattened aluminum cans (as well as valuable PET) are often incorrectly sorted into the fiber line as flattened cans behave more like two-dimensional fiber than three-(3) dimensional uncrushed cans. 2) Often, the fines and glass that drop out of the system, such as MRF glass, can be high in aluminum. HDR's facility engineers have experience with aging equipment in MRFs that cause whole cans to end up in the glass material sent for secondary processing. In this case, repairs should be completed on the glass breaker to limit the size of material falling through the screen.

2.2.6 Balers

Balers are critical for keeping processing lines operating and achieving desired truck and rail load ratings. Some of the MRFs have replaced balers or plan to replace, but some of the smaller facilities still have original equipment that is performing well. If feedstock increases and systems are pushed to design capacities, some facilities will likely need to replace aging balers (some over 20 years old). Careful selection and arrangement to maximize facility productivity are important. Less-expensive single ram and lighter-duty balers may not have the processing capacity that is needed over the long-term.

2.2.7 Conveyors

Conveyors are used to move material through the processing system and between sorting equipment. Conveyors at MRFs are usually maintained as belts, idlers, drives, and pulleys. As processing lines are modified, conveyors may be modified to provide proper alignment and spacing between equipment components. Older systems generally have a larger conveyor system between sorting locations. Picking

stations may be designed with enclosures to avoid noise and provide heating, ventilation, air conditioning (HVAC), and lighting as required. Some of the MRFs surveyed are very constrained for space; therefore, equipment improvements and respective conveyor adjustments are limited to upgrades or replacements that do not require much additional space.

2.2.8 Fire Protection Systems

MRF facilities are at high risk for potentially devastating fires due to combustible materials such as non-empty aerosol cans, propane or butane cans, and lithium-ion batteries. Fires can also be caused by equipment overheating or other factors (e.g., human factors such as cigarettes on site). The feedstock needs to stay dry and loose for processing, which maximizes its combustibility.

Fires can put workers at risk and put MRFs out of service for long periods of time. For these reasons, the fire protection systems should be evaluated and updated with the latest technology to monitor the facility from the tipping floor to bale storage, to proactively address any fires. Not all facilities surveyed have updated fire protection systems, but some larger facilities have fire rover technology

2.2.9 Other Equipment

The various MRFs each have other support and processing equipment. Examples include but are not limited to metering drums; commodity storage bins; loading docks; air compressor systems; concrete wear surfaces; building components; operator support facilities such as lockers, breakrooms, training areas, and offices; truck scales; parking lots; parts storage; and maintenance shops. These components are needed for operation and, in some cases, could be upgraded for efficient future operation.

2.2.10 Mobile Equipment

Each MRF had the mobile equipment necessary for its current operation and has developed a replacement program to maintain operation; however, the quantity and type of equipment may need to change as throughput increases. Examples of mobile equipment include front end loaders, forklifts, skid steers, roll-off trucks, pick-up trucks, etc.

2.3 Potential Existing MRF Improvements

Based on survey and interview data reported by nine (9) out of 13 in-state recycling facilities in Maryland, potential facility upgrades and correlating cost estimates for implementing these upgrades were provided by Project Team engineers and industry experts. Based on discussions with MRF operators for in-state facilities,

Table 3 outlines the reported capital upgrades, equipment, and associated cost estimates for installing additional capacity at MRFs.

Table 3: Estimated MRF Equipment Purchase and Installment Costs (2024)

Capital Upgrades	Equipment Cost (Procured and Installed)
Auger Screen	$250,000
OCC Screen (per deck)[8]	$150,000 - $300,000
Ballistic Screen (3 sort)	$500,000
Paper Screen	$350,000
Additional Conveyor[9]	$100,000 - $200,000
Eddy Current Separator	$200,000
Magnets	$150,000
Container Line Optical Sorter	$500,000
Fibers Line Optical Sorter	$800,000
Residue Line Optical Sorter	$500,000
Robotics	$300,000
Baler (small)	$620,000 - $800,000
Baler (large)	$1M - $1.5M
Bale Breaker[10]	$230,000
Incidental Film Recovery System	$200K - 550K
New Full Film Recovery System	$550K
Glass Cleanup System[11]	$200K - $400K
Early Fire Protection Systems (4-8 thermal cameras)	$100K - $125K

[8] Individual deck is approximately $300,000; however, it is likely that the whole screen is replaced for approximately $500,000.

[9] Includes electrical and potential need for stairs, platforms, etc. Costs vary based on width, length, installation and type of conveyor.

[10] Low density bale breaker for 30” x 45” x 62” bales weighing approximately 900 lbs. Does not include the dewirer which would be needed for high throughput requirements.

[11] When the glass is crushed and removed from the process line, it is removed based on size; therefore, it still contains other materials less than about 2 inches in size (rocks, dirt, bottle caps, corks, shredded paper, small plastic, etc.). This technology further separates non-glass material less than a certain size (~1 inch), to remove the smaller dirt, gravel, and small glass shards that can't be recycled. Glass beneficiation equipment can easily recover glass down to 1/8 of an inch – it is important when breaking glass to minimize fines and dust. Next, light material such as shredded paper is removed, leaving behind a high concentration of glass by weight. These systems are added for glass clean up and are not part of the basic glass separation process. The number of MRFs upgraded with this technology may be reduced based current transportation of materials to select facilities for processing. Modeling for the upgrades was based on the single stream MRFs in the state.

Capital Upgrades	Equipment Cost (Procured and Installed)
Controls Upgrades[12]	Facility Dependent
Outdoor Covered Bale Storage	Facility Dependent
Bunkers[13]	Facility Dependent

The MRFs chosen for this Needs Assessment are either single stream or dual stream facilities. These recommendations assume that each MRF in the State can upgrade their facilities to accept more material, more efficiently. Equipment recommendations also include technology which would allow MRFs to accept new materials. Estimated equipment costs may vary by equipment type and require additional capital to support the reconfiguration of existing system to fit the new equipment, new conveyors, supports (platforms, stairs, etc.), and integration with controls. Based on discussions with MRF operators, MRF improvement recommendations were identified for each facility and aggregated into regional costs for MRF expansions. Recommended upgrades have been aggregated to maintain the confidentiality of the facility operators that participated in the survey. Additional (or upgraded) equipment and operational improvements are expected to improve efficiency, manage more materials, and yield higher quality material in existing MRF infrastructure in the Western Maryland, Washington Metro, and Baltimore Metro Regions. **Table 4** summarizes the cost estimates by Region.

Table 4: Estimated Regional MRF Tonnage 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	2,550[1]	$0
Lower Eastern Shore	2,500	2,500[1]	$0
Total	438,550	628,700	$9.2M - $10.3M

[1] Total capacity cannot be expanded beyond current materials processed

[12] Includes cost of down time for three (3) months. May also include transitioning to a cloud-based software, improving equipment performance reporting (fire protection, conveyor loading, production information, market information), or adjusting equipment setting such as conveyor angles and speeds, start and stop balers, etc. Includes electrical upgrades and installations that increase safety (handrails, etc.)

[13] Will be customized per location. Silo bunkers may be most appropriate for existing Colorado MRFs in the Front Range.

According to Project Team facility engineers, and feedback from MRF operators during interviews, potential upgrades to existing MRF infrastructure may cost approximately $9.2 million to $10.3 million, adding approximately 190,150 tons to in-state capacity.

In addition to the annualized MRF upgrades in **Table 4,** two (2) 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. These estimated costs are based on publicly available information gathered from facilities that have allocated funds and are currently undergoing facility upgrades.

Based on survey information and desktop research, push and bale facilities handling significant quantities of recyclables were identified throughout the State and the region to ensure recycling tonnage is captured comprehensively in this analysis; however, because these facilities are not permitted by the State, it is possible that not all facilities were identified. The Project Team provided estimated increased tons managed at the known facilities based on interview information provided by the facility.

2.3.1 Push and Bale Facility Improvements

Maryland's push and bale facilities feed material to in-state and out-of-state MRFs for further processing. As mentioned above, these facilities tend to sort and sell specific materials such as cardboard or metals and ship the remaining materials in mixed bales to larger facilities for processing.

Given material transfer is the primary operation, potential equipment needed for improvements to these facilities is less complicated than a larger MRF. Equipment needs may include balers, eddy current, and magnets. To further reduce material loss and improve material value, facilities could consider investing in metal sortation as these materials are particularly prone to compaction or adherence/molding to adjacent materials (i.e., aluminum attached to plastic) when breaking up a bale and may end up in residue. Costs for magnets and eddy current separators are found in **Table 3**.

2.4 Transfer Station Overview

According to County surveys, hauler surveys, and desktop research, there are approximately 38 transfer stations in Maryland, half of which (19) specifically transfer recyclables. Most transfer stations are permitted as Solid Waste Acceptance Facilities. **Table 5** summarizes the transfer station count by Region.

Table 5: Number of Transfer Stations by Region (2024)

Region	Accepts Recycling	Does Not Accept Recycling	Total
Western Maryland	2	2	4
Washington Metro	1	4	5

Region	Accepts Recycling	Does Not Accept Recycling	Total
Baltimore Metro	7	9	16
Southern Maryland	3	1	4
Upper Eastern Shore	4	0	4
Lower Eastern Shore	2	3	5
Total	**19**	**19**	**38**

Materials are being transferred from these facilities to MRFs that are located within or outside of the State, as discussed in **Section 2.1**. With this current system, transfer stations will be essential in effectively transporting increased volumes of recyclable and compostable material across the State, particularly in the more rural areas of the State to support increased economies of scale of recycling programs.

2.5 Transfer Station Equipment and Potential Improvements

This section provides high-level estimates of costs associated with upgrading a typical transfer station. The Project Team has not estimated the cost of upgrading or retrofitting all facilities in the State. In general, transfer stations can be upgraded to manage increased quantities of recyclable materials by adding a baler, compactor, increasing tipping floor size, adding bale storage, or increasing the number of bays for recycling to be loaded into transfer trailers. The upgrades could include adding recycling transfer to a previously trash-only transfer station or adding more capacity to manage recyclables at a recycling transfer station. Loads can be transferred loose, compacted, or baled. The costs provided in **Table 6** show the estimated equipment costs that are relevant for transfer stations, which can also apply to push and bale facilities that are transferring commingled recyclables to a MRF.

Table 6: Transfer Station Equipment Cost Estimates

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

In some cases, transfer stations would require additional baling and transfer capacity, and physical spacing would need to be slightly adjusted to accommodate a baler for increased materials. In other cases, physical spaces need to be slightly adjusted to accommodate a compactor for increased materials or the tipping floor needs to be expanded.

Contingency, permitting, design, and construction administration are not included in the cost estimates, but would need to be incurred as part of an expansion. Upgrade options range from strictly adding more material to building expansions. Due to space constraints, not all the existing transfer stations will be able to expand to accept more materials.

2.6 Key Findings

- **The current Maryland MRF infrastructure could manage approximately 71,400 additional tons per year** based on survey data reported by nine (9) out of 13 in-state recycling facilities. There are currently five (5) in-state single stream MRFs, one (1) dual stream MRF, and seven (7) push and bale facilities that process Maryland recyclables. The majority of the facilities are located in the Regions with the largest populations, Washington Metro and Baltimore Metro Regions. Three (3) out of state single stream facilities also receive material from Maryland.
- **Investments in MRF upgrades could expand recycling capacity by 190,150 tons per year.** Survey data and analysis suggest that Maryland's MRFs require capital investments of $9.2 million to $10.3 million to enhance their capacity by approximately 190,150 tons annually. Recommended upgrades include modernizing sorting equipment such as optical sorters, eddy current separators, robotics, and balers, as well as improving systems for specific materials like film recovery and glass cleanup. These upgrades aim to improve efficiency and material quality while expanding the facilities' ability to handle diverse recyclables. Regional cost estimates highlight opportunities for growth in Western Maryland, the Washington Metro, and Baltimore Metro regions. In addition to the recommended upgrades by the Project Team describe above**,** two (2) 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.
- **Targeted investments in push and bale facilities would allow for material flows to operate more efficiently in the State.** Maryland's push and bale facilities, which prepare materials for further processing at larger MRFs, primarily focus on sorting high-value materials like metals and cardboard. Key improvement areas include adding magnets and eddy current separators to reduce material loss and improve the quality of sorted materials. These targeted upgrades are less complex than those required for full-scale MRFs but are essential for enhancing the facilities' operational efficiency and material recovery rates.
- **Transfer stations are critical to supporting Maryland's recycling system.** With 38 transfer stations across the State, 19 of which handle recyclables, these facilities play a vital role in efficiently transporting recyclable materials to MRFs. Upgrading transfer stations with equipment such as balers,

compactors, and expanded tipping floors could significantly increase their capacity to manage recyclable materials. These upgrades are particularly important in rural areas, where economies of scale are essential for enhancing recycling efficiency and expanding material recovery efforts. However, space constraints at certain facilities may limit their ability to expand.

3 Organics Processing Facilities

The following sections describe the current state of organics processing facilities in Maryland, including types of facilities (e.g., Tier I, Tier II) equipment and levels of automation, feedstocks, current and potential capacity, and costs for improvements.

3.1 Organics Processing Overview

As discussed, in **Appendix B: Residential Recycling Stream Analysis Technical Memorandum**, there are approximately 25 organics processing facilities in Maryland. Facilities that accept compostable packaging are Tier II facilities in the Washington Metro and Baltimore Metro Regions according to survey information received from 10 facilities and desktop research.

Table 7: Organics Processing Facilities by Region (2024)

Region	Tier I	Tier II	Anaerobic Digestion[1]	Total
Western Maryland	1	0	0	1
Washington Metro	5	3	0	8
Baltimore Metro	6	4	1	11
Southern Maryland	1	0	0	1
Upper Eastern Shore	1	2	0	3
Lower Eastern Shore	0	1	0	1
Total	14	10	1	25

1. Anaerobic digesters only include facilities that accept food waste. There may be other anaerobic digesters in the State that process manure or biosolids that are not evaluated as part of the Needs Assessment.

According to 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, which is the most relevant in terms of compostable packaging since they are permitted to process food waste (assuming compostable packaging is not screened out by a depackager). Five (5) of those facilities accept compostable packaging. This information is summarized in **Table 8**, which highlights the potential opportunities for more Tier II facilities to accept compostable packaging in the future.

Table 8: Compost Facility Capacity by Region

Region	Maximum Capacity (Tons per Year)	Maximum Tier II Capacity (Tons per Year)	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
Total	978,600	799,500	5

3.2 Organics Processing Equipment

Based on survey information from facility operators, and industry expertise from HDR facility engineers, the following equipment and site improvements are needed to manage compostable packaging at organics facilities. Descriptions are provided as to how these improvements are relevant for processing compostable packaging.

- **Screen:** Sift through finished product to remove unfinished materials (overs) such as contamination or remnants of compostable packaging that would need to re-run through the system.
- **Grinder:** Grind compostable packaging with other feedstock into smaller sizes prior to composting to enhance the decomposition process.
- **Manual sort line:** Allow for manual sorting to remove contamination associated with food waste and compostable packaging acceptance. There are examples of material recovery facilities with sort lines which pull off recyclable materials and leave organics (including compostable packaging) with some residuals to be further processed through composting or another process to recover the organic material. The non-compostable residual is removed at the end of the composting process through use of one (1) or more screens. This is not utilized in Maryland facilities today but may be considered for larger facilities as compostable packaging is more prevalent in the stream.
- **Air knife density separator:** Air is used to separate contaminants and heavy materials from the organic feedstock based on differences in density.
- **Optical sorting:** Similar to manual sort lines, optical sorters can recover specific materials. The positive sort for specific materials will result in non-compostable materials being removed from the feedstock stream. This level of investment is relevant to facilities that manage >50,000 tons of material.

- **New buildings:** New buildings may be required to enable processing of compostable packaging. This is often appropriate to enclose certain activities (sorting) and/or equipment to improve worker safety, improve lifetime of the equipment or reduce potential environmental impacts such as aesthetics, noise, and odor. It allows a more efficient operation and working environment (e.g., for manual sorters) that is not affected by weather (e.g., rain, wind, and snow).
- **Litter fencing:** Fencing to limit litter impacts from compostable packaging and residuals.
- **Lined detention pond:** Accepting compostable packaging and food waste feedstock may require management of contact water and construction of a lined detention pond.

3.3 Potential Organics Processing Improvements

Based on survey information received from a representative sample of compost facility class types, potential facility upgrades, and correlating cost estimates are provided by Project Team engineers and industry experts. **Table 9** summarizes the estimated capital costs considered for improving an individual existing Tier II composting facility in Maryland. Estimated costs for equipment operators are not provided as this will vary by Region. These estimates are for capital upgrades that will assist with processing additional food waste and compostable packaging. Estimates do not include ongoing operations and maintenance, engineering services, contingency, and inflationary costs.

Table 9: Estimated Compost Facility Improvement Costs (2024)

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**

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

As described above, the total cost to improve equipment and infrastructure for a single organics facility may range from approximately $1,775,000 to $25,535,000 depending on facility size (less than 2,500 to over 50,000 tons per year).

3.4 Key Findings

- **There is nearly 800,000 tons of processing capacity across Maryland's Tier II and anaerobic digestion facilities.** Five (5) of those facilities accept compostable packaging according to survey responses.
- **Helpful equipment for processing increased quantities of compostable packaging materials may include screens, grinders, and air density separators according to survey responses.** Facilities also noted the need for more mobile equipment such as front-end loaders and/or skid steers for managing these materials.
- **The total cost to improve equipment and infrastructure for a single organics facility may range from approximately $1,775,000 to $25,535,000.** This cost depends on facility size, and does not reflect site-specific cost estimates but provides a planning level range for the level of investment required per facility to accept food waste and/or compostable packaging materials.

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 will increase across the State requiring expanded capacity to receive, process, and market additional packaging materials. The following provides an overview of the MRFs under development, Priority Funding Areas (PFAs), and proximity to key infrastructure that can support management and transportation of recycling materials.

4.1 Material Recovery Facility Development

There are several ongoing projects in the State focused on developing new MRFs and upgrading aging recycling processing infrastructure. Through surveys and interviews with stakeholders, the Project Team obtained the following information regarding planned facility developments:

- **Waste Management New Single Stream MRF.** A new Waste Management (WM) recycling facility is being developed to replace the aging Elkridge (MRF). The new $50 million MRF project is part of WM's overall plan to invest over $1 billion in new and upgraded recycling facilities across the country through 2026. The new facility will feature advanced automation, reducing staffing needs by 40 to 60% while creating higher-paying roles for

maintenance and technical staff. With a planned capacity of approximately 50 tons per hour (TPH), 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 from 15 to 20% to 10 to 15%, enhancing operational efficiency and minimizing disposal costs. Additionally, the new facility supports opportunities for growth, including potential partnerships with municipalities, large retailers, and a proposed glass processor in the area. By upgrading technology, increasing capacity, and reducing temp labor requirements, the new facility could support a hub and spoke system in the Baltimore Region and play a pivotal role in advancing recycling processing capacity

- **Montgomery County MRF Planned Upgrades.** Montgomery County's dual-stream MRF faces several operational challenges but has a robust plan for modernization and efficiency improvements. Currently, overcapacity issues lead to commingled materials being shipped to external facilities out of state for processing. The facility's infrastructure, over 35 years old, requires significant upgrades, including electrical and fire suppression systems. Plans for a new Material Recovery Facility (MRF) include replacing their current dual-stream facility with a 25 TPH facility with a commingled container line, leveraging optical sorters and robotics for increased automation. Although landlocked with no room for expansion, the redesign aims to maximize throughput within the existing footprint by utilizing five (5) loading bays and reconfiguring the space. Next steps include finalizing equipment specifications and design, which is currently at the 30% design stage and the County is working to optimize intake capacity and processing efficiency. Plans to shut down operations and overhaul the facility for a complete overhaul are under consideration, ensuring the redesign meets future needs despite spatial constraints. The new facility will improve material recovery and operational efficiency, addressing current limitations while preparing for increased recycling demands.
- **Baltimore County MRF Planned Upgrades.** The Baltimore County MRF experiences operational challenges primarily due to aging infrastructure, limited capacity, and contamination issues. The facility, upgraded to single-stream processing in 2013, operates with a Bollegraaf system including four (4) optical sorters and star screens. Its design capacity of 35 TPH often exceeds the 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. Despite these challenges, the facility maintains strong relationships with vendors, enabling it to manage overflow during peak times and material backups; however, space constraints on the tipping floor

and in bale storage remain persistent issues, particularly during the holiday season, necessitating the use of the co-located transfer station for overflow. To address these challenges, a comprehensive study is underway to evaluate options for improving the system, infrastructure, and revenue modeling. The County is considering a full system review to determine the next steps, including potential facility upgrades or redesigns. New equipment, such as polypropylene processing machines, has been introduced to target specific materials, but further investments will be needed to modernize operations, reduce downtime, and better manage contamination. Improving the facility's functionality will ensure long-term efficiency and adaptability to future recycling demands.

4.2 Priority Funding Areas

Aligning new or expanded processing capacity with high-growth areas can enhance recycling accessibility, reduce transportation costs, and support environmental and economic goals to foster a more resilient and sustainable recycling system. Maryland's Priority Funding Areas (PFAs), shown in **Figure 2**, are designated regions where state funding is directed to support growth and development, aligning with the state's Smart Growth policy.[14] These areas focus on encouraging sustainable urban and suburban growth while preserving rural and natural landscapes.

Figure 2: Maryland Priority Funding Areas

PFAs typically include municipalities, areas inside the Baltimore and Washington Beltways, and other locally designated growth zones. They serve as indicators of

[14] Maryland Department of Planning. Priority Funding Areas. Priority Funding Areas

fast-growing areas by highlighting regions with existing or planned infrastructure investments, such as transportation, water, and sewer systems, which attract residential, commercial, and industrial development. PFAs may also be considered for potential recycling infrastructure growth as increasing populations and development will generate more recyclable materials and require more services. By focusing resources in these areas, Maryland aims to accommodate population increases, drive economic development, and create vibrant, sustainable communities.

In addition to the planned facilities discussed above, Existing brownfield redevelopment opportunities can provide locations to transform underutilized or contaminated sites into hubs for recycling operations. Additionally, these areas are typically within the proximity of regional end markets and infrastructure, such as beneficiation facilities, mills, and bottling plants, due to similar zoning needs. While the Project Team has not conducted a comprehensive zoning analysis across the State, **Table 10** presents an analysis that shows the number of brownfield locations located in PFAs in the State to show where potential opportunities for future facility development may be located.

Table 10: Brownfields in Priority Funding Areas

Region/County	Brownfields	Brownfields in PFAs	% Brownfields in PFAs
Western Maryland	**92**	**80**	**87%**
Garrett	8	5	63%
Allegany	27	22	81%
Washington	57	53	93%
Washington Metro	**465**	**417**	**90%**
Frederick	74	62	84%
Montgomery	189	175	93%
Prince George's	202	180	89%
Baltimore Metro	**1,125**	**1,017**	**90%**
Harford	73	58	79%
Baltimore	230	194	84%
Carroll	53	35	66%
Howard	67	61	91%
City of Baltimore	554	550	99%
Anne Arundel	148	119	80%
Southern Maryland	**55**	**39**	**71%**

Region/County	Brownfields	Brownfields in PFAs	% Brownfields in PFAs
Charles	23	15	65%
Calvert	8	7	88%
St. Mary's	24	17	71%
Upper Eastern Shore	**166**	**127**	**77%**
Talbot	24	18	75%
Caroline	16	12	75%
Queen Anne's	9	4	44%
Kent	20	14	70%
Cecil	97	79	81%
Lower Eastern Shore	**89**	**71**	**80%**
Dorchester	20	18	90%
Wicomico	37	27	73%
Somerset	13	12	92%
Worcester	19	14	74%

Regions like the City of Baltimore stand out with the highest concentration of brownfields in PFAs (99%), indicating a significant opportunity for redevelopment within areas already prioritized for growth and infrastructure support. The Baltimore Metro area and Washington Metro area also show a strong presence of brownfields within PFAs, with 90% of sites aligning with these strategic development zones.

In addition to the City of Baltimore counties with notable brownfields located in PFAs include Montgomery County (93%), Somerset County (92%), Howard County (91%), and Washington County (93%), showcasing their alignment with growth planning efforts. Conversely, Queen Anne's County (44%) reflects a lower percentage of brownfields within PFAs, suggesting there are fewer opportunities to site new facilities in brownfields that are also located in PFAs.

Brownfields in PFAs are areas that have potential for the development of eco parks (e.g., locations where reuse and recycling businesses can co-locate to achieve operational and financial efficiencies) and business reuse initiatives, especially in industrial areas along the I-95 corridor. These parks could serve as hubs for recycling, reuse, and remanufacturing businesses, offering opportunities to attract and expand small businesses focused on repair, refurbishment, and material reuse. By concentrating such activities in dedicated industrial zones, eco parks could facilitate collaboration, improve efficiency, and reduce logistical barriers to expanding recycling and reuse opportunities in the State.

Successful models like Baltimore's Camp Small, which recycles wood, and Second Chance, which focuses on building material reuse, provide a blueprint for similar initiatives throughout the state. Replicating such programs within eco parks could enhance Maryland's capacity for recycling and reuse while driving innovation and job creation. Expanding access to recycling infrastructure in these areas not only benefits businesses but also increases service availability for residents, helping to build a more resilient and inclusive recycling system statewide.

4.3 Proximity to Freight Rail

Rail access provides an efficient, cost-effective, and environmentally sustainable method for transporting large volumes of recyclables to end markets or downstream processors. With the ability to move materials over long distances, rail connectivity can help overcome geographic limitations and reduce dependency on local markets, enabling facilities to tap into regional, national, or even international markets for recycled commodities.

Additionally, rail transport minimizes the environmental footprint associated with logistics by offering lower emissions per ton-mile compared to truck transport. This is particularly important for managing bulky materials like glass or large volumes of mixed recyclables that would otherwise require significant truck traffic. Facilities located near rail lines also benefit from operational flexibility, as they can manage higher throughput capacities and adapt to market fluctuations with reduced transportation bottlenecks. **Table 11** presents the distribution of brownfield sites located within one (1) mile of freight rail lines across the State's regions and counties, emphasizing the proximity of these sites to critical transportation infrastructure.

Table 11: Brownfields Within One Mile of Freight Rail in the State

Region/County	Brownfields 1 mile from Freight Rail	% Brownfields 1 mile from Freight Rail
Western Maryland	**66**	**72%**
Garrett	3	38%
Allegany	18	67%
Washington	45	79%
Washington Metro	**218**	**47%**
Frederick	45	61%
Montgomery	83	44%
Prince George's	90	45%
Baltimore Metro	**809**	**72%**
Harford	47	64%

Region/County	Brownfields 1 mile from Freight Rail	% Brownfields 1 mile from Freight Rail
Baltimore	119	52%
Carroll	34	64%
Howard	31	46%
City of Baltimore	533	96%
Anne Arundel	45	30%
Southern Maryland	**10**	**18%**
Charles	10	43%
Calvert	0	0%
St. Mary's	0	0%
Upper Eastern Shore	**78**	**47%**
Talbot	0	0%
Caroline	7	44%
Queen Anne's	3	33%
Kent	4	20%
Cecil	64	66%
Lower Eastern Shore	**45**	**51%**
Dorchester	2	10%
Wicomico	25	68%
Somerset	6	46%
Worcester	12	63%

In the Baltimore Metro region, 72% of brownfields are within this distance, with City of Baltimore standing out, as 96% of its brownfields are near freight rail lines. This high percentage reflects the city's industrial legacy and its strategic positioning for redevelopment projects that leverage rail connectivity. Similarly, Western Maryland exhibits a strong alignment, with 72% of its brownfields situated near freight rail, particularly in Washington County (79%).

4.4 Key Findings

- **Statewide investments in recycling facilities highlight a commitment to modernization and efficiency**. Based on publicly available information and stakeholder interviews, current MRF projects are estimated to cost between $75-$85 million, aiming to address aging infrastructure and operational

inefficiencies. The new facilities are expected to incorporate advanced automation, increase capacity, and reduce residue rates, creating a hub for regional recycling needs while reducing reliance on temporary labor.

- **Aging infrastructure creates operational bottlenecks, necessitating strategic upgrades.** Facilities like Baltimore County's MRF face challenges, including outdated equipment, capacity constraints, and contamination-related downtimes. Issues such as insufficient storage, mechanical breakdowns, and fire risks from hazardous materials highlight the urgency for upgrades. Planned improvements, including new processing lines and a comprehensive review of operations, aim to enhance efficiency, minimize downtime, and address contamination concerns.
- **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 promising opportunities for economic and environmental gains.** 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 Reuse and Waste Reduction Infrastructure

According to the Maryland Recycles Directory, nearly 295 reuse companies and organizations exist throughout the State. Of these, 58, or 19%, accept packaging-related materials. There are approximately 50 package-free shops, 13 reusable cup and container programs, 58 pre-filled refill systems, and 10 other types of reuse programs ongoing around the State.

This section explores the reuse and refill solutions and programs in place across the State, including package-free shops, reusable cup and container programs, pre-filled

refill systems, and other reuse program types. Reuse and refill programs are in place at some grocers and markets, at colleges and universities, and at specific concert/event venues across the State. Best practices can be mirrored from these systems to promote reuse and refill programs in areas where this might be lacking, for example, at large stadiums, restaurants, and food takeout/delivery services.

5.1 Current Programs

Table 12 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.

Table 12: Maryland Reuse and Refill Solutions by Category

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

The following provides further detailed description of the opportunities presented by each reuse and refill solution in the State.

5.1.1 Package-Free Shops

Package-free shopping involves shopping at locations and choosing products that are free from unnecessary packaging and support sustainable, waste-free production and distribution methods. This shopping method emphasizes a commitment to minimizing environmental impact through mindful purchasing and consumption habits and ultimately reduces waste in landfills, waterways, and the atmosphere.

In Maryland, there are several different package-free shopping opportunities, primarily embedded within grocery/market business models. **Table 13** identifies package-free grocery shopping opportunities that are available throughout the State.

Table 13: Package-Free Shops in Maryland (2024)

Business Name	Locations	Types of Package-free Products
Wholesome Harvest Food Co-op	Frostburg	Bulk foods.
Love Your Mama	Berlin	Refillery selling bulk household cleaning supplies and personal care products, plus other low-waste goods.
Common Market COOP	Frederick	Bulk foods.

Business Name	Locations	Types of Package-free Products
Roots Market	Clarksville, Olney	Bulk foods and coffee.
David's Natural Market	Columbia, Gambrills	Bulk foods, teas, and coffee, plus low-waste goods.
MOM's Organic Market	Bowie, College Park, Frederick, Gaithersburg, Jessup, Rockville, Timonium, Waldorf, White Marsh	Bulk foods, teas, coffee, household cleaning supplies, and personal care products, plus low-waste goods.
Glut Food Co-op	Mount Rainier	Bulk foods, teas, and coffee.
Whole Foods Market	Annapolis, Chevy Chase, Columbia, Gaithersburg, Riverdale Park, Rockville, Silver Spring	Bulk foods.
The Fresh Market	Annapolis, City of Baltimore, Gambrills, Rockville	Bulk foods.
Juniper Culinary Apothecary	City of Baltimore	Bulk herbs, spices, teas, and salts.
Mount Royal Soaps	City of Baltimore	Bulk household cleaning supplies and personal care products.
OK Natural Food Store	City of Baltimore	Bulk foods.
Federal Hill Natural Market	City of Baltimore	Bulk foods.
Sprouts Farmers Market	City of Baltimore, Bel Air, Burtonsville, Ellicott City, Pasadena, Towson, Westminster	Bulk foods and teas.
Catonsville Co-op Market	Catonsville	Bulk foods, coffee, household cleaning supplies, and personal care products.
Mary's Land Farm	Ellicott City	Locally grown produce.
Wholesome Harvest Food Co-op	Frostburg	Bulk foods.
BD Provisions	Severna Park	Bulk foods, teas, coffee, household cleaning supplies, and personal care products.
Refill Goodness	Stevensville	Refillery selling bulk household cleaning supplies and personal care products, plus other low-waste goods.
Fulfillery	Takoma Park	Refillery selling bulk household cleaning supplies and personal care products, plus other low-waste goods.
TPSS Co-op	Takoma Park	Bulk foods, herbs, spices, teas, and coffee.
Dawson's Market	Rockville	Bulk foods.

Business Name	Locations	Types of Package-free Products
Willow Oaks Flower and Herb	Severn	Flowers, plants, herbs, organics.
From Here to Home Essentials	Wheaton	Mobile refillery selling bulk household cleaning supplies and personal care products, plus other low-waste goods.
MOM's Organic Market	White Marsh	Bulk foods, teas, coffee, household cleaning supplies, and personal care products, plus low-waste goods.
Wholesome Harvest Food Co-op	Frostburg	Bulk foods.
Love Your Mama	Berlin	Refillery selling bulk household cleaning supplies and personal care products, plus other low-waste goods.
Common Market COOP	Frederick	Bulk foods.
Roots Market	Clarksville, Olney	Bulk foods and coffee.
David's Natural Market	Columbia, Gambrills	Bulk foods, teas, and coffee, plus low-waste goods.

The majority of package-free shops in Maryland are concentrated in the Washington Metro, Baltimore Metro, and Howard County regions, with notable activity in Montgomery, Prince George's, Baltimore, and Anne Arundel counties. These areas feature numerous businesses, including organic markets, co-ops, refilleries, and specialty stores offering bulk foods, household products, and low-waste goods. In contrast, there is a lack of package-free businesses in more rural areas, particularly in Western Maryland (Garrett, Allegany, and Washington counties), Southern Maryland (Calvert and St. Mary's counties), and much of the Lower Eastern Shore (Dorchester, Wicomico, Somerset, and Worcester counties), where fewer sustainable shopping options are available.

5.1.2 Reusable Cup and Container Programs

Throughout Maryland, various reusable cup and container programs are offered, in which individuals or businesses provide customers with specially designed, durable cups and containers that can be used multiple times instead of single-use disposable options. Often a system is in place to return and clean service ware. The goal of these programs is to reduce waste and promote sustainability. In Maryland, examples of these programs exist throughout the State, including at college and university campuses and event venues. There does not appear to be a robust reusable cup and container programs at stadiums in the State, presenting a potential opportunity for reuse programs at large congregation venues.

University Campus Programs

Many colleges and universities in the State offer reusable cup and container programs to their faculty, staff, students, and visitors. The purpose of cup and

container reuse programs on university campuses is to reduce single-use packaging waste, promote sustainability, and reduce the environmental impact produced by these operations. This section provides a brief description/summary of the reusable cup and container programs at Maryland's college campuses:

- **University of Maryland College Park:** The University offers a reusable food to-go container program that provides the customer a $0.25 discount. The customer first pays $5.00 for the container, and once finished the container is returned to a machine called OZZI that rinses and wipes the container then the customer is given a token to use so they can receive a clean container the next time they want to use one.[15] The University also offers discounts including 5-cents off for using a reusable bag in a campus convenience shop and 20-cents off in campus cafes with your reusable cup/mug.[16] The reuse of containers ultimately helps to reduce waste.
- **Salisbury University:** The University offers reusable carry-out containers for use in the dining hall's carry-out program. These reusable containers prevent an estimated 250,000 disposable single-use containers from being sent to the landfill annually. As a result of this program, single use carry-out plastic bags were eliminated from all dining locations on campus in 2023. At the Dining Hall, all dine in meals are served using only durable, reusable/washable food service ware instead of single-use plastics or polystyrene. Additionally, the University has a Reusable Coffee Cup Campaign with the two (2) coffee shops/providers on campus, Chesapeake Coffee Roasters and Cool Beans, which offer a $0.50 discount on each beverage purchase, if a personal reusable cup is used.[17]
- **Towson University:** In the University's focus to reduce waste created on campus, it offers the Reuse Pass program, a service provided by Topanga.io.[18] The Reuse Pass allows students to rent out green, reusable Tupperware containers so that they may take food from dining halls and eat wherever they like on campus. By including reusable containers with every All-Access meal plan the University allows its guests to do their part to reduce

[15] The Sustainability Tracking, Assessment & Rating System. "University of Maryland, College Park OP-T2-11: Reusable Container Discounts." Accessed November 25, 2024. https://reports.aashe.org/institutions/university-of-maryland-college-park-md/report/2014-02-12/OP/dining-services/OP-T2-11/.

[16] University of Maryland. "Waste Minimization: Reduce, Reuse, Recycle, and Compost." Accessed November 25, 2024. https://sustainability.umd.edu/waste.

[17] Salisbury University. " Campus Sustainability: Dining Services." Accessed November 26, 2024. https://www.salisbury.edu/administration/administration-and-finance-offices/sustainability/dining-services.aspx.

[18] Towson University. "ReusePass comes to Towson." Accessed November 26, 2024. https://thetowerlight.com/reusepass-comes-to-towson-tiger-bite/.

waste, save water, and avoid emissions associated with the use of single-use packaging.[19]

- **Bowie State University:** The University implements the 3Rs concept (Reduce, Re-Use, Recycle) and as part of this program, students have the option to choose reusable options as often as possible (such as water bottles, multi-use shopping bags, coffee cups, metal straws) instead of one (1)-use disposable items. The University's cafeteria is trayless, does not use plastic straws or Styrofoam containers, and encourages reusable to-go container options. [20]
- **Loyola University of Maryland:** Loyola Dining has made a commitment to making its dining operations as "green" as possible, including offering reusable dining options and a Choose to Reuse reusable to-go container program.[21] Boulder 2.0 offers reusable dishware options to cut down on waste from disposable containers, while students who wish to take their meal to-go, need to enroll in the Choose to Reuse: Reusable To-Go Box Program. There is a $5.00 deposit to join the program, which is refunded at the end of the semester, once the last container is returned. Once enrolled, the student receives either a carabiner clip that can be exchanged for a reusable to-go container or a reusable to-go container for immediate use. Used containers can be placed in designated bins to be washed, and either a clean container or carabiner clip, can be exchanged for a container whenever needed.
- **Morgan State University (MSU):** MSU Dining introduced a new Greenware initiative with the goal to eliminate waste on campus, the new Greenware program will allow students to take food out of the dining hall with reusable trays and cups.[22] This program allows students to take food from the main Dining Hall with reusable trays. Students who are signed up for the free Greenware program can get a reusable tray and cup by retrieving a green token from the cashiers located at the entrance of the dining hall, go to the designated stations in the dining hall, and provide the green token to have their reusable tray filled with food of their choice. As part of the program's next phase, MSU Dining will begin to implement side dish trays that will allow students to get smaller portions of food from other stations within the dining hall.

[19] Towson University. " Environmental Sustainability." Accessed November 26, 2024. https://towson.campusdish.com/en/sustainability/whatarewedoing/.

[20] Bowie State University. "Sustainability at Bowie State University." Accessed November 26, 2024. https://www.bowiestate.edu/about/sustainability/sustainability-brochure.pdf

[21] Loyola University Maryland. "Dining Services: Our Sustainable Commitment." Accessed November 26, 2024. https://www.loyola.edu/department/dining/about/sustainable-commitment.html.

[22] The Spokesman. "New Greenware initiative introduced by MSU Dining." Accessed November 26, 2024. https://themsuspokesman.com/13330/campus-news/new-greenware-initiative-introduced-by-msu-dining/.

- **Frostburg University:** In the University's Java City Coffee Shop, patrons can purchase a Reusable Mug for hot beverage purchases, and the guests receive refills for a reduced price for all hot coffee and tea purchases.[23] After purchasing this refillable/reusable travel mug, a refill can be obtained for $0.99 instead of paying $1.89 for a regular coffee in a paper cup. Additionally, since Fall 2006, Aramark and subsequently Chartwell, the food service providers at Frostburg State University, have been trayless in the campus dining halls as no trays are available for use.
- **Stevenson University:** There are several re-use programs and other sustainability practices in place at Stevenson University. In the dining hall, Xpressnap napkin dispensers save 30% in paper over traditional napkin dispensing mechanisms.[24] Additionally, the Dining Services' dishwashing Apex system uses 95% less packaging material than current methods. Apex products come in a compact solid form that significantly reduces transportation shipments compared to bulkier liquid detergents. Dining Halls are also completely trayless. At the Rockland Marketplace the Take-Out Program provides reusable take out containers in one of the campus's dining restaurants to help reduce the use of nonrecyclable products. The Jazzman's Coffee shop offers reusable mugs for hot beverages.
- **Mount St Mary's University:** As part of the University's sustainability initiatives, students and visitors are encouraged to use a reusable water bottle throughout campus and discourage to use to-go containers at Dining Services unless one is leaving.[25]
- **Johns Hopkins University (JHU):** The Homewood Recycling Office is committed to responsible waste reduction and disposal to increase the reuse, recycling, and composting of waste generated on the Homewood campus and reduce the amount of waste incinerated.[26] The Hop Reuse Hub was designed by Homewood Recycling to increase the quantity and quality of reuse on the Homewood campus and to encourage and inspire the JHU community to resist the "throw-away culture." [27] In addition to selling furniture, the Reuse Hub offers office supplies, in-house furniture repairs/touch-ups,

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[23] The Sustainability Tracking, Assessment & Rating System. "Frostburg State University: OP-22: Waste Minimization." Accessed November 26, 2024. https://reports.aashe.org/institutions/frostburg-state-university-md/report/2016-06-12/OP/waste/OP-22/

[24] Stevenson University. "Sustainability." Accessed November 26, 2024.

https://stevenson.sodexomyway.com/en-us/explore/sustainability.

[25] Mount Saint Mary's University. "Sustainability" Accessed November 27, 2024. https://msmary.edu/about/sustainability/index.html.

[26] Johns Hopkins University. "Custodial and Recycling Services." Accessed November 27, 2024. https://jhfre.jhu.edu/facilities/custodial/.

[27] Johns Hopkins University. "Hop Reuse Hub." Accessed November 27, 2024. https://jhfre.jhu.edu/wp-content/uploads/2023/07/HopReuseHubBrochure.pdf.

and reupholster services. A Hopkins Dining Reusable Mug Program is also in place at the University.

The Project Team was not able to identify reusable cup or container programs at other colleges including McDaniel College, University of Maryland Eastern Shore, Coppin State University, and the Naval Academy.

Events and Venues

Event venues, such as indoor/outdoor concert halls, have begun working with private entities to roll out reusable systems and programs. Since October 2015, Maryland raw requires event organizers to provide recycling at any special event, which includes temporary events (e.g., periodic use of a public street, publicly owned facility, or public park), events serving food or drink, and events expecting at least 200 attendees.[28] This law is enforced at the County level. Building on this legislation, numerous reuse programs are being implemented throughout the State, as described below:

- **Pier 6 Pavilion:** Located in Baltimore, Pier 6 Pavilion partners with Live Nation Entertainment, which is shifting to TURN Reusable Cup System at all of their events to reduce environmental impact and encourage reuse at these large-scale events.[29] Live Nation Entertainment, the world's leading live entertainment company, announced a strategic investment in TURN Systems, which operates a leading Reusable Cup System. Live Nation will begin rolling out reusable cups at its venues and festivals to eliminate single-use plastics and work toward zero-waste concerts. The TURN system includes reusable cups, collection bins and mobile washing systems powered by an incentive-based software offering. A single reusable TURN cup has the potential to displace up to 100 single-use cups and can break even on its environmental impact in as few as three (3) uses. As the primary option for beverages at participating Live Nation events, fans will be able to easily use the return bin system in place of a traditional trash or recycling can. Live Nation's pledge to eliminate single-use plastics from its events is a key pillar in the company's overall Green Nation global sustainability program.
- **Merriweather Post Pavilion**: An amphitheater with a capacity of over 19,000 located in Columbia, MD, Merriweather Post Pavilion works with a private entity to roll out a reuse program, as part of their initiative to help eliminate single-use waste and keep the venue clean and green. Merriweather has partnered with r.World, a leader in the reuse movement in North America with

[28] Legislation - SB0781

[29] Live Nation Entertainment. "Live Nation Shifting To TURN Reusable Cup System At Events To Reduce Environmental Impact." Accessed December 3, 2024. https://www.livenationentertainment.com/2022/09/live-nation-shifting-to-turn-reusable-cup-system-at-events-to-reduce-environmental-impact/.

support from artists, venues, concessionaires, sports leagues, the White House, and Non-Governmental Organizations (NGOs).[30]

Restaurants/Hospitality Business

There is not a large robust network of reuse programs within the restaurant and hospitality industries in the State, although there are existing programs that entities in the State would benefit from partnering with, to enhance the reuse culture within the take-out/delivery categories.

- **To Go Green**: A startup in Washington D.C. and a platform that allows customers to order takeout from participating restaurants in reusable containers. The containers are dishwasher and microwave safe, Bisphenol A (BPA) free, and National Sanitation Foundation (NSF) International certified, and customers can return the containers by requesting a porch pick up or dropping them off at a participating restaurant.[31] The reusable take out containers are easy to access, as all one has to do is go to the To Go Green website and choose from one of the participating restaurants and order takeout as normal. Everything is done on their website, so there is no need to navigate multiple apps to create an eco-friendly order. When the delivery arrives, it is packaged in a reusable container, designed to withstand 1,000 uses.
- **Recirclable:** Provides eco-conscious consumers and restaurants the opportunity to reduce waste by offering reusable containers for takeout as an alternative to single use containers.[32] Currently, Recirclable is building up a community of restaurants around the Boston area, enabling an open network of restaurants to offer reusables to their customers.
- **DeliverZero:** A network of returnable, reusable food containers who make it easy for restaurants, delivery platforms, and Point-of-Sale (POS) systems to offer customers the option to receive takeout and delivery.[33] Restaurants can be sorted based on preferences such as distance or cuisine type, as order can be made directly through DeliverZero or through one of our third-party ordering platforms. Containers may be returned to any location on the

[30] r.World Reusables. “r.World reuseable serveware is the best way to reduce event waste.” Accessed December 3, 2024. https://rworldreuse.com/why-rworld/music-venues/.

[31] WUSA 9. “DC launches reusable takeout container service.” Accessed December 4, 2024. https://www.wusa9.com/article/tech/science/environment/reusable-takeout-container-service-launching-dc-washington-restaurant-recycling-environment/65-910eeefb-6357-4aad-835f-db8fcc63147d#:~:text=The%20reusable%20take%20out%20containers,it%20also%20helps%20save%20money.

[32] Recirclable. “Beautiful food & takeout, without the waste.” Accessed December 4, 2024. https://www.recirclable.com/#:~:text=Recirclable%20provides%20eco%2Dconscious%20consumers,Eat%2C%20rinse%20and%20return.

[33] DeliverZero. “Food to go in reusable containers.” Accessed December 3, 2024. https://www.deliverzero.com/howitworks.

network to drop off containers or schedule a pickup. At select restaurants, containers may be returned to the courier who delivers the order.

Stadiums

The Project Team reviewed reusable cup and container programs at the following large stadiums in the State:

- Oriole Park at Camden Yards
- M&T Bank Stadium
- Northwest Stadium
- Pimlico Racecourse
- CFG Bank Arena
- College Sports Stadiums and Arenas
- Multiple Minor League Baseball stadiums

Aside from standard souvenir cups that can be purchased and used for a beverage refill at a discounted price, there are no refill programs at stadiums and sports venues were identified (this does not include stadiums on college/university campuses).

5.1.3 Pre-Filled and Refill Systems

Pre-fill and re-fill systems are innovative approaches designed to reduce the generation of packaging waste by encouraging the reuse of containers and minimizing single-use materials. In pre-fill systems, products are sold in reusable or returnable packaging that is pre-filled by the manufacturer or distributor. 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.

Table 14 presents the pre-filled reuse and/or refill systems related to a wide range of different products in operation throughout Maryland.

Table 14: Pre-Filled Reuse and Refill Systems in the State by County (2024)

County	Name of Business/System
Anne Arundel County	Refill Goodness
	Whole Foods
	The Fresh Market
	The Loading Dock
	MOM's Organic Market
	Whole Foods Market (3 locations)

County	Name of Business/System
City of Baltimore[34]	Sprouts Farmers Market
	SCRAP B-More
Baltimore County[35]	Multiple Businesses
Calvert County	Smile
Carroll County	ReStore
	Sprouts (bulk section)
Cecil County	Polo Pallet (Elkton, MD)
Charles County[36]	Hooks and Hangers
	The Catherine Foundation
	Charles County Children's Aid Society, Inc.
	Go Green Thrift Store
	Charels County Department of Community Services
	GreenDrop LLC
Frederick County	The Common Market
	Mom's Organic Market
	Various Micro-breweries
Garrett County	Habitat for Humanity ReStore
	Nearly New Shop
	Christian Crossing
Howard County	Mom's Organic Market
	DIY Education Center
Kent County	Hidden Treasures
	Women in Need
Montgomery County	Bikes for the World
	Leveling the Playing Field

[34] Maryland Recycling Network. Reuse Options in Maryland." Accessed November 27, 2024. https://www.marylandrecyclingnetwork.org/content.aspx?page_id=22&club_id=685083&module_id=565207.

[35] Baltimore County Department of Public Works. "Baltimore County Reuse Directory 2021-2022." Accessed November 26, 2024. https://www.baltimorecountymd.gov/files/Documents/Public_Works/solidwastemanagement/reusedirectory.pdf.

[36] Charles County, Maryland. "Reuse Directory." Accessed November 25, 2024. https://www.charlescountymd.gov/services/environmental-resources/reuse-directory/reuse-directory/.

County	Name of Business/System
	Colonial Restoration
	Goodwill Industries
	Fulfillery (Takoma Park)
	The Pearl Refill Station (Silver Spring)
	Habitat for Humanity ReStore
	Mac Recycling Clinic
	Paradigm To Go
	Phoenix Computers
	Friends of the Library
	The Salvation Army
	Value Village
	Unique Thrift Stores
	Silver Spring Timebank
Prince George's County	Community Forklift
	Goodwill
	GreenDrop/Purple Heart
	Habitat for Humanity
	MD Recycles Directory
	Mom's Organic Market
	The Salvation Army
Saint Mary's County[37]	Planet Aide
Washington County	ReStore
	Goodwill
	Salvation Army
Wicomico County	Salisbury Scrap Metal (Salisbury)
Maryland Department of Aging	Durable Medical Equipment Program

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

[37] St. Mary's County. Reuse Directory. https://www.stmaryscountymd.gov/docs/ReuseDirectory.pdf?200801090000

Anne Arundel and Howard counties. Charles County is an exception to this trend. Notable examples include Refill Goodness in Anne Arundel County, which offers bulk household cleaning supplies and personal care products, and The Pearl Refill Station in Silver Spring. Additionally, Fulfillery in Takoma Park and the OZZI system at the University of Maryland College Park exemplify refill programs that encourage sustainability. Other businesses like MOM's Organic Market, Whole Foods, and Sprouts Farmers Market across various counties also offer bulk and refillable options, allowing consumers to reduce waste and promote environmentally conscious shopping habits. These systems, while widely available in more metropolitan regions, are less prevalent in rural areas.

5.1.4 Other Programs

Many additional reuse programs exist at colleges and universities, and State Government agencies. The following provides descriptions of some of these reuse-related programs:

- **UMD College Park Campus ReUse Store:** At the University of Maryland College Park, the UMD Campus Reuse Store manages the collection and recirculation of donated unused or gently used small appliances, cooking/kitchen items, room accessories, clothing, school supplies, etc., from over 20 donation sites across the UMD campus.[38] The Program involves sorting and organizing the donations into the Terp-to-Terp Campus ReUse Store storefront at Harford Hall Service Center for UMD students to shop for Free. The Reuse Store also collaborates with the UMD Campus Pantry as well as any student groups or campus offices looking to get involved with waste prevention.
- **UMD Terrapin Trader:** The Terrapin Trader manages the removal of university-owned surplus property in environmentally responsible ways including sales, bids, and auctions.[39] The Terrapin Trader store is open to UMD departments, other State agencies, faculty, staff, students, and the public looking for an inexpensive option to furnish an apartment, home, or business.
- **Johns Hopkins University Host a Green Event:** JHU also has some additional reuse-related programs and sustainability initiatives, such as the opportunity to 'Host a Green Event', as well as the Green Move-In and Move-Out Program. The Host a Green Event Program includes The Free Food Alert. This allows event hosts to share leftover food from events through a mobile alert system to help reduce food waste.[40]

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[38] University of Maryland Department of Residence Life. "Terp to Terp Campus ReUse Store." Accessed December 3, 2024. https://reslife.umd.edu/terptoterp.

[39] University of Maryland Facilities Management. "Terrapin Trader." Accessed December 5, 2024. https://facilities.umd.edu/services/logistical-services/terrapin-trader.

[40] Johns Hopkins University Climate and Sustainability. "Host a Green Event." Accessed November 27, 2024. https://sustainability.jhu.edu/engage/live-sustainably/host-a-green-event/.

- **Johns Hopkins University Green Move-In and Move-Out Program**: While many students refer to general university packing lists prior to move-in, these lists often include unnecessary items that are already made available to students by their institutions.[41] JHU offers a Green Packing List for students to follow when buying supplies, decor, clothes, and personal items before arriving at Hopkins. This list aids in buying items second-hand and coordinating with roommate(s) and is an impactful and cost-effective strategy to reduce resource consumption and environmental impact prior to and during move-in. As part of Housing Operations' commitment to sustainability and giving back to the community, a Green MoveOut program provides an opportunity for residents to donate all of their unwanted, but usable clothing, shoes, housewares, books, toiletries and appliances as well as unopened, non-perishable food to the local non-profits.
- **Bowie State University Book Rental Program**: The Bowie State University Bookstore has a rental program (students can rent a semester at a time) which keeps textbooks circulating several times over and reduces the need to print more.[42] Additionally, rather than wasting or trashing used books, the bookstore buys back books and sends them to another Follett store, and, in case they cannot be used, they are donated to Better World Books. Students are also encouraged to contact Better World Books for any non-BSU Bookstore books and books older than 3 years.
- **Montgomery County's Don't Dump. Donate! Program**: County's "Don't Dump. Donate! The program recycles construction building material via the reuse drop-off at the County's Shady Grove Transfer Station and Processing Facility.[43] All donated and collected materials are assessed by non-profit organizations for reuse.[44]
- **Maryland Port Administration's Innovative Reuse and Beneficial Use Program**: The Maryland Port Administration (MPA) manages the Innovative Reuse and Beneficial Use Program for the Port of Baltimore. This Program is intended to make long-term, sustainable reuse of dredged material a widely used tool for managing dredged sediments. The goal is to promote capacity recovery in upland containment facilitates and support the continued viability

[41] Johns Hopkins University Student Affairs – Community Living. "Sustainability Practices." Accessed December 4, 2024. https://studentaffairs.jhu.edu/community-living/university-housing/living-at-hopkins/sustainability-practices/.

[42] Bowie State University. "Recycling and Waste Reduction." Accessed November 27, 2024. https://bowiestate.edu/about/sustainability/recycling-and-waste-reduction.php.

[43] Montgomery County, Maryland Department of Environmental Protection. "Don't Dump. Donate! Program - Reusable building material recycling." Accessed December 3, 2024. https://www2.montgomerycountymd.gov/depwebstore/itemdetail.aspx?item_id=215&subcatalog=29.

[44] Montgomery County, Maryland Department of Environmental Protection. "How to recycle / dispose building materials - usable condition." Accessed December 3, 2024. https://www2.montgomerycountymd.gov/DepHowDoI/material.aspx?tag=building-materials&material_key=39.

of the Port of Baltimore.[45] The Innovative Reuse aspect includes the use of dredged material in the development or manufacturing of commercial, industrial, horticultural, agricultural or other products. The Beneficial Reuse aspect means that any dredged material from the Chesapeake Bay and its tributary waters be placed into waters or onto the bottomland of the Chesapeake Bay or its tidal tributaries for the restoration of underwater grasses. This includes the restoration of islands; the stabilization of eroding shorelines; the creation or restoration of wetlands; and the creation, restoration, or enhancement of fish or shellfish habitats.

- **Maryland Department of Aging Durable Medical Equipment Re-Use Program** - The Maryland Department of Aging provides free durable medical equipment to Marylanders with any illness, injury, or disability, regardless of age, at no cost.[46] All equipment is collected via donation and is sanitized, repaired, and redistributed to Marylanders in need. The DME program is improving the quality of life for many Maryland residents by providing the opportunity to avoid costlier levels of care.
- **Maryland Department of Disabilities Maryland High-Tech Assistive Technology Reuse Center (MATR)** – The Maryland Department of Disabilities, based in Columbia, MD, manages the Maryland High-Tech Assistive Technology Reuse Center (MATR) the State's high-tech Assistive Technology reuse center.[47] The Center takes in donations of assistive technology, cleans, refurbishes, repairs, and donates them back out to Marylanders with disabilities in need. The Program relies solely on donations, as commonly donated equipment including CCTVs/video magnifiers/magnifiers, iDevices, adapted computer keyboards, mice, switches, speech communication devices, amplified telephones, and eye-gaze systems.
- **The Talbot County Repurposing Center:** accepts unwanted asphalt, fill dirt, concrete, brick/block, wood chips and logs from over 200 Mid-Shore contractors, landscapers, and municipalities.[48] The Center then repurposes this unwanted material into 25 usable products for sale back to the contractors and governments. These products include RC-6 (recycled concrete), RC-2 (recycled concrete), Bio-Retention Material, Top Soil, Fill

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[45] Maryland Port Administration. “Maryland Port Administration’s Innovative Reuse and Beneficial Use Program.” Accessed December 3, 2024. https://gis.anchorqea.com/MDOTMPA_IRBU/.

[46] Maryland Department of Aging. “Maryland Durable Medical Equipment Re-Use.” Accessed December 4, 2024. https://aging.maryland.gov/pages/DME.aspx.

[47] Maryland Department of Disabilities. “Maryland High-Tech AT Reuse Center.” Accessed December 3, 2024. https://mdod.maryland.gov/mdtap/Pages/ATreuse.aspx#:~:text=The%20Maryland%20High%2DTech%20Assistive,Marylanders%20with%20disabilities%20in%20need.

[48] Talbot County, Maryland. “Repurposing Center.” Accessed December 3, 2024. https://talbotcountymd.gov/repurposing-center.

Dirt, Natural Mulch, Wood Chips, Organic Soil Amendment/Compost, Asphalt Millings, Concrete Dust.

5.2 Key Findings

The following presents the key findings from the reuse and waste reduction infrastructure presented above:

- **Maryland has a total of 49 package-free shops, with a strong presence in the Washington Metro, Baltimore Metro, and Howard County Regions**. These shops primarily focus on bulk foods, household cleaning supplies, and personal care products. Additionally, there are 13 reusable cup and container programs and 58 pre-filled refill systems, showing significant investment in reusable and refillable solutions. However, other program types are relatively limited, with only 10 identified statewide. The concentration of package-free shops and refill systems in urban and suburban areas such as Montgomery, Prince George's, and Baltimore counties contrasts sharply with the rural areas, particularly in Western Maryland (Garrett, Allegany, and Washington counties) and Southern Maryland (Calvert and St. Mary's counties), which have few or no such businesses.
- **Maryland has various reusable cup and container programs at universities, event venues, and businesses, but they are not widespread across the State.** Colleges such as the University of Maryland and Towson University have implemented systems to reduce waste by offering reusable containers for meals and beverages, promoting sustainability and reducing disposable packaging waste. University programs, like those at Salisbury and Bowie State University, help eliminate single-use containers and plastic bags, significantly reducing campus waste. These programs also promote discounts for students and faculty who use reusable options, further encouraging participation and sustainability.
- **Event venues in Maryland, including Pier 6 Pavilion and Merriweather Post Pavilion, are adopting reusable cup systems.** These programs are part of larger efforts by entertainment companies like Live Nation and r.World to promote zero-waste events.
- **Restaurants and hospitality businesses are experimenting with reusable take-out programs.** The overall network of these services in Maryland is not extensive. Expanding these programs, such as To Go Green and Recirclable, in the State could significantly enhance the reuse culture, especially in the growing take-out and delivery sectors.
- **There is opportunity to implement reusable cup and container programs in Maryland's sports stadiums.** Reducing packaging at the point of sale at stadiums in the State presents an opportunity to minimize packaging waste. With many major sports stadiums lacking robust reuse systems,

implementing a cohesive program could complement existing sustainability efforts and reduce waste at large events.

- **Prefilled and refill systems are primarily concentrated in urban and suburban areas of Maryland, particularly in the City of Baltimore, Montgomery County, and parts of Anne Arundel and Howard counties.** Businesses like Refill Goodness, The Pearl Refill Station, and Fulfillery, as well as MOM's Organic Market, Whole Foods, and Sprouts Farmers Market, offer bulk and refillable options in these regions, promoting sustainable shopping practices. However, such systems are less common in rural areas of the state.
- **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.** Programs like the UMD College Park ReUse Store and Johns Hopkins University's Green Move-In and Move-Out initiative encourage donation and recycling of items such as appliances, clothing, and housewares, reducing waste while providing resources to the community. Bowie State University's book rental and buy-back program also promotes reuse in the academic environment, limiting the demand for new textbooks. Additionally, the Maryland Department of Aging's durable medical equipment re-use program and the Maryland High-Tech Assistive Technology Reuse Center cater to underserved populations, ensuring that necessary medical equipment is reused rather than discarded.
- **Statewide initiatives also offer significant opportunities for environmental and community impact.** Montgomery County's "Don't Dump. Donate!" program recycles building materials, benefiting non-profit organizations, while the Maryland Port Administration's reuse program for dredged materials aids in environmental restoration efforts. Talbot County's Repurposing Center exemplifies how construction waste can be turned into valuable resources, creating sustainable products for local businesses. These varied programs highlight the growing trend of reusing and repurposing materials and goods across Maryland, providing a strong foundation for the expansion of similar efforts at other institutions and regions within the state.